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# Contents

# Computer Science

# 1 Computer Introduction

## Computer

Computer is miracle of 20th century, it is an electronic computing device that takes raw data as input from the user and processes these data under the control of set of instructions (called program) and gives the result (output) and saves output for the future use. It can process both numerical and non-numerical (arithmetic and logical) calculations.

## Area of Computer applications

- Education
- Scientific Research
- Industrial Application
- Computer Aided Designing
- Astronomy & Astrophysics
- Aviation
- Robotics
- E-Governance
- Online shopping

## History and Generations of Computers

### The First Generation: Vacuum Tubes

### ENIAC

The ENIAC (Electronic Numerical Integrator And Computer), designed and constructed under the supervision of Jonh Mauchly and John Presper Eckert at the University of Pennsylvania, was the world's first general-purpose electronic digital computer. The project was a response to U.S. wartime needs. Mauchly, a professor of electrical engineering at the University of Pennsylvania and Eckert, one of his graduate students, proposed to build a general-purpose computer using vacuum tubes. In 1943, this proposal was accepted by the Army, and work began on the ENIAC. The resulting machine was enormous, weighting 30 tons, occupying 15,000 square feet of floor space, and containing more than 18,000 vacuum tubes. When operating, it consumed 140 kilowatts of power. It was faster than any electronic-mechanical computer, being capable of 5000 additions per second.

### Commercial Computers

The 1950s was the birth of the computer industry with two companies, Sperry and IBM, dominating the marketplace.

In 1947, Eckert and Mauchly formed the Eckert-Maunchly computer Corporation to manufacture computers commercially. Their first successful machine was the UNIVAC-I (Universal Automatic Computer), which was commissioned by the Bureau of the Census for the 1950 calculations. The Eckert-Maunchly Computer Corporation became part of the UNIVAC division of Sperry-Rand Corporation, which went on to build a series of successor machines.

### The Second Generation : Transistors

The first major change in the electronic computer came with the replacement of the

vacuum tube by the transistor. The transistor is smaller, cheaper, and dissipates less heal than a vacuum tube but can be used in the same way as a vacuum tube to construct computers. Unlike the vacuum tube, which requires wires, metal plates, a glass capsule, and a vacuum, the transistor is a solid-state device, made from silicon.

### The Third Generation : Integrated Circuits (IC)

A single, self-contained transistor is called a discrete component. Throughout the 1950s and early 1960s, electronic equipment was composed largely of discrete components—transistors, resistors, capacitors, and so on. Discrete components were manufactured separately, packaged in their own containers, and soldered or wired together onto circuit boards, which were then installed in computers, oscilloscopes, and other electronic equipment. Whenever an electronic device called for a transistor, a little tube of metal containing a pinhead-sized piece of silicon had to be soldered to a circuit hoard. The entire manufacturing process, from transistor to circuit board, was expensive and cumbersome.

In 1958 came the achievement that revolutionized electronics and started the era of microelectronics: the invention of the integrated circuit. It is the integrated circuit that defines the third generation of computers. Perhaps the two most important members of the third generation are the IBM System/360 and the DEC PDP-8.

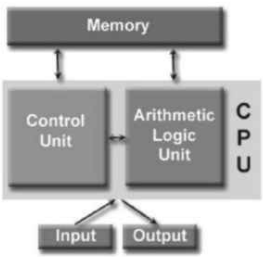
### Fourth Generations : Very Large Scale Integration

There have been a fourth and a fifth generation, based on advances in integrated circuit technology. With the introduction of large-scale integration (LSI), more than 1000,000 components can be placed on a single integrated circuit chip. Very-large-scale integration (VLSI) achieved more than 1000,000,000 components per chip, and current VLSI chips can contain more than 1000,000 components.

### Functional Units of Computer

Computer allocates the task between its various functional units. The computer system is divided into three separate functional units for its operation. They are :

- Central Processing Unit (CPU)
- Arithmetic Logical Unit (ALU)
- Control Unit (CU)




**Basic block diagram of a computer**

### Central Processing Unit (CPU)

The ALU and the CU of a computer system are jointly known as the central processing unit. You may call CPU as the brain of any computer system. It is just like brain that takes all major decisions, makes all sorts of calculations and directs different parts of the computer functions by activating and controlling the operations.

### Arithmetic Logical Unit (ALU)

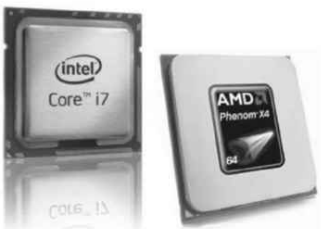
After you enter data through the input device it is stored in the Primary storage unit. The actual processing of the data and instruction are performed by Arithmetic Logical Unit. The major operations performed by the ALU are addition, subtraction, multiplication, division, logic and comparison. Data is transferred to ALU from storage unit when required. After processing the output is returned back to storage unit for further processing or getting stored.

### Control Unit (CU)

The next component of computer is the Control Unit, which acts like the supervisor seeing that things are done in proper fashion. The control unit determines the sequence in which computer programs and instructions are executed. Things like processing of programs stored in the main memory, interpretation of the instructions and issuing of signals for other units of the computer to execute them. It also acts as a switch board operator when several users access the computer simultaneously.

### Processor

It is also called Central Processing Unit (CPU) or Brain of Computer system. The main unit inside the computer is the CPU, it is also called the brain of the computer system. This unit is responsible for all events inside the computer. It controls all internal and external devices, performs arithmetic and logic operations. The CPU (Central Processing Unit) is the device that interprets and executes instructions.




### Software

Software, simply are the computer programs. The instructions given to the computer in the form of a program is called Software. Software is the set of programs, which are used for different purposes. All the programs used in computer to perform specific task is called Software.

## Types of Software

### 1. System software

**(a) Operating System Software :** Operating system is an example of system software ,which provide the platform to the application softwares. DOS, Windows XP, Windows Vista, Unix/Linux, MAC/OS X etc.

**(b) Utility Software :** Windows Explorer (File/Folder Management), Windows Media Player, Anti-Virus Utilities, Disk Defragmentation, Disk Clean, BackUp, WinZip, WinRAR etc...

### 2. Application software

**(a) Package Software :** Ms. Office 2003, Ms. Office 2007, Macromedia (Dreamweaver, Flash, Freehand), Adobe (PageMaker, PhotoShop).

**(b) Tailored or Custom Software :** SAGE (Accounting), Galileo/Worldspan (Travel) etc.

## Computer Languages and Scripting Languages

### (a) Low Level Language

(i) Machine Language
(ii) Assembly Language
(iii) High Level Language

### (i) Machine Language

These language instructions are directly executed by CPU .It is in the form of '0' and '1' means in binary language.

### (ii) Assembly Language

The endeavor of giving machine language instructions a name structure that means bit strings of instructions of machine language are given name here.

### (iii) High Level Language

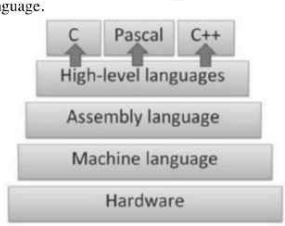
The user friendly language more natural language than assembly language. Like C++, Java, COBOL, FORTRAN, BASIC etc.

### Assembler

It is a program written in a computer language which convert assembly language into machine language.

### Complier

It is also a program written in a computer language, which convert high level to machine language.




## Types of Computer on the Basis of Working Principle

### (a) Analog Computer

An analog computer (spelt analogue in British English) is a form of computer that uses continuous physical phenomena such as electrical,

mechanical, or hydraulic quantities to model the problem being solved.


**Analog Computers**

### (b) Digital Computer

A computer that performs calculations and logical operations with quantities represented as digits, usually in the binary number system.

### (c) Hybrid Computer : (Analog + Digital)

A combination of computers those are capable of inputting and outputting in both digital and analog signals. A hybrid computer system setup offers a cost effective method of performing complex simulations.

**Hybrid Computers**

## Computer Types on the Basis of Size

### (a) Super Computer

The fastest type of computer. Supercomputers are very expensive and are employed for specialized applications that require immense amounts of mathematical calculations. For example, weather forecasting requires a supercomputer. Other uses of supercomputers include animated graphics, fluid dynamic calculations, nuclear energy research, and petroleum exploration.

**Super Computer**

The major difference between a super computer and a mainframe is that a supercomputer channels all its power into executing a few programs as fast as possible, whereas a mainframe uses its power to execute many programs concurrently.

### (b) Mainframe Computer

Mainframe Computer is very large and expensive computer capable of supporting hundreds, or even thousands, of users simultaneously. In the hierarchy that starts with a simple microprocessor (in watches, for example) at the bottom and moves to super computers at the top, mainframes are just below super computers. In some ways, mainframes are more powerful than supercomputers because they support more simultaneous programs. But super computers can execute a single program faster than a mainframe.

**Mainframe Computer**

### (c) Mini Computer

A mid-sized computer. In size and power, mini computers lie between workstations and mainframes. In the past decade, the distinction

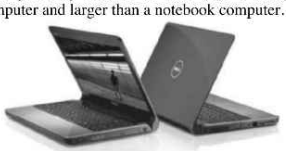
between large minicomputers and small mainframes has blurred, however, as has the distinction between small minicomputers and workstations. But in general, a minicomputer is a multiprocessing system capable of supporting from 4 to about 200 users simultaneously.

### (d) Micro Computer

**(i) Desktop Computer :** A personal or micro-mini computer sufficient to fit on a desk.

**Desktop Computer**

**(ii) Laptop Computer :** A portable computer complete with an integrated screen and keyboard. It is generally smaller in size than a desktop computer and larger than a notebook computer.



**Laptop**

**(iii) Palmtop Computer/Digital Diary/Notebook/PDAs :** A hand-sized computer. Palmtops have no keyboard but the screen serves both as an input and output device.

**Palmtop**


**Notebook**

### (e) Workstations

It is a terminal or desktop computer in a network. In this context, workstation is just a generic term for a user's machine (client machine) in contrast to a "server" or "mainframe."

**Workstations**

### Booting

The process of loading the system files of the operating system from the disk into the computer memory to complete the circuitry requirement of the computer system is called booting.

## Multiple Choice Questions

1. The radian of a number system—
   (A) Is variable
   (B) Has nothing to do with digit position value
   (C) Equals the number of its distinct counting digits
   (D) Is always an even number
2. The section of the CPU that selects, interprets and monitor the execution of program instructions—
   (A) Memory (B) Register unit
   (C) Control unit (D) ALU
3. The term referring to evacuating the content of some part of the machine is known as—
   (A) Dump (B) Enhancement
   (C) Down (D) Compiler
4. A single packet on a data link is known as—
   (A) Path (B) Frame
   (C) Block (D) Group
5. The examination and changing of single bits or small groups of bits within a word is called—
   (A) Bit
   (B) Byte
   (C) Bit manipulation
   (D) Bit slice
6. The symbols used in an assembly language are—
   (A) Codes (B) Mnemonics
   (C) Assembler (D) All of the above
7. The average time necessary for find the correct sector of a disk to arrive at the read write head is ?
   (A) Down time (B) Seek time
   (C) Rotational delay (D) Access time
8. ASCII stands for—
   (A) American standard code for information interchange
   (B) All purpose scientific code for information interchange
   (C) American security code for information interchange
   (D) American Scientific code for information interchange
9. Which device of computer operation dispenses with the use of the keyboard ?
   (A) Joystick (B) Light pen
   (C) Mouse (D) Touch
10. Any storage device added to a computer beyond the immediately usable main storage is known as—
    (A) Floppy disk (B) Hard disk
    (C) Backing store (D) Punched card
11. The brain of any computer system is—
    (A) ALU (B) Memory
    (C) CPU (D) Control unit
12. What difference does the 5th generation computer have from other generation computers ?
    (A) Technological advancement
    (B) Scientific code
    (C) Object Oriented Programming
    (D) All of the above
13. The tracks on a disk which can be accused without repositioning the R/W heads is—
    (A) Surface (B) Cylinder
    (C) Cluster (D) All of the above
14. Which of the following is the 1's complement of 10 ?
    (A) 01 (B) 110
    (C) 11 (D) 10
15. Which part interprets program instructions and initiate control operations—
    (A) Input (B) Storage unit
    (C) Logic unit (D) Control unit
16. A computer program that converts assembly language to machine language is—
    (A) Compiler (B) Interpreter
    (C) Assembler (D) Comparator
17. The time required for the fetching and execution of one simple machine instruction is—
    (A) Delay time (B) CPU cycle
    (C) Real time (D) Seek time
18. The time for which a piece of equipment operates is called—
    (A) Seek time (B) Effective time
    (C) Access time (D) Real time

19. Any type of storage that is used for holding information between steps in its processing is—
(A) CPU
(B) Primary storage
(C) Intermediate storage
(D) Internal storage

20. A program component that allows structuring of a program in an unusual way is known as—
(A) Correlation (B) Coroutine
(C) Diagonalization (D) Quene

21. Which output device is used for translating information from a computer into pictorial form on paper—
(A) Mouse (B) Plotter
(C) Touch panel (D) Card punch

22. The list of coded instructions is called—
(A) Computer program
(B) Algorithm
(C) Flowchart
(D Utility programs

23. A device designed to read information encoded into a small plastic card is ?
(A) Magnetic tape (B) Badge reader
(C) Tape puncher (D) Card puncher

24. A group of magnetic tapes, videos or terminals usually under the control of one master is—
(A) Cylinder (B) Cluster
(C) Surface (D) Track

25. The first generation of computers available was based on the How much bit micro processors ?
(A) 4 (B) 8
(C) 16 (D) 64

26. The complete picture of data stored in database is known as ?
(A) Record
(B) Schema
(C) System flowchart
(D) DBMS

27. Which is a unit representing the Bit rate—
(A) Baud (B) Byte
(C) Bit (D) All of the above

28. The personnel who deals with the computer & its management put together are called—
(A) Software (B) Humanware
(C) Firmware (D) Hardware

29. Compilers and interpreters are themselves—
(A) High-level language
(B) Codes
(C) Programs
(D) Mnemonics

30. Compression of digital data for efficient storage is—
(A) Buffer (B) CPU
(C) Packing (D) Field

31. A memory that holds micro programs is ?
(A) Core memory (B) ROM
(C) RAM (D) Control memory

32. The organization and interconnection of the various components of a computer system is—
(A) Architecture (B) Networks
(C) Graphics (D) Designing

33. Which of the following is the coding of data so that is can't be easily understood if intercepted.
(A) Barcode (B) Decoder
(C) Encryption (D) Mnemonics

34. Which network is a packet switching network?
(A) Ring network (B) LAN
(C) Star network (D) EuroNET

35. Who is considered the 'father' of the minicomputer and one of the founder fathers of the modern computer industry world-wide?
(A) George Tate (B) Kenneth H. Olsen
(C) Seymour Cray (D) Blaiz Pascal

36. Where have the program and data to be located before the ALU and control unit of a computer can operate on it ?
(A) Internal memory
(B) Secondary memory
(C) Microprocessor
(D) Magnetic tapes

37. Control Unit of a digital computer is often called the—
(A) Clock (B) Nerve center
(C) ICs (D) All of the above

38. Time during which a job is processed by the computer is—
(A) Delay time (B) Real time
(C) Execution time (D) Down time

39. The software used to convert source program instructions to object instruction is known as—
(A) Compiler
(B) Assembler
(C) Interpreter
(D) Language processor

40. An instruction that transfers program control to one or more possible paths is known as—
(A) Utility program
(B) System software
(C) Broadband channel
(D) Application program

41. A .....is simply an arrangement where multiple disk drives appear as a single disk drive to the user.
(A) disk (B) disk array
(C) bunch of disks (D) disk pack

42. Which of the following holds data and processing instructions temporarily until the CPU needs it ?
(A) ROM
(B) Control unit
(C) Main memory
(D) Coprocessor chips

43. The language that is an input for statement translation is called—
(A) Assembly language
(B) Source language
(C) High-level language
(D) Object language

44. Before a disk drive can access any sector record, a computer program has to provide the record's disk address. What information does this address specify ?
(A) Track number (B) Sector number
(C) Surface number (D) All of the above

45. A high speed device used in CPU for temporary storage during processing is called—
(A) A register (B) A bus
(C) A databus (D) All of the above

46. The memory which is ultraviolet light erasable and electrically programmable is—
(A) ROM (B) PROM
(C) RAM (D) EPROM

47. A hashing scheme is used with—
(A) sequential file organization
(B) direct file organization
(C) indexed sequential file organization
(D) partitioned file organization

48. The time taken for the read/write head to move to the correct track on the magnetic disk is called—
(A) epoch delay (B) latency delay
(C) seek time (D) approach time

49. Computer Operators—
(A) Write computer programs for specific problems
(B) Operate the devices which input and output data from the computer
(C) Normally require a college degree in computer science
(D) All of the above

50. Why is the width of the data bus so important to the processing speed of a computer ?
(A) The narrower it is, the greater the computer's processing speed
(B) The wider it is, the more data that can fit into main memory
(C) The wider it is, the greater the computer's processing speed
(D) The wider it is, the slower the computer's processing speed

51. Which of the following are the two main components of the CPU ?
(A) Control Unit and Registers
(B) Registers and Main Memory
(C) Control unit and ALU
(D) ALU and bus

52. The two basic types of record access methods are—
(A) Sequential and random
(B) Sequential and indexed
(C) Direct and immediate
(D) Online and real time

53. A disadvantage of the laser printer is—
(A) It is quieter than an impact printer
(B) It is very slow
(C) The output is of a lower quality
(D) None of the above

54. Different components in the motherboard of a PC unit are linked together by sets of parallel electrical conducting lines. What are these lines called ?
(A) Conductors
(B) Buses
(C) Connectors
(D) Consecutives

55. The language that the computer can understand and execute is called—
(A) Machine language
(B) Application software
(C) System program
(D) All of the above

56. Which of the following is used as a primary storage device ?
(A) Magnetic drum
(B) PROM
(C) Floppy disk
(D) All of these

57. Which of the following memories needs refresh ?
(A) SRAM (B) DRAM
(C) ROM (D) All of above

58. Which of the following devices can be used to directly input printed text ?
(A) OCR (B) OMR
(C) MICR (D) All of above

59. The output quality of a printer is measured by—
(A) Dot per cm
(B) Dots per inch
(C) Dots printed per unit time
(D) All of the above

60. In analog computer—
(A) Input is first converted to digital form
(B) Input is never converted to digital form
(C) Output is displayed in digital form
(D) All of the above

61. Who designed the first electronics computer–ENIAC
(A) Von Neumann
(B) Joseph M Jacquard
(C) J. P. Eckert and J. W. Mauchly
(D) All of the above

62. Modern computers are very reliable but they are not—
(A) Fast (B) Powerful
(C) Infallible (D) Cheap

63. Which 8-bit chip was used in many of today's TRS-80 computers ?
(A) Z-8000 (B) Motorola 6809
(C) Z-8808 (D) Z-80

64. Personal computers used a number of chips mounted on a main circuit board. What is the common name for such boards ?
(A) Daughterboard (B) Motherboard
(C) Father board (D) Childboard

65. In most of the IBM PCs, the CPU, the device drivers, memory, expansion slots and active components are mounted on a single board What is the name of the board ?
(A) Motherboard (B) Daughterboard
(C) Bredboard (D) Fatherboard

66. A computer program that converts an entire program into machine language at one time is called a/an—
(A) Interpreter (B) CPU
(C) Compiler (D) Simulator

67. A computer Program that translates one program instruction at a time into machine language is called a/an—
(A) Interpreter (B) CPU
(C) Compiler (D) Simulator

68. The memory which is programmed at the time it is manufactured—
(A) POM (B) RAM
(C) PROM (D) EPROM

69. Which of the following memory medium is not used as main memory system?
(A) Magnetic core (B) Semiconductor
(C) Magnetic tape (D) Both (A) and (B)

70. Registers, which are partially visible to users and used to hold conditional, data are known as—
(A) PC
(B) Memory address registers
(C) General purpose register
(D) Flags

71. One of the main feature that distinguish microprocessors from micro-computers is—
(A) Words are usually larger in micro-processors
(B) Words are shorter in microprocessors
(C) Microprocessor does not contain I/O devices
(D) Exactly the same as the machine cycle time

72. The least significant bit of the binary number, which is equivalent to any odd decimal number, is—
(A) 0 (B) 1
(C) 1 or 0 (D) 3

73. What type of control pins are needed in a microprocessor to regulate traffic on the bus, in order to prevent two devices from trying to use it at the same time ?
(A) Bus control (B) Interrupts
(C) Bus arbitration (D) Status

74. When was the world's first laptop computer introduced in the market and by whom ?
(A) Hewlett-Packard
(B) Epson, 1981
(C) Laplink traveling software Inc. 1982
(D) Tandy model-2000, 1985

75. The first microprocessor built by the Intel Corporation was called—
(A) 8008 (B) 8080
(C) 4004 (D) 8800

## Answers

| | | | | |
|---|---|---|---|---|
| 1. (C) | 2. (C) | 3. (A) | 4. (B) | 5. (C) |
| 6. (B) | 7. (B) | 8. (A) | 9. (C) | 10. (C) |
| 11. (C) | 12. (A) | 13. (B) | 14. (A) | 15. (D) |
| 16. (C) | 17. (B) | 18. (B) | 19. (C) | 20. (B) |
| 21. (B) | 22. (A) | 23. (B) | 24. (A) | 25. (A) |
| 26. (B) | 27. (A) | 28. (B) | 29. (C) | 30. (C) |
| 31. (B) | 32. (A) | 33. (C) | 34. (D) | 35. (B) |
| 36. (A) | 37. (B) | 38. (C) | 39. (D) | 40. (C) |
| 41. (B) | 42. (C) | 43. (B) | 44. (D) | 45. (A) |
| 46. (D) | 47. (B) | 48. (C) | 49. (B) | 50. (C) |
| 51. (C) | 52. (A) | 53. (D) | 54. (B) | 55. (A) |
| 56. (B) | 57. (B) | 58. (A) | 59. (B) | 60. (B) |
| 61. (C) | 62. (C) | 63. (D) | 64. (B) | 65. (A) |
| 66. (C) | 67. (A) | 68. (A) | 69. (C) | 70. (D) |
| 71. (C) | 72. (C) | 73. (C) | 74. (B) | 75. (C) |

❑❑

# 2 MS Window/MS DOS

## Microsoft Operating System

**Windows** is the operating system sold by the Seattle-based company Microsoft. Microsoft entered the market place in August 1981 by releasing version 1.0 of the operating system Microsoft DOS (MS-DOS), a 16-bit command-line operating system.

The first version of Microsoft Windows (**Microsoft Windows 1.0**) came out in November 1985. It had a graphical user interface, inspired by the user interface of the Apple computers of the time. Windows 1.0 was not successful with the public, and Microsoft Windows 2.0, launched December 9, 1987, did not do much better.


### DOS

DOS stands for Disk Operating System. DOS was the standard operating system for PCs before Windows was created. It required the user to type commands at a boring screen with no pictures, no sound, no mouse, no color.

**DOS Screen**

### Window

A window is a rectangle portion of the display which is being used for a specific program. Each program has its own window. It is possible to have more than one window on the screen at one time. The word windows with a lower case 'w', refers to more than one window; with an upper case 'W', it refers to Microsoft Windows, the operating system for most personal computers.

### Window Pane

A window pane is simply a rectangular portion of a window. For example, a window may be divided in half vertically. In this case, you would have two window panes, one on the left, and the other on the right.

### Microsoft Windows

Microsoft Windows is the name of the program which runs your computer if you use a standard PC. It allows you to run other programs, each in their own window. It also allows you to

view and manage the files on your disk drives using icons to represent each item. Windows 98 is currently the latest version of this program.

### Microsoft Windows 95

Microsoft Windows 95 is the operating system in use on most of today's computers. It provides smoother (preemptive) multitasking, support for long filenames, better multimedia, and much more over Windows 3.1. Windows 95 was a big change from Windows 3.1. It does provide backward compatibility with Windows 3.1, though, so older programs will almost always work on this newer version of Windows. However, older programs will not take advantage of newer features (such as long filenames).

### Microsoft Windows 98

Microsoft Windows 98 is the latest version of Microsoft Windows. It adds much improved Internet software, support for TV and DVD, and more. It is also supposed to start itself and other programs faster than Windows 95. It is still backward compatible with Windows 3.1 & DOS.

### Double-click

Move your mouse pointer over the object, then press the left mouse button twice in a row quickly. Be **VERY** careful to **not** move the mouse as you double-click. If you move the mouse while trying to double-click, you may end up dragging the object instead of double-clicking it.

### Drag

Move the mouse pointer over the object you wish to drag, and then hold down the **left** mouse button. While holding the mouse button, move the mouse pointer (and the object) to the location you want it, then let go of the mouse button. This will move or copy the object to the new location, depending on the context.

### Driver Software

Driver software is software that works as a translator between another program and some piece of hardware. In the software industry, there are generally standard ways to do things. There are many different types of hardware, however, and each piece of hardware may have its own protocol (or "language"). The driver software receives standard signals from another program, then translates these into commands for a particular piece of hardware. This way a program can be written in a standard way, and it will work with many different devices.

### Taskbar

This is the portion of your screen including the Start button, the time display, and everything in between. The start button gives you access to the programs installed on your computer, your system settings, a shut down command, and more. Immediately to the right of the start button are buttons for each program you are currently running. You will probably also have little icons to the left of the time display for miscellaneous programs that make the computer work. For example, you most likely have a speaker icon for your sound, maybe an icon for anti virus software, and others. Try double-clicking any of these to see what they are.

### Text Cursor

The text cursor is the location that text will appear as you type it. It is also called the insertion point. With modern software, it is usually a blinking vertical line. It will normally be at the end of the line of text that you are typing; however it could also be placed between two characters of text.

### Toggle

To toggle means to switch on or off. If the item is currently off, then it will be turned on. If it is already on, then it will be turned off. An example of a item that toggles is a checkbox. The first time you click, an X will be placed in the box, the next time the X will be removed.

### Toolbar

A toolbar is a collection of buttons, usually organized by category. Some programs allow you to turn individual toolbars on and off (to display or hide them), and you may even be able to customize the toolbar by changing what buttons are shown (or even add your own buttons). Often, you can drag a toolbar (by dragging from an edge of the toolbar where there is no button) to move it to a different location on the screen. If a novice user does this, though, the user may not know what he or she did and may "lose" the toolbar. Usually, you can turn toolbars on and off by clicking the "**view**" menu, then choosing "**toolbars**".

# MS Window/MS DOS Terminology

### 32-bit OS

A 32-bit operating system allows Windows 9x/NT to access computer data faster than 16-bit systems by taking it in larger pieces.

### Accessories

Accessories is a submenu of the Programs menu that gives access to such helpful applications as Calculator, Notepad, WordPad, and Paint.

### Active Window

The active window is the area on the Desktop that is currently being used and which usually contains a file or an application. The active window has darkened window elements, such as title bar, scroll bars, and buttons.

### ALT

The [ALT] (or Alternate) key on the keyboard is used in conjunction with other keys and mouse actions to perform various commands and functions.

### Application

An application is a program that runs on the computer.

### Arial

Arial is a sans serif font that is available on every Windows-based computer.

### BACKSPACE

The [BACKSPACE] key on the keyboard is most often used to delete data to the left of the insertion point.

### Bitmap

A bitmap is a type of graphics file that is usually created in MS Paint.

### Browsing

Browsing means looking through a computer system to locate files, folders, applications, or printers.

### Button

A button is an icon that represents a tool or command.

### Calculator

Calculator is a small application in Windows used for performing arithmetic.

### Cancel

Cancel is a command button in a dialog box that halts a current operation, such as printing.

### CD-ROM

CD-ROM stands for Compact Disc-Read Only Memory. It is a high-capacity data disc used in conjunction with a CD-ROM drive. Data cannot be saved to a CD-ROM, only read from it.

### Check Box

A check box in a dialog box is used to specify one or more available options by clicking within a small square.

### Click

Clicking means pressing the left mouse button once while pointing at an object. Hold the mouse steady, press the left mouse button, and then release it quickly.

### Clipboard

Clipboard is a small application in Windows Operating System that temporarily stores information which has been cut or copied.

### Close Button

The Close button is an icon located in the upper right corner of a window that is used to shut down a document or application quickly.

### Context-sensitive

Context-sensitive refers to information or menus that are specific to the selected object.

### Control Buttons

Control buttons are the Minimize, Maximize, Restore, and Close buttons found in the upper right corner of an open file or application window.

### Control Panel

The Control Panel is a collection of small applications used for changing settings in the computer system, such as screen colors, fonts, and other features.

**Copy**

Copy is a command that sends a duplicate of selected data to the Clipboard for use in another location.

**CTRL**

The [CTRL] (or Control) key on the keyboard is used in conjunction with other keys and mouse actions to perform various commands and functions.

**Cut**

Cut is a command that removes selected data and places it on the Clipboard for use in another location.

**Default**

A default setting is the software manufacturer's preset option for a particular command or function. Default settings can be changed.

**Defragmenting**

Defragmenting is the process of reorganizing the files on a disk to make the disk more efficient.

**Deselecting**

Deselecting is removing the active mark or highlight from an object.

**Desktop**

The Desktop is the area of Windows OS that contains My Computer, Recycle Bin, the Taskbar, and shortcuts to files and applications on the system.

**Dialog Box**

A dialog box presents a way for Windows to give or receive information.

**Dimmed**

Some menu items, as well as buttons and other options in a dialog box, can be dimmed or grayed out if it is not possible to use them under the current circumstances.

**Document**

A document is any file that can be produced by an application and reopened, modified, saved, and closed.

**Documents Command**

Found on the Start menu, the Documents command opens a menu of the 15 most recently used files.

**Double-click**

Double-clicking means pressing the left mouse button twice in rapid succession.

**Drag**

Dragging is the process of holding the left mouse button down while moving the mouse.

**Drag-and-Drop**

Dragging-and-dropping is the process of moving a selected item to another location by holding the left mouse button down on it, and then moving the mouse and releasing the button.

**Drag-select**

Drag-selecting is the process of selecting areas of text by holding the left mouse button down, and then moving the mouse across the area and releasing the button.

**Drop-down List**

A drop-down list is a list of choices that become available by clicking a text box or its adjacent down-arrow.

**Embossed Text**

Embossed text is similar to shadowed text, though the effect is more of a highlight than a shadow. Embossed text takes the same color as the background and appears slightly raised.

**File Management**

File management is the process of organizing objects contained on the hard disk into a formal structure of folders, subfolders, and files.

**Files**

A file is a collection of data referred to by a given name.

**Find Command**

The Find command allows you to search the computer for files and folders based on particular criteria.

**Folders**

Part of the organizational system of the computer disk, folders are sleeves that can contain files or other folders.

**Font**

A font is a style and size of type, such as Times New Roman, 12 point, bold.

**Fonts Folder**

The Fonts folder is an area on the system used for controlling and managing type styles.

**Grouping Objects**

Grouping objects combines multiple objects into a single object with its own selection handles.

**Help**

Help is a menu item found in Windows OS and most Windows applications that provides assistance or additional information.

**Help Command**

The Help command is an item on the Start menu that contains information about Windows OS features.

**HyperTerminal**

HyperTerminal is an application used for connecting the computer to another computer using a modem.

**Icon**

An icon is a graphical representation of an object.

**Inactive Window**

An inactive window is any open window that is not currently being used. The inactive window has grayed window elements, and doesn't have the title bar buttons.

**Insertion Point**

An insertion point is the place where text or graphics will appear in the document.

**List Box**

A list box is a box that contains a list of available choices, such as files or field names.

**Marquee-select**

Marquee-selecting is the process of clicking-and-dragging the mouse pointer over a group of objects until a dotted line forms a box around it.

**Maximize**

The Maximize command enlarges a window to fill the entire Desktop.

**MB**

MB (or megabyte) is a data measurement. One megabyte is equal to 1,000 kilobytes of data.

**Media Player**

Media Player is a small application used for playing audio and video files.

**Memo Wizard**

The Memo Wizard helps you create a memo by asking you a series of questions regarding the kind of memo you want to create.

**Memory**

Memory is the working area of the computer where active applications and files are loaded for use.

**Menu Bar**

A menu bar is a list of commands across the top of the screen that may be opened to reveal additional commands.

**Microsoft Graph**

Microsoft Graph is an application that allows you to create graphs in PowerPoint.

**Minimize**

The Minimize command reduces a window to a button on the Taskbar.

**Mouse Pointer**

A mouse pointer is a screen element that corresponds to the spot where you are rolling the mouse. The mouse pointer can change depending on the current action.

**Moving Drag-and-drop Mouse Pointer**

The northwest arrow mouse pointer becomes the moving drag-and-drop mouse pointer while you are dragging a selected item from one location to another.

**MS-DOS**

MS-DOS stands for MicroSoft Disk Operating System.

**Multitasking**

Multitasking is the process of running more than one application or activity at a time.

**My Computer**

My Computer is a folder on the Desktop that provides access to the systems disk drives and other hardware.

### Navigation Keys

Navigation keys are keyboard keys that allow you to move around within a document, such as [PAGE UP], [HOME], and the arrow keys.

### Notepad

Notepad is a small application in Windows OS used for creating and editing text files.

### Notes Pages View

In Notes Pages View, each page corresponds to a slide. A page in Notes Pages View contains a reduced image of a slide as well as an area to include speaker's notes.

### Objects

Objects are any data that can be used in an application or shared with other applications.

### OLE

Object Linking and Embedding (OLE) are processes that permit the sharing of files and objects between applications.

### Option Button

An option button in a dialog box is a round button that is used to select one of several mutually exclusive commands.

### Organization Chart

Organization Chart is an application that allows you to create organization charts in PowerPoint.

### Outline View

Outline View only shows slide titles and body text, and you can use it to rearrange the order and organization of a presentation. You can also enter most of your text in this view.

### Paint

Paint is a small application used for creating, modifying, and viewing graphics.

### Paste

Paste is a command that inserts data from the Clipboard into a document.

### Path

A path is a line of text that shows the exact location of a file, including any folders and subfolders.

### Phone Dialer

Phone Dialer is a small application in Windows OS (Operating System) that will automatically initiate phone calls via a modem.

### Picture Toolbar

The Picture toolbar contains buttons that you can use to format the selected picture. The toolbar appears, usually under the Formatting toolbar, when you insert or select a picture in a document, and it closes when you deselect the picture.

### Point

Pointing is the action of placing the mouse pointer over the desired object or text.

### Pop-up Window

When you click a dotted-line hot spot, a separate window "pops up" on your screen. When you are done reading the information in the pop-up window, you can click anywhere to close it.

### Presentation

A presentation is a collection of slides, handouts, speaker's notes, and an outline, all combined into a file that can be printed onto transparencies or slides or projected from a computer.

### Programs Command

The Programs command is an item on the Start menu that contains icons for starting applications installed on the system.

### Recycle Bin

The Recycle Bin is a temporary storage area used for keeping files until they are either recovered or permanently deleted.

### Restore

The Restore command returns a window to its default size after it has been either minimized or maximized.

### Right-click

Right-clicking is the process of pressing and releasing the right mouse button, usually to produce a shortcut menu.

### Right-click Menu

A right-click menu is a context-sensitive menu for an object.

**Right-drag**

Right-dragging is the process of pressing and holding the right mouse button while moving the mouse.

**Run Command**

The Run command is the section of the Start menu that reveals a text box for typing in application commands.

**Save**

Save is a command that stores a file or changes to a file onto a disk.

**Save As**

Save As is a command that stores a new file or an existing file under a new name onto a disk.

**Scan Disk**

Scan Disk is an application used to check for errors or damage to a disk.

**Screen Element**

A screen element is an object on the screen, such as a button or a ruler. Screen elements will vary between the different Word views.

**Scroll Arrows**

Scroll arrows are used to navigate windows horizontally and vertically in small increments.

**Scroll Bar**

The scroll bar is a panel for moving the display horizontally or vertically within a window.

**Scroll Bar Arrows**

The scroll bar arrows, located at the ends of the scroll bars, may be clicked to slowly move the view within a window up, down, or across.

**Scroll Box**

The scroll box is the box within a window's horizontal or vertical scroll bar that indicates your position within the window.

**Scroll Boxes**

Scroll boxes are used to navigate windows horizontally and vertically in very large increments by clicking-and-dragging them along the scroll bar.

**Scrolling**

Scrolling is the process of navigating through a document up-and-down (vertical scrolling) or side-to-side (horizontal scrolling).

**Select**

In order to work with an object, you must first select or activate it. One way to select an object is by clicking it with the mouse.

**Selecting**

Selecting is highlighting an object or data in order to perform a command or operation.

**Selection Bar**

The selection bar is an unmarked area in the left margin of a document that allows for easy data selection.

**Settings Command**

The Settings command is an item on the Start menu that shows customizable options of the Windows OS environment.

**Shading Color**

Shading color is the percentage or type of shading applied to a selected paragraph, table cell, or frame.

**Shadowing Text**

When you shadow text, you add a drop-shadow behind it. You can use shadowing for emphasis.

**SHIFT**

The [SHIFT] key on the keyboard is used in conjunction with other keys and mouse actions to capitalize letters and perform various commands and functions.

**SHIFT+Click**

[SHIFT Click] is the process of holding down the [SHIFT] key while pressing the left mouse button.

**SHIFT+Click Selections**

Click to place the insertion point where you want to begin your selection, then [SHIFT+Click] the location where you want to end your selection. The area in-between will become selected.

**Shortcut**

A shortcut points to an application or document in another location and is represented by an icon with an arrow at the bottom.

**Shortcut Menu**

A shortcut menu shows a list of context-sensitive options. (See Right-click Menu.)

**Shut Down Command**

The Shut Down command is an item on the Start menu that is used to turn off the system.

**Start Button**

The Start button is a command located on the Taskbar that opens the Start menu. Use this button on the Taskbar to show the Start menu to open applications.

**Start Menu**

The Start menu is a list of selectable commands that are used for accessing applications, files, and system settings.

**Status Bar**

The status bar provides information about the open document, and the current settings and operations in progress.

**Subfolder**

Subfolders are folders within or under folders that are used to organize the files inside the folders.

**Tabs**

Tabs are the titles of the cards found in some dialog boxes. Clicking one brings that card to the front.

**Task Buttons**

Task buttons are icons on the Taskbar that represent open windows.

**Taskbar**

The Taskbar is a panel that appears on the Desktop which contains all the available windows, the Start button, and the status box.

**Text Box**

A text box is an area in a dialog box that is used for entering text.

**Title Bar**

The title bar is the area at the top of a window that contains the name of the application or open file.

**Tool**

A tool is a shortcut button, usually shown on a bar near the top of a window, that provides quick access to a commonly used command.

**Toolbar**

A toolbar is a group of tools of usually related functions.

**Tool Tip**

A ToolTip is a descriptive label that appears when the mouse pointer is held over a tool.

**Trace**

Tracing is the process of navigating through an open menu by moving the mouse over menu items.

**Transition**

A transition is an effect that can be run between slides to signal a shift from one slide to the next.

**Truncated**

Truncated text is the shortening or abbreviation of text due to limited display space.

**Ungrouping Objects**

Ungrouping objects allows you to work with each part of a grouped object individually.

**View Buttons**

The View buttons allow you to switch between the most common Word views.

**Wallpaper**

Wallpaper is the graphic or background design visible on your Desktop.

**Working Screen**

When you start Word, the application opens to the working screen. The screen contains the application window, the document window, and tools for using Word successfully.

**Wrapping Text**

Wrapping text is an automatic feature of Word. When you reach the end of a line while typing, Word forces the text to break onto a new line.

**Writing Style**

Use the various writing styles to define the grammar rules for checking grammar. Choose from casual, standard, formal, or technical styles, or create your own custom style. You also can change the rules that each style uses to check the grammar.

**WYSIWYG**

WYSIWYG is an acronym for What You See Is What You Get, meaning that what you see on the screen should be what prints on the page.

## Multiple Choice Questions

1. An entire path name, consisting of several sub-directory names can contain upto—
   (A) 13 character (B) 36 character
   (C) 63 character (D) 53 character
2. In which year the first operating system was developed—
   (A) 1910 (B) 1940
   (C) 1950 (D) 1980
3. MS-DOS developed in—
   (A) 1991 (B) 1984
   (C) 1971 (D) 1961
4. Maximum length of DOS command using any optional parameter is—
   (A) 26 characters (B) 87 characters
   (C) 127 characters (D) None of these
5. In which version of DOS. CHKDSK command has been changed to SCANDISK ?
   (A) 5.0 (B) 6.2
   (C) 6.0 (D) 6.2
6. CHKDSK command is used to—
   (A) Analyze the hard disk error
   (B) Diagnose the hard disk error
   (C) Report the status of files on disk
   (D) All of the above
7. Which file is the batch file that is read while booting a computer ?
   (A) Autoexec.bat
   (B) Auto-batch
   (C) Autoexecutive.bat
   (D) Auto.bat
8. Which command is used to backup in DOS 6+ Version—
   (A) BACKUP
   (B) MSBACKUP
   (C) MSBACKEDUP
   (D) All of the above
9. Copy and Xcopy are same in the sense—
   (A) Both are internal command of DOS
   (B) Both are external commands of DOS
   (C) Both can be used to copy file or group of files
   (D) Both (A) and (B)
10. Which command is used to clear the screen—
    (A) CLS (B) Clear
    (C) Clscreen (D) All of above
11. Internal command in DOS are—
    (A) Cls, rd label
    (B) Dir, ren, sys
    (C) Time, type, dir
    (D) Del, disk copy, label
12. Which command is used to copy files ?
    (A) Copy
    (B) Diskcopy
    (C) Type
    (D) All of the above
13. To copy the hidden system files of DOS to another disk you can use the command—
    (A) Copy (B) Ren
    (C) Sys (D) Diskcopy
14. Disk copy command in DOS is used to—
    (A) Copy a file
    (B) Copy contents of one floppy disk to another
    (C) Copy contents of CD-ROM to another
    (D) All of the above
15. SYS command is used to—
    (A) Copy DOS system files to new disk
    (B) Copy DOS configuration files to a new disk
    (C) Update the DOS system files
    (D) None of the above
16. The command used to copy a file named temp.doc from drive C: to drive A : is—
    (A) Copy temp.doc to a:
    (B) Copy c:\temp.doc a:
    (C) Copy c: a:
    (D) Copy temp a: c:
17. External command in DOS are—
    (A) Copy, edit, sys, format
    (B) Edit, sys, chkdsk
    (C) Chkdsk, prompt, date
    (D) Sys, ver, vol

18. Which keys can be pressed quit without saving in DOS—
(A) Ctrl + A (B) Ctrl + B
(C) Ctrl + C (D) Ctrl + D

19. Which command is used to get the current date only ?
(A) Date (B) Time
(C) Second (D) All of these

20. Generally, the DATE is entered in the form—
(A) DD-YY-MM (B) YY-DD-MM
(C) MM-YY-DD (D) MM-DD-YY

21. Which statement is valid about "TIME" command ?
(A) Time command is used to display and allow changes to the system time
(B) Time format can be changed by changing in country setting in config.sys file
(C) MS DOS displays the time in 12-hour or 24-hour format
(D) All of the above

22. Which command is used to see the sub-directory structure of drive ?
(A) Tree (B) List
(C) Subdir (D) Subtree

23. Which command is used to display the subdirectory structure of the currently logged drive and pause the screen display after each screen full of the information ?
(A) Tree (B) Deltree/f
(C) Dir/more (D) Tree/more

24. Which command is used to provide access to files located in other directories or disks ?
(A) Tree (B) Path
(C) Dir (D) Cd

25. You can copy command.com to your disk from hard disk
(A) true (B) false

26. Which command is used to see the contents of a file ?
(A) Type (B) Copy
(C) Ed (D) None of these

27. Which command is used to see the disk volume label ?
(A) Ver (B) Vol
(C) Version (D) Volume

28. Which command is used to see the version ?
(A) Version (B) Ver
(C) Verson (D) None of these

29. What is the name of the batch file that is automatically run when MS-DOS is booted ?
(A) Run.bat (B) Config.sys
(C) Config.bat (D) Autoexec.bat

30. What is the switch that is used to make sure that the copy command copied files correctly
(A) /a (B) /c
(C) /s (D) /v

31. What will be the output of the command prompt $lSp$g ?
(A) <c:\> (B) C:\>
(C) C:\>> (D) C:<\>

32. Which among the following are the best tools for fixing errors on disks ?
(A) Fdisk (B) Scandisk
(C) Chkdsk (D) Fixdsk

33. Which command can be used to create the disk's tracks and sectors ?
(A) Fdisk (B) Format
(C) Chkdsk (D) Attrib

34. Which command in DOS can be used to recover accidentally deleted files ?
(A) UNDELETE
(B) DELETE/CANCEL
(C) RESTORE
(D) RECOVER

35. Which command in DOS is used to display the version of MS-DOS ?
(A) VERSION (B) VERIFY
(C) VER (D) VERSN

36. Which command is used to copy all files from drive a with extension .txt to the currently logged drive and directory ?
(A) Copy a. *.txt (B) Copy *.txt a:
(C) Copy *.txt c: (D) Copy *.txt all.txt

37. Which command is used to create root directory and FAT on disk ?
(A) Chkdsk
(B) Command.com
(C) Format
(D) Fat

38. Which command is used to delete all the files extension .txt on the current drive and directory ?
(A) Del .txt (B) Erase .txt
(C) Del *.txt (D) Del *.*/p

39. Which command is used to delete all the files in the root directory of drive a—
(A) A:\del (B) Del *.* a:
(C) Del a:\ (D) Erase *.*

40. Which command is used to display a list of deleted files that DOS can undelete ?
(A) Undelete *.*
(B) Undelete/all
(C) Undelete/list
(D) None of the above

41. Which command is used to undelete delete a bunch of files with extension .doc that you have just deleted
(A) Undelete (B) Undelete *.doc
(C) Undelete/all (D) All of these

42. Which file in MS-DOS contain internal command that are loaded during booting process ?
(A) Io.sys (B) Msdos.sys
(C) Command.com (D) Config.sys

43. Which is the valid filename assign in MS-DOS ?
(A) Ram*.txt (B) Ram?.doc
(C) Ram_$.txt (D) None of these

44. Which is valid extension that user creates on operating system ?
(A) Exe (B) Com
(C) Sys (D) Bat

45. Which of the following file names are invalid in MS-DOS ?
(A) MYFILE.DOS (B) CHECK$.(1)
(C) Verified.### (D) Qwerty.1?3

46. Which of the following statements in regard to directories is false ?
(A) Directories can exist inside directories
(B) The root directory is always at the highest level
(C) Directories with files can be deleted
(D) Directories cannot be renamed

47. Which of the following statements is true in regard to diskcopy ?
(A) Copy and discopy are same
(B) Discopy is a built in command in dos
(C) Diskcopy can be used on hard disks
(D) Diskcopy can be used with a floppy and a hard disk

48. Which switch should be used in the DIR command to view files in all directories ?
(A) /p (B) /w
(C) /s (D) /l

49. Which type of command in DOS needs additional files for their execution ?
(A) Internal commands
(B) External commands
(C) Batch commands
(D) Redirectors

50. Which was the last version of MS-DOS that was released separately ?
(A) 5.0 (B) 6.0
(C) 6.11 (D) 6.22

51. While working with MS-DOS which command is used to change the extension of all filenames ending with .txt to .doc ?
(A) Ren *.doc *.txt
(B) Ren *.txt *.doc
(C) Ren file.doc file.txt
(D) Ren a: *.doc *.txt

52. While working with MS-DOS which command is used to combine file1 plus file2 into new file named file3 ?
(A) Copy file3 file1+file2
(B) Copy file1+file2 file3
(C) Copy file1+file2+file3
(D) Copy file2 file1+file3

53. While working with MS-DOS which command is used to copy all files with extension .txt into one file named all.txt ?
(A) Copy a: *.txt (B) Copy *.txt a:
(C) Copy *.txt c: (D) Copy *.txt all.txt

54. While working with MS-DOS, which command is used to more file from one directory to another ?
(A) Rename (B) Copy
(C) Move (D) Cp

55. While working with MS-DOS, which command is used to rename a file named file1.doc to file2.doc from a different directory called dir1 ?
(A) Ren2.doc \dir\file1.doc
(B) Ren file1.doc file2.doc
(C) Ren .doc\dir\.doc
(D) Ren \dir1\file1.doc file2.doc

56. While working with which command is used to copy all files from the currently logged drive and directory with the extension .txt to the drive a—
(A) Copy a. *.txt (B) Copy *.txt a:
(C) Copy *.txt c: (D) Copy *.txt all.txt

57. Which command in DOS can be used to recover accidentally deleted files ?
(A) UNDELETE
(B) DELETE/CANCEL
(C) RESTORE
(D) RECOVER

58. Which command is used to set a name to a disk in DOS ?
(A) VOLUME (B) VOL
(C) LABEL (D) DISKLABEL

59. Which of the following command display the name of files in sorted order ?
(A) Dir/o:n (B) Dir/so
(C) Dir/an (D) Dir/ah

60. Which command displays the list of all previous commands entered by the used ?
(A) COMMANDS/ALL
(B) KEYDOS
(C) DOSKEY
(D) DIR/ALL

61. ..... runs on computer hardware and serve as platform for other software to run on.
(A) Operating system
(B) Application software
(C) System software
(D) All

62. ....is the layer of a computer system between the hardware and the user program.
(A) Operating environment
(B) Operating system
(C) System environment
(D) None

63. The primary purpose of an operating system is.....
(A) To make the most efficient use of the computer hardware
(B) To allow people to use the computer
(C) To keep systems programmers employed
(D) To make computers easier to use

64. .....transforms one interface into another interface.
(A) Program (B) Software
(C) Data (D) None

65. .....system is built directly on the hardware.
(A) Environment (B) System
(C) Operating (D) None

66. Multiprogramming system—
(A) Are easier to develop than single programming system
(B) Execute each job faster
(C) Execute more jobs in the same time period
(D) Are used only one large mainframe computers

67. .....is the first program run on a computer when the computer boots up.
(A) System software
(B) Operating system
(C) System operations
(D) None

68. .....interface consists of things like program counter, registers, interrupts and terminals.
(A) Hardware (B) Software
(C) Data (D) None

69. ....share characteristics with both hardware and software.
(A) Operating system (B) Software
(C) Data (D) None

70. ....is used in operating system to separate mechanism from policy.
(A) Single level implementation
(B) Two level implementation
(C) Multi level implementation
(D) None

71. The operating system creates ..... from the physical computer.
    (A) Virtual space
    (B) Virtual computers
    (C) Virtual device
    (D) None

72. Swapping—
    (A) Works best with many small partitions
    (B) Allows many programs to use memory simultaneously
    (C) Allows each program in turn to use the memory
    (D) Does not work with overlaying

73. Which of the following operating does not implement multitasking truly ?
    (A) Windows 98 (B) Windows NT
    (C) Windows XP (D) MS DOS

74. What is the name of the latest server operating system developed by Microsoft ?
    (A) Windows NT
    (B) Windows 2000
    (C) Windows XP
    (D) Windows 2003

75. Where do you find user.dat ?
    (A) C:\windows
    (B) C:\windows\system32
    (C) C:\windows\system
    (D) C:\

## Answers

| | | | | |
|---|---|---|---|---|
| 1. (C) | 2. (C) | 3. (B) | 4. (C) | 5. (D) |
| 6. (D) | 7. (A) | 8. (B) | 9. (C) | 10. (A) |
| 11. (C) | 12. (A) | 13. (C) | 14. (B) | 15. (A) |
| 16. (B) | 17. (B) | 18. (C) | 19. (A) | 20. (D) |
| 21. (D) | 22. (A) | 23. (D) | 24. (B) | 25. (A) |
| 26. (A) | 27. (B) | 28. (B) | 29. (D) | 30. (D) |
| 31. (A) | 32. (B) | 33. (B) | 34. (A) | 35. (C) |
| 36. (A) | 37. (C) | 38. (C) | 39. (C) | 40. (C) |
| 41. (B) | 42. (C) | 43. (C) | 44. (D) | 45. (D) |
| 46. (D) | 47. (C) | 48. (C) | 49. (B) | 50. (D) |
| 51. (B) | 52. (B) | 53. (D) | 54. (C) | 55. (D) |
| 56. (B) | 57. (A) | 58. (C) | 59. (A) | 60. (C) |
| 61. (A) | 62. (B) | 63. (C) | 64. (C) | 65. (C) |
| 66. (B) | 67. (B) | 68. (A) | 69. (A) | 70. (B) |
| 71. (B) | 72. (C) | 73. (A) | 74. (D) | 75. (D) |

❑❑

# 3 Internet and Web Technology

### Internet

The Internet is a Network of computers, all over the world, Interconnected to each other and available to any individual.

The Internet is a worldwide collection of networked computers which are able to exchange information with one another very quickly. The computers that make up the Internet exchange information using the same cables and general technology that your home phone uses. Most people use the Internet in two ways, e-mail and the World Wide Web.


### URL

URL's, or 'uniform resource locators', are the web browser addresses of Internet pages and files. A URL works together with IP addresses to help us name, locate, and bookmark specific pages and files for our web browsers.

URL's commonly use three parts to address a page or file : the protocol (which is the portion ending in '//:'); the host computer (which sometimes ends in .com); and the filename/pagename itself. For example :

- https://virendracs.webs.com
- http://google.com/eBook/main
- ftp://files.microsoft.com/public/ eBookreader.msi
- telnet://freenet.edmonton.ca/main

### ISP

ISP is Internet Service Provider. That is the private company or government organization that plugs you into the vast Internet around the world. Your ISP will offer varying services for varying prices : web page access, email, hosting your own web page, hosting your own blog, and so on. ISP's will also offer various Internet connection speeds for a monthly fee. (E.g. ultra high speed Internet *Vs*. economy Internet).

## Internet and Web Technology Terminology

### Active X

**Active X** is a technology introduced by Microsoft in 1996 as part of the OLE framework. It includes a collection of prewritten software components that developers can implement within an application or webpage.

### Address bar

An **address bar** is a text field near the top of a Web browser window that displays the URL of the current webpage.

### Apache

**Apache** is the most popular Web server software. It enables a computer to host one or more websites that can be accessed over the Internet using a Web browser.

### ASP

**ASP** has two different meanings in the IT world :

(1) Application Service Provider, and
(2) Active Server Page.

**(1) Application Service Provider**

An Application Service Provider is a company or organization that provides software applications to customers over the Internet. These Internet-based applications are also known as "software as a service" (SaaS) and are often made available on a subscription basis. This means ASP clients often pay a monthly fee to use the software, rather than purchasing a traditional software license. Some SaaS applications can be accessed via a web browser, while others operate over a proprietary secure port.

**(2) Active Server Page**

An Active Server Page, commonly called an "ASP page," is a webpage that may contain scripts as well as standard HTML. The scripts are processed by an ASP interpreter on the web server each time the page is accessed by a visitor. Since the content of an ASP page can be generated on-the-fly, ASP pages are commonly used for creating dynamic websites.

**Archie**

A play on the word 'archive', it is a distributed database of archive files.

**Bitnet**

An education and research network that makes up part of the Internet, mainly used for email.

**Bandwidth**

A measurement of a network's transmission speed, how much data a network can transfer in a given amount of time.

**Bookmark**

The process of saving a URL in your Web browser. Allows the user to return to a particular site or entry by making a record of it.

**Bulletin Board System**

A service dedicated to a specific topic where users post messages that are read by others. It is a computer or computers that offer dial-in communication which offers users the ability to send e-mail, use news-groups, and sometimes access the Internet.

**Captcha**

A captcha is program used to verify that a human, rather than a computer, is entering data. Captchas are commonly seen at the end of online forms and ask the user to enter text from a distorted image.

**Client-server**

Two computer systems linked by a network or modem connection where the client computer uses resources by sending requests to the server computer.

**Cyberspace**

Unlike most computer terms, "cyberspace" does not have a standard, objective definition. Instead, it is used to describe the virtual world of computers.

**Cloud Computing**

Cloud computing refers to applications and services offered over the Internet. These services are offered from data centers all over the world, which collectively are referred to as the "cloud." This metaphor represents the intangible, yet universal nature of the Internet.

**Cookie**

A cookie is a small amount of data generated by a website and saved by your web browser. Its purpose is to remember information about you, similar to a preference file created by a software application.

**DHCP**

Stands for "Dynamic Host Configuration Protocol." A network server uses this protocol to dynamically assign IP addresses to networked computers.

**Dial-up Service**

It is a common method of connecting to the Internet. A user's modem dials up to a service provider, through which an Internet connection is established.

**Domain Names**

The name of a computer or server on the Internet in the form of a string of names or numbers, separated by periods.

**Download**

The transfer a file or files from a remote computer to the user's computer.

**DNS**

Abbreviation for Domain Name System. A distributed client-server database system which links domain names with their numerical IP adresses.

**E-mail**

Abbreviation for electronic mail. A letter or memo sent to a person or group electronically on the Internet.

**E-mail Address**

A user's electronic mailbox name or address, needed for linking the sender of e-mail and the recipient.

**Extranet**

An extranet actually combines both the Internet and an intranet.

**FAQ**

Abbreviation for Frequently Asked Questions. A document (often a hypertext document) containing common questions and answers for a particular website or topic.

**Flame**

Personal verbal attacks on other Internet users, via e-mail, USENET, or mailing lists. Flame wars occur when a series of flames are sent back and forth between two or more people.

**Finger**

Internet service that provides information about the users on a particular computer.

**Freeware**

Software that is available free of charge for personal use.

**FTP (File Transfer Protocol)**

An Internet tool/software utility which allows you to transfer files between two computers that are connected to the Internet. Anonymous FTP allows you to connect to remote computers and to transfer publicly available computer files or programs.

**Gateway**

A computer system that connects two incompatible services such as a commercial online service and the Internet.

**GIF**

Graphical Interchange Format is a commonly used graphics file format for image files on the Internet.

**Gopher**

A play on the words "go for." A text menu-based browsing service on the Internet. The user selects an item on the menu and is led to either a file or another menu.

**Home Page**

The main page of hypertext-based information for n individual or organization on the World Wide Web (WWW).

**Hot List**

Similar to a bookmark in Gopher or Netscape, this list makes note of particular pages on the WWW that are accessed when using the Mosaic browser.

**HTML (Hypertext Markup Language)**

The coding applied to text files that allows them to appear as formatted hypermedia documents on the World Wide Web.

**HTTP**

Abbreviation for Hyper Text Transfer Protocol. Often this is the initial sequence of letters in a web address.

**HTTPS**

Stands for "Hyper Text Transport Protocol Secure." HTTPS is the same thing as HTTP, but uses a secure socket layer (SSL) for security purposes.

**Hypermedia**

A system for storing information using embedded references to other pages, sounds, and graphics used on the WWW.

**Hypertext**

The text-based version of hypermedia.

**Internaut**

Slang for someone who is an experienced Internet user.

**Internet**

The worldwide, interconnected system of computer networks.

**Internet address (a.k.a. IP address)**

An assigned series of numbers unique to each computer on the Internet which is used to identify it for data exchanges.

**IP**

Abbreviation for Internet Protocol. A protocol that ensures data goes where it is supposed to go on the Internet.

**IPv4**

IPv4 is the most widely used version of the Internet Protocol. It defines IP addresses in a 32-bit format.

**IPv6**

IPv6, also called IPng (or IP Next Generation), is the next planned version of the IP address system. (IPv5 was an experimental version used primarily for streaming data.) While IPv4 uses 32-bit addresses, IPv6 uses 128-bit addresses

**IRC**

Abbreviation for Internet Relay Chat. An Internet service accessed through software programs that features real-time communication on channels devoted to specific topics.

**LAN**

Abbreviation for Local Area Network. Used to connect computers over a short distance such as computers within the same company or office.

**LISTSERV**

An e-mail list server. A computer program that maintains lists of e-mail addresses in order that users can participate in an electronic discussion or conference. There are thousands of listserve on all imaginable topics.

**Login**

The process entering in information related to an account name and its password in order to access a time-sharing computer.

**Mailing list**

An e-mail system that includes multiple recipients as part of its address.

**Mosaic**

A browser program developed by the National Center for Supercomputing Applications that provides the internet user with a point-and-click interface to WWW, Gopher, FTP, and other Internet services.

**Newbie**

Slang for someone who is new to the Internet or a specific aspect of it.

**Netiquette**

The unwritten "rules" of etiquette used on the Internet.

**NetScape**

A graphical World Wide Web browser for Macintosh, Microsoft Windows, and Amiga systems.

**Network**

A set of computers that all use the same protocol in order to exchange information among themselves.

**Password**

Secret code of letters and numbers needed to gain access to a time-sharing computer or FTP system, or to protect Web pages.

**Ping**

Packet InterNet Groper is a program and UNIX command that helps testing and debugging network and/or Internet connections. An 'Echo' command is sent to a specified computer and then waits for a response. The result is a report that displays the success or failure, usually a report back of a timed response in seconds, of the intended action.

**Posting**

Can refer to a message or article that appears on a newsgroup or message board system, or the act of sending an electronic message to a newsgroup or message board.

**PPP**

Abbreviation for Point to Point Protocol. It is a protocol used for sending information via a modem which is connected to the Internet.

**Protocol**

The rules make possible the exchange of messages between users on the Internet, or within any given network.

**Search Engine**

A tool or program which allows keyword searching for relevant sites or information on the

Internet. General and topic-specific search engines are prevalent today, for example, Google, Speedbit, Education World, WebCrawler, Infoseek, Lycos, and Yahoo are examples of search engines.

**Service provier**

A company that provides dial-up or direct access to the Internet for a fee. Sometimes referred to as ISP (internet service provider).

**Shareware**

Copyrighted software that is available for personal use for a small fee, and often downloadable from the Internet.

**SLIP**

Stands for Serial Line Internet Protocol. Similar PPP, this is another protocol that is used with a modem to establish an IP connection to the Internet.

**Snail mail**

Slang for regular, paper mail sent through the postal services.

**SSL**

Stands for "Secure Sockets Layer." SSL is a secure protocol developed for sending information securely over the Internet.

**TCP**

Stands for Transmission Control Protocol. both the protocol and software that ensure that data sent over the Net arrive in the correct order.

**TCP/IP**

Short for Transmission Control Protocol/ Internet Protocol. A group of protocols that specify how computers communicate over the Internet. All computers on the Internet need TCP/IP software.

**Telnet**

An Internet command that allows your computer to directly connect and interact with remote computers, often through a text-based 'terminal' environment. Often involves the need for passwords and access information.

**Unix**

A computer operating system developed by AT&T Bell Labs and used to develop the Internet. It is no longer the sole operating system used to run servers.

**Upload**

Transferring a file or files from the user's computer to a remote computer.

**URL**

Short for Uniform Resource Locator. A string of characters used to uniquely identify a page of information on the WWW. This information is used by browser software to find other WWW, FTP, telnet, gopher, etc. sites on the Internet.

**Usenet**

A group of computers that exchange network news information.

**Veronica**

An Internet tool that allows you to search by keyword through gopher titles and directories.

**WAIS**

Short for Wide Area Information Server. An internet search service that locates documents containing a keyword or phrase.

**WAN**

Stands for Wide Area Network. A network of computers that covers a large geographical distance.

**Whois**

An Internet database that provides information on a person or an organization.

**WWW**

Stands for World Wide Web. A very popular Internet service that organizes information using a hypertext and hypermedia system of linking documents, FTP sites, gopher sites, WAIS, and telnet.

**WYSIWYG**

Short for What You See Is What You Get -- that is, the image you see on screen matches what will print on paper.

**ZONE**

A zone file is stored on a name server and provides information about one or more domain names. Each zone file contains a list of DNS records with mappings between domain names and IP addresses. These records define the IP address of a domain name, the reverse lookup of an IP to other domains, and contain DNS and mail server information.

## Multiple Choice Questions

1. Internet is ?
   (A) Network of Network that connects computers all over the world.
   (B) Connections of two PCs situated in two countries
   (C) Network restricted within a area
   (D) None of the above
2. Search engine is ?
   (A) website used by intelligence agencies
   (B) Website to find out any specific information
   (C) Website used by universities
   (D) None of the above
3. URL Stands for—
   (A) Uniform Resource Locator
   (B) Universal Resource Locator
   (C) Unified Register Language
   (D) Unified Resource Language
4. Cookies is—
   (A) Mechanism for storing persistent data on client in the file called cookies
   (B) A product made in berklays
   (C) Mechanism for storing a information on the net
   (D) None of the Above
5. Gopher Service is ?
   (A) Design to act as a distributed document delivery system
   (B) Is multiple access portal
   (C) Is email service
   (D) None of the above
6. SMTP Protocol—
   (A) Site between client and server
   (B) Send email message between servers
   (C) Transmits news to all client
   (C) None of the above
7. ISDN stands for—
   (A) Integrated Society Discreet Network
   (B) Integrated Services Digital Network
   (C) Integrated Society Digital Network
   (D) None of the above
8. Main protocol used in Internet—
   (A) IPX/SPX (B) Token Bus
   (C) TCP/IP (D) X.25
9. Two which of the following a search engine continiously send out the start on a home page of a server and pursue all link stepwise ?
   (A) Spider (B) Cookies
   (C) Packet (D) None of these
10. Spamming is—
    (A) Ethical Technique
    (B) Unethical Technique
    (C) Illegal technique
    (D) Legal Technique
11. Anchor is—
    (A) Off page factor
    (B) On page factor
    (C) Home page factor
    (D) End page factor
12. Black hat is ?
    (A) Disturb a website
    (B) Work according to search engine guideline
    (C) Do not follow the rules of search engine
    (D) None of the above
13. User agent is—
    (A) Web spider
    (B) Any user
    (C) String sent by user
    (D) All of the above
14. Robot is—
    (A) Spider (B) Sphinx
    (C) Web server (D) Web publisher
15. In the UTL http:// stxavie.com/index.html the domain name is—
    (A) http (B) www
    (C) stxavier (D) index
16. A ..... is a computer program that continuously and rapidly explores the World Wide Web, voraciously reading and cataloguing every Web document it can find.
    (A) directory (B) web browser
    (C) search engine (D) chat room

17. What is a *spider* ?
    (A) A computer virus
    (B) A program that catalogs Web sites
    (C) A hacker who breaks into corporate computer systems
    (D) An application for viewing Web sites
18. The Internet is an example of a—
    (A) packet switched network
    (B) cell switched network
    (C) circuit switched network
    (D) Virtual switched network
19. The Internet protocol—
    (A) Ensures that connections are maintained between computers
    (B) Handles Software computer address
    (C) Find the quickest route between two computers
    (D) None of the above
20. Web pages are uniquely defined using—
    (A) IP address (B) URL
    (C) Domain (D) Filename
21. FTP is—
    (A) A Person
    (B) A File
    (C) A Program for copying files from one computer to another
    (D) An operating system
22. Crawlar are also known as—
    (A) Spider
    (B) Robot
    (C) Both (A) and (B)
    (D) None of the above
23. JSP are ?
    (A) Provides a simplified way to create a web page that display dynamically generated control A
    (B) Technology to create a HTML script
    (C) Both (A) and (B)
    (D) None of the above
24. CGI is ?
    (A) Common Gateway Interface
    (B) Common Generated Interface
    (C) Computer Gateway Interface
    (D) None of the above
25. Spoofing is ?
    (A) Sending of incorrect information
    (B) Sending of illegal information
    (C) Sending of mixed information
    (D) None of the above
26. Domain Name Server—
    (A) Translate domain name to IP address
    (B) Translate http to IP
    (C) Create a new page for uploading
    (D) None of the above
27. Spam is ?
    (A) Contains no valuable contents
    (B) Contains valuable contents
    (C) Contains content about website and is an operating system
    (D) None of the above
28. Web page is ?
    (A) A page of the book on the web technology
    (B) Is a HTML document that is stored in web server
    (C) A hard copy of server pages print out
    (D) None of the above
29. WAP stands for—
    (A) Wireless application protocol
    (B) Wired application protocol
    (C) Wireless access protocol
    (D) None of the above
30. Bluetooth is a ?
    (A) A short range radio technology used to perform synchronization between devices
    (B) It is a VLSI chip making technique
    (C) All AI technique
    (D) None of the above
31. Which of the following is required to communicate between two computers ?
    (A) Communications Software
    (B) Protocol
    (C) Communication Hardware
    (D) All of Above Including Access To Transmission Medium
32. DHCP is the abbreviation of—
    (A) Dynamic Host Control Protocol
    (B) Dynamic Host Configuration Protocol

(C) Dynamic Hyper Control Protocol
(D) Dynamic Hyper Configuration Protocol

33. IPV4 Address is—
(A) 8 bit (B) 16 bit
(C) 32 bit (D) 64 bit

34. ADSL is the abbreviation of—
(A) Asymmetric Dual Subscriber Line
(B) Asymmetric Digital System Line
(C) Asymmetric Dual System Line
(D) Asymmetric Digital Subscriber Line

35. Router operates in which layer of OSI Reference Model ?
(A) Layer 1 (Physical Layer)
(B) Layer 3 (Network Layer)
(C) Layer 4 (Transport Layer)
(D) Layer 7 (Application Layer)

36. Each IP packet must contain—
(A) Only Source address
(B) Only Destination address
(C) Source and Destination address
(D) Source or Destination address

37. ISO OSI model is used in—
(A) Stand Alone PC
(B) Network Environment
(C) Topology
(D) None

38. Print server uses.....which is a buffer that holds data before it is send to the printer.
(A) Queue (B) Spool
(C) Node (D) None

39. What is max data capacity for optical fiber cable ?
(A) 10 Mbps (B) 100 Mbps
(C) 1000 Mbps (D) 10000 Mbps

40. Web server—
(A) Computer system that delivers web pages
(B) Delivers news
(C) Providing the option for those seeking real time discussion capabilities
(D) None of the above

41. 50.150.H1.H2 is a ?
(A) Class A Network (B) Class B Network
(C) Class C Network (D) Class E Network

42. Web Browser is ?
(A) Software tool used to configure a web server
(B) Hardware tool used to browse the internet
(C) Software tool that computer used to communicate with server on Internet
(D) None of the above

43. Servlet API provides—
(A) Provide link between servlet and Java code
(B) Link between sever and servlet
(C) Provide link between java and JDMC
(D) Provide interface between JDBC and JMBC

44. In which of the field API does not provide support ?
(A) Servlet life cycle management
(B) Access to servlet context
(C) Utility classes
(D) None of the above

45. Gateway pages improve ?
(A) A website search engine placement
(B) A semantic accuracy
(C) Syntactic accuracy
(D) Resolution of a page

46. Meta tag is ?
(A) Element of 'c'
(B) Element of HTML
(C) Element of operating system
(D) Element of assembler

47. Each search engine has its—
(A) Own indexing algorithm
(B) Own portal
(C) Own protocol
(D) Own password

48. White hat is ?
(A) Is used to decorate a website
(B) Do not follow the rule of search engine
(C) Follow the rule of search engine
(D) None of the above

49. Referer is ?
(A) Header (B) Footer
(C) Trailer (D) Sailor

50. Blog is ?
    (A) Present articles in reverse chronological order
    (B) Special partition in web server
    (C) Title of a book
    (D) Name of a search engine

51. A combination of software and hardware that work together to allow computers to exchange data and to share software and devices such as printers is called a—
    (A) network
    (B) modem
    (C) peripheral device
    (D) hard disk array

52. Which guideline is a netiquette guideline ?
    (A) Access the account of another user.
    (B) Never change your password.
    (C) Share your password.
    (D) Be considerate of other people's beliefs.

53. In Dreamweaver, which extension is added to basic HTML documents ?
    (A) .docx (B) .txt
    (C) .html (D) .css

54. Unauthorized network access is prevented by using a—
    (A) hub. (B) router.
    (C) firewall. (D) cookie.

55. A device that can connect different network technologies is called a(n)—
    (A) ISP.
    (B) operating system.
    (C) node.
    (D) router.

56. Transmitting and receiving data is called—
    (A) flashing bits per second.
    (B) computer transmitting.
    (C) telecommunications.
    (D) demodulation.

57. An ISDN is a—
    (A) cable modem.
    (B) conventional modem.
    (C) subscriber line.
    (D) digital telephone network.

58. The most widely used Internet service is—
    (A) Internet Relay Chat (IRC).
    (B) the World Wide Web.
    (C) network news.
    (D) bulletin board services.

59. Microsoft Internet Explorer is a—
    (A) website.
    (B) web page.
    (C) web browser.
    (D) mailing list server.

60. Which is not required to send and receive e-mail messages?
    (A) an e-mail address
    (B) e-mail software
    (C) Internet access
    (D) a Word processor

61. Which website's purpose is to inform readers about current events and issues ?
    (A) personal (B) portal
    (C) informational (D) media

62. Real-time communication is possible by using—
    (A) a mailing list server.
    (B) e-mail software.
    (C) Gopher.
    (D) instant messaging.

63. In the URL http://www.cnn.com, which part is the web protocol ?
    (A) http (B) //
    (C) www.cnn.com (D) .com

64. Which Internet Explorer button is clicked to display the previously selected web page ?
    (A) the Back button
    (B) the Forward button
    (C) the Refresh button
    (D) the Home button

65. Which Internet Explorer button is clicked to display the web page that is displayed when Internet Explorer is first started ?
    (A) the Back button
    (B) the Forward button
    (C) the Home button
    (D) the Refresh button

66. A search engine—
    (A) is software required to send e-mail messages.
    (B) is a program that searches e-mail attachments for viruses.
    (C) is a program that searches a database of web pages for keywords.
    (D) is used when long web pages need to be printed.

67. Which is used to exclude web pages in a search?
    (A) + (B) –
    (C) OR (D) XOR

68. Which of the following options is correct with regard to HTM L ?
    (A) It is a modelling language
    (B) It is a DTP language
    (C) It is a partial programming language
    (D) It is used to structure documents

69. Consider the following statement :
    GET /cgi bin/dispenser.pl&want=whatsnew. html HTTP/1.0
    Which of the following options is a correct one ?
    (A) The above statement is a part of a request from a web client
    (B) The above statement is a part of the input to a CGI program
    (C) want is a variable and whatsnew.html is a value
    (D) dispenser.pl may be a CGI program.

70. When trying to access a URL, the following message is displayed on the browser:
    Server; Error 403
    What could be the reason for the message ?
    (A) The requested HTML file is not available
    (B) The URL refers to a CGI script and the header of the script does not indicate where the interpreter is located
    (C) The path to the interpreter of the script file is invalid
    (D) The requested HTML file or CGI script has insufficient permission.

71. Which of the following statements is incorrect regarding multimedia on the web?
    (A) The MPEG, AIFF and WAV are cross-platform formats
    (B) The MPEG, AU and MIDI are cross-platform formats
    (C) The SND format has a relatively low fidelity
    (D) VRML can be used to model and display 3D interactive graphics
    (E) The dynsrc attribute in the <img> element can be used to include videos in web pages.

72. What would be the colours of the RGB where the hexadecimal values are #FF0000, #00F F00 and #0000FF respectively ?
    (A) Blue, Green, Red
    (B) Green, Blue, Red
    (C) Green, Red, Blue
    (D) Red, Green, Blue

73. The elements <DIV> and <SPAN> have the following characteristics—
    (A) Element <DIV> inherits properties defined for <SPAN> in a stylesheet
    (B) <DIV> and <SPAN> have no real meanings as html tags unless stylesheet is applied
    (C) Elements <SPAN> and <DIV> define content to be inline or block-level
    (D) <DIV> and <SPAN> are used as alternatives for the element <P>

74. Which of the following statement is not true regarding JavaScript ?
    (A) JavaScript is a loosely typed language
    (B) JavaScript is an object-based language
    (C) JavaScript is event driven
    (D) A JavaScript embedded in an HTML document is compiled and executed by the client browser

75. The following is a web-page :
    <html>
    <head> <title>JavaScript</title> </head>
    <body bgcolor="#0000ff">
    <script language="JavaScript">

<!-- document.write("<h1> hello world </h1>"); //-->
</script>
</body>
</html>

When the above web page is loaded into a browser, what will happen ?

(A) The body of the web page will not contain any text

(B) The body of the web page will contain the text "<h1> hello world </h1>"

(C) The body of the web page will contain the text "hello world" as an h1 heading

(D) The background color of the web page will be green

(E) document.write("<h1> hello world </h1 >"); is a comment.

## Answers

| | | | | |
|---|---|---|---|---|
| 1. (A) | 2. (B) | 3. (A) | 4. (A) | 5. (A) |
| 6. (B) | 7. (B) | 8. (C) | 9. (A) | 10. (B) |
| 11. (A) | 12. (C) | 13. (D) | 14. (A) | 15. (C) |
| 16. (B) | 17. (B) | 18. (A) | 19. (A) | 20. (B) |
| 21. (C) | 22. (C) | 23. (C) | 24. (A) | 25. (A) |
| 26. (A) | 27. (A) | 28. (B) | 29. (A) | 30. (A) |
| 31. (D) | 32. (B) | 33. (C) | 34. (D) | 35. (B) |
| 36. (C) | 37. (B) | 38. (B) | 39. (C) | 40. (A) |
| 41. (A) | 42. (C) | 43. (B) | 44. (D) | 45. (A) |
| 46. (B) | 47. (A) | 48. (C) | 49. (A) | 50. (A) |
| 51. (A) | 52. (D) | 53. (C) | 54. (C) | 55. (D) |
| 56. (C) | 57. (D) | 58. (B) | 59. (C) | 60. (D) |
| 61. (D) | 62. (D) | 63. (A) | 64. (A) | 65. (C) |
| 66. (C) | 67. (B) | 68. (D) | 69. (E) | 70. (E) |
| 71. (A) | 72. (E) | 73. (C) | 74. (D) | 75. (A) |

❑❑

# 4 MS Word/Access/Excel

### Microsoft Word

Microsoft Word is an example of a program called a "word processor." Word processors are used to create and print text documents in much the same way that you would use a typewriter. The key benefit to using a word processor is that you can make changes easily, including correcting spelling; adding, deleting, formatting, and relocating text; and inserting images. Once you create a document, you can effortlessly print it (as many copies as you want!), save it for later modifications, or send it to a friend via e-mail. Microsoft Word is a very powerful word processor. There are other word processors out there, including Open Office.org Writer, Word Perfect, Apple Pages, and WordPad.

### Microsoft Access

Microsoft Access is a computer application used to create and manage computer-based databases on desktop computers and/or on connected computers (a network). Microsoft Access can be used for personal information management (PIM), in a small business to organize and manage data, or in an enterprise to communicate with servers.

Microsoft Access, also known as Microsoft Office Access, is a database management system from Microsoft that combines the relational Microsoft Jet Database Engine with a graphical user interface and software-development tools. It is a member of the Microsoft Office suite of applications, included in the Professional and higher editions or sold separately.

### Microsoft Excel

Excel is the spreadsheet program created by Microsoft. Although you can use any spreadsheet program for analyzing data, the instructions given here are specific for Excel and you must use Excel for the three Excel quizzes.

## MS Word/Access/Excel Terminology

### 3-D Pie Chart

The 3-D pie chart is a simple chart style that is useful for illustrating the parts of a whole.

### 3-D Reference

A 3-D reference makes it possible to link worksheets together. When the name of a sheet tab appears in a formula followed by an exclamation point, the cell address is a 3-D reference. You can type 3-D references, but clicking the reference you want to add is much easier, because it automatically adds the exclamation point.

### Active Cell

The active cell contains the insertion point and is identified by a dark border around the cell. Its address is shown in the formula bar. Any action you perform is performed on the active cell.

### Alignment

Alignment refers to the position of lines in a paragraph in relation to the documents left and right margins; *i.e.*., whether they are left-aligned, centered, right-aligned, or justified (evenly spaced).

### Applying Styles

Applying styles refers to the action of formatting paragraphs and text according to an existing style definition.

### Argument

Arguments are parts of a formula that are used to produce the resulting calculation. In this lesson, the arguments are logical test, value if true, and value if false.

### Arithmetic Operators

Arithmetic operators are the symbols used in formulas to calculate values, such as addition (+), subtraction (-), multiplication (*), division (/), and exponentiation (^).

### AutoFill

AutoFill is the Excel feature that allows you to automatically copy cells and fill them with a series without using Copy.

### Arrange All

Use the Arrange All command on the Window menu to see all of the available windows at one time. The windows are arranged horizontally, which is helpful if you are working with two or more documents at the same time.

### Arrow Keys

The arrow keys on the keyboard can be used to move the insertion point up and down line by line and right and left character by character. In a cell, when the last line or character is reached, the arrow keys will move the insertion point to the next cell.

### ASCII Text

ASCII text, also known as plain text, can be created in such applications as Notepad. Unlike Word documents, ASCII documents cannot be formatted.

### AutoCorrect

AutoCorrect continuously checks your document for misspelled and unrecognized words and for grammar errors. Right-click a word with a wavy red or green line beneath it to see a menu of alternatives.

### AutoFit

Use the AutoFit command to format each column to the width of the widest entry in that column.

### AutoFormat

AutoFormat is a feature that automatically changes text as you type. AutoFormat includes such formatting as numbered and bulleted lists, borders, capitalization, and common spelling errors.

### Automatic Numbering

Automatic numbering refers to the application of sequential numbers to consecutive paragraphs. Typically, each numbered paragraph is an item in a list. When paragraphs are added to or deleted from a series of numbered paragraphs, the paragraphs will renumber automatically.

### AutoText

AutoText refers to text and graphics that can be named, stored, and reused in Word documents.

### Background Printing

Use the Background Printing option in the Printing Options area to have Word print the document "behind the scenes" while you continue to work in Word.

### BACKSPACE

The [BACKSPACE] key on the keyboard is most often used to delete data to the left of the insertion point.

### Bold

Bold characters appear on the screen in a higher intensity or in a different color than surrounding text. Bold characters on the printed page appear as darker characters or makes them appear "fatter." Bold should be used for emphasis, but like all formatting characteristics, should be used sparingly.

### Book Icon

Book icons contain groupings of Help topics according to main themes or ideas. These books can contain sub-books as well as topics. Books are opened and closed by double-clicking them.

**Borders**

Borders are boxes that are placed around text, pages, and tables. Borders add emphasis or decoration to the enclosed data, and they can be in any number of formats.

**Break Dialog Box**

The Break dialog box allows you to insert a page, column, or section break in a document and specify the type of section break to be used.

**Browse**

Use the Browse feature to look through a document using its elements. For instance, you could look for specific text, the next or previous table, a specific page, the next or previous heading, or the next or previous footnote.

**Bullets**

Bullets are special characters or symbols that are used to set off a paragraph. Typically, each bulleted paragraph is an item in a list, and it consists of the bullet symbol and indenting to set the bullet apart from the text.

**Catalog**

Catalog refers to a type of document created in Mail Merge that contains multiple records per page.

**Cell**

A cell is the intersection of a row and a column in a table.

**Cell Height**

Cell height is the space between the top and bottom borders of a cell.

**Cell Width**

Cell width is the space between the left and right borders of a cell.

**Center Alignment**

With center alignment, each line of a paragraph is centered between the left and right margins or indents.

**Centering**

Centering is the placement of a line of text in the center of the screen or page where the left-most and right-most characters in the line are the same distance from the left and right margins.

**Character Style**

Character styles are represented by an underlined "a" on the Style list. Character styles store all the formatting for a single character. They can be applied to one or many characters within a paragraph without affecting the entire paragraph.

**Chart Text Boxes**

Chart text boxes are items that provide information about a chart. You click the text box to select and edit the contents. A chart title identifies the purpose of the chart. A legend identifies the data series or categories. Data labels identify specific points or series.

**Click-and-drag**

To click-and-drag, press the left mouse button and keep it down while you move the mouse on the mouse pad.

**Click-and-hold**

To click-and-hold, hold the mouse steady, press the left mouse button, and keep it down until you have performed the action you want.

**Clip Art**

Clip art consists of pre-designed images that can be placed within a document.

**Close**

Use the Close command on the File menu to complete your work on a document and put it away without leaving Word.

**Collate**

Use the Collate option in the Copies area to have Word print complete, multiple-page documents before printing any subsequent copies of the same document.

**Columns**

In a document, columns refer to the formatting of text so that it flows side-by-side on a page like a newspaper.

**Contents And Index**

Use the Contents and Index command on the Help menu to access various kinds of help about Word.

**Contents Card**

The Contents card contains book icons that display Help topics organized by category.

**Copies**

The Copies area allows you to specify the number of copies to print by typing the number in the Number of copies text box.

**Copying Drag-and-drop Mouse Pointer**

The northwest arrow becomes the copying drag-and-drop mouse pointer when you [CTRL+Click-and-drag] a selected item from one location to another.

**Courier New**

Courier New is a monospaced font that is available on every Windows-based computer.

**Crop**

Crop describes the editing of a graphic by trimming off unwanted portions of the image.

**CTRL+Click-and-drag**

Use [CTRL+Click-and-drag] to copy information without using the Windows Clipboard.

**Current Document**

The current, or active document is the document you see on the Word screen.

**Data Form**

A data form is a dialog box that allows you to view and edit individual records in a database.

**Data Source**

A data source contains the information from which a merged document is created. The data source is merged with a main document, which specifies the kind of output required.

**Database**

A database is a collection of organized information.

**Database Field**

A field is a specific category of information in a database. Some examples of possible fields are Name, Telephone Number, and Address.

**Default**

Default means standard. Default settings are the settings that Word uses unless you ask it to use other settings.

**Delete Rows**

Use the Delete Rows command on the Table menu to delete selected rows in a table.

**Dictionary**

Word uses two kinds of dictionaries : a main dictionary and a custom dictionary. The main dictionary cannot be altered. You can add words to your custom dictionary.

**Document**

A document is any data file that is created by a specific application.

**Document Field**

A field is an area in your document where a specific type of data is entered or calculated.

**Document Icon**

Use the document Icon in Help windows to open the Help document about the topic.

**Double-click**

To double-click, hold the mouse steady while you press the left mouse twice quickly.

**Double-click Selections**

Double-clicking a word will select the entire word. Double-clicking in the selection bar will select an entire paragraph.

**Drag-and-drop**

Drag-and-drop is a feature that allows you to move or copy information without using the Windows Clipboard. To use it, you simply drag a selected item from one location to another. It is best used for moving or copying small items short distances.

**Drag-select**

Use drag-select to select text. With the I-beam mouse pointer, click before the text you want to select, and drag to the end of the text you want to select. The selected text appears highlighted (with a dark background) and is ready to be changed.

**Drawing Objects**

Use the Drawing Objects option in the Include with Document area to have Word also print drawing objects that have been created in or inserted into your document. If you don't need to print the graphics in your document, turn this feature off to print faster and save ink or toner.

**End-of-document Marker**

Seen in some views, the end-of-document marker is a horizontal bar near the left margin of the document that indicates the end of the document.

### Envelopes

Envelopes refers to a type of document created in Mail Merge that contains only one record per page.

### Exit

Use the Exit command on the File menu to close all documents and leave Word entirely.

### Field

A field is an area in your document where a specific type of data is entered or calculated.

### File List

The file list appears under the Look in text box in the Open dialog box, and shows the documents or folders in the current folder.

### File Name

Word assumes that you want to use the first line of your document as its file name, and places this text in the File name text box in the Save As dialog box.

### File Name Text Box

Use the File name text box in the Open dialog box to enter the name of the document you want to open.

### Files of Type Box

Use the Files of type box in the Open dialog box to specify the type of file that you want to open. Use the down-arrow to open a list of common file types.

### Find Card

The Find card contains a database of all the words found in the Help topics, allowing you to search for help by using key words or phrases.

### Find In Field Dialog Box

The Find in Field dialog box allows you to search for specific data in a field from within a data form.

### Float Over Text

Use the Float over text option to create a floating picture. The picture can be placed anywhere on the page, and is not dependent upon the text on the page. This is the default setting when you insert a picture into a document.

### Folder

A folder is an area on the disk that can contain files and subfolders that are usually related by type, purpose, or application.

### Font

A font is a style and size of type, such as Times New Roman, 12 point, bold. A font is a set of all the characters available in one typeface and size, including uppercase and lowercase letters, punctuation, and numerals.

### Font Formatting

Font Formatting changes the appearance of the text. Font formatting includes enhancements such as font style (bolding, centering, and underlining), point size (12 pt), and font typeface (Times New Roman, Arial, and Courier).

### Footer

A footer is the contents of an area located within the bottom margin of a page.

### Form Letters

Form Letters refers to a type of document created in Mail Merge that contains only one record per page.

### Format Painter

Format Painter is a Word command that allows you to copy the formatting of one paragraph and apply it to another paragraph.

### Format Picture Dialog Box

Use the Format Picture dialog box to define the size, position, color, or contrast of the selected picture, or to set how the text wraps around the picture in the document.

### Formatting Toolbar

Located under the standard toolbar, the formatting toolbar gives quick access to various formatting commands and functions such as font type and style and text alignment.

### Formulas

Word allows you to perform simple calculations that follow the syntax of Excel formulas. If you need to perform more complex calculations, you can also insert an Excel worksheet into Word.

### Frame

A frame is a container for text and graphics that can be placed anywhere within a document,

including the margins, and which forces existing text to wrap around it.

### Graphics

Graphics are images such as clip art, word art, graphs, and charts.

### Grid Setting

Use the Grid setting on the Borders card of the Borders and Shading dialog box to apply a grid effect to a table.

### Gridlines

Use the Gridlines command on the Table menu to display thin dotted lines around the cells of a table. Gridlines do not print.

### Header

A header is the contents of an area located within the top margin of a page.

### Header And Footer Toolbar

The Header and Footer toolbar allows for easy access to the primary tools for editing headers and footers.

### Heading Styles

Heading styles refers to the nine predefined styles, called Heading 1 through Heading 9, that determine the size, numbering, and position of document headings and which are an important aspect of document organization.

### Headings

If a table breaks to two or more pages, headings can be applied so that they appear at the top of each page.

### Hot Spot

A hot spot is a green word or phrase that can be used to open help about the word or phrase. Click a hot spot with a solid underline to open a help document about the phrase. Click a hot spot with a dotted underline to open a pop-up window about the phrase.

### Indentation

An indentation is an amount of space measured from the page margin that is applied to a paragraph or an area of a document.

### Inline Picture

Use an inline picture when you want the picture to be connected to the text around it, so that when you insert or remove any text in the document, the picture moves with its text. To define a picture as an inline picture, you turn off the Float over text option.

### Insert Mode

Type using the Insert mode to insert text in the existing document. Insert mode is the default mode of Word 97.

### Insert Rows

With the insertion point within an existing table, use the Insert Rows command on the Table menu to create a new row above the current row.

### Insertion Point

An insertion point is the place where text or graphics will appear in the document. It point is the flashing vertical bar that indicates the current position in the document.

### Italic

Italic characters appear on the screen slightly tilted to the right. Italics is usually used to provide special emphasis to text.

### Justification

Justification determines how lines and characters within those lines are printed. With full justification, all lines start at the left margin and end at the right margin.

### Justified Alignment

With justified alignment, all but the last line of a paragraph is aligned with both the left and right margins or indents. To accomplish this, Word adjusts the spacing between words, which can result in uneven and "loose" spacing.

### Left Alignment

Left alignment is Word's default alignment for body text. The left side of the paragraph is aligned with the left margin or indent, and the right side is "ragged."

### Left Justification

Left-justified text starts at the left margin and wraps all text at the right margin to form a ragged appearance.

### Line Spacing

Line spacing refers to the number of lines used by each line of text. In single-line spacing, each line of text is followed by another line of

text, and there are no blank lines in between. In double-line spacing, each line of text is followed by a blank line.

**List Box**

A list box is a box that contains a list of available choices, such as files or field names.

**Mail Merge**

Mail Merge refers to the process of combining a data source, and a main document to produce a unique output.

**Main Document**

A main document is a type of document available in Mail Merge, such as form letters, mailing labels, and envelopes, that can be combined with a data source to produce unique outputs.

**Margin**

The margin is the amount of blank space, usually measured in inches or characters, above and below and to the right and left of the main body of a document.

**Memo Wizard**

The Memo Wizard helps you create a memo by asking you a series of questions regarding the kind of memo you want to create.

**Menu Bar**

The menu bar contains the names of Word's menus and is used to navigate through their commands.

**Merge Cells**

Use the Merge Cells command on the Table menu to combine selected cells in a row. This results in a single cell with the combined width of the original cells.

**Merge Field**

A merge field is a placeholder inserted into a main document that instructs Word where to put information that comes from a data source during a mail merge.

**Normal View**

Normal View is Word's default document view and is the most practical view for performing such routine functions as typing, editing, and formatting.

**Office Assistant**

The Office Assistant gives you tips as you work, and it can be used to get help about Word.

**Open Dialog Box**

Use the Open dialog box to access an existing document so that you can open it in Word.

**Outline View**

Outline View provides a structured view of the document, arranging its contents according to heading levels and opening the Outlining toolbar for modifying the document's organization.

**Option Button**

An option button in a dialog box is a round button that is used to select one of several mutually exclusive commands.

**Page Break Before**

Use the Page Break Before command to force Word to insert a page break before the paragraph.

**Page Layout View**

Page Layout View shows the document's margins, headers and footers, frames, and other elements, thus providing a more accurate representation of what a document will look like when it is printed.

**Page Setup Dialog Box**

The Page Setup dialog box allows you to change the margin settings and layout of a document as well as to determine the paper size and the paper source for the printer.

**Paragraph**

A paragraph in Word begins where you start typing, and it ends where you press [ENTER].

**Paragraph Formatting**

Paragraph formatting includes formatting options such as text alignment, indents, tabs, margins, and justification.

**Paragraph Style**

Paragraph styles are represented by the paragraph mark on the Style list and are more common than Character styles. When you apply a Paragraph style, the characteristics of that style are applied to the entire paragraph.

### Picture Toolbar

The Picture toolbar contains buttons that you can use to format the selected picture. The toolbar appears, usually under the Formatting toolbar, when you insert or select a picture in a document, and it closes when you deselect the picture.

### Point

Pointing is the action of placing the mouse pointer over the desired object or text.

### Pop-up Window

When you click a dotted-line hot spot, a separate window "pops up" on your screen. When you are done reading the information in the pop-up window, you can click anywhere to close it.

### Position

Use the Position drop-down lists in the Frame dialog box to establish the horizontal and vertical positions of a frame relative to another part of the document.

### Preview Area

In the Font dialog box, the Preview area displays an example of the selected font. Many dialog boxes in Word contain similar Preview areas.

### Print Preview

Print Preview in Word allows you to see how your document will look on the page before it is printed.

### Print Range

The Print range area allows you to specify parts of the document to print. The All option prints the entire document. The Current page option prints the page where the insertion point is located. The Pages option allows you to specify which pages to print by typing their page numbers.

### Printer Font

Printer fonts are fonts that are typically installed with your printer. Printer fonts cannot be scaled to any size, and they may not look on the screen as they will in the printed document.

### Printer Name Drop-down List

Use the Printer Name drop-down list to choose a printer to use from among the installed printers.

### Proportionally Spaced Font

Proportionally spaced fonts contain characters of differing widths. Typically, the widest character is the capital M and the narrowest is the lowercase l. Most fonts are proportionally spaced.

### Protected Form

A protected database form allows you to enter data, but prevents the labels, design, and field names from being changed. You can turn the protection off when you need to make changes.

### Query

A query is a request for information in a database. For example, a user might request "all sales orders with a quantity greater than five".

### Query Filter

Query Filter refers to a process available in Mail Merge that allows you to specify that only certain records from a data field be merged.

### Query Sort

Query Sort refers to a process available in Mail Merge that allows you to specify the order in which the records of a data field are merged.

### Quick View

Use the Quick View command on a file's shortcut menu to preview an unformatted version of the particular file. Quick View is an optionally installed feature of Windows.

### Record

A record is a set of information contained in a database. For example, a company might keep a database containing client records. Each record would contain a variety of information such as name, phone number, and address.

### Right Alignment

With right alignment, the right side of the paragraph is aligned with the right margin or indent, and the left side is "ragged."

### Rows

In a table, a row is a horizontal series of cells.

### Rulers

The rulers are located below the formatting toolbar and on the left side of the screen. They are used to place and show tabs, margins, indents, and cell dimensions.

### Save A Document

If you want to use a document again, you should save it on a disk. When you save a document, you name it and tell Word where you want to store it.

### Save As

Use the Save As command on the File menu to open the Save As dialog box if you want to save the current document under a new name or store it in a different folder or disk while also keeping the original version.

### Save As Dialog Box

Use the Save As dialog box to save the current document for the first time, save the current document under a different name, or save the current document in a different folder or on a different disk.

### Scaling

Scaling describes the resizing of a graphic proportionally by width and height.

### Screen Element

A screen element is an object on the screen, such as a button or a ruler. Screen elements will vary between the different Word views.

### Scroll Bar

The scroll bar is a panel for moving the display horizontally or vertically within a window.

### Scroll Bar Arrows

The scroll bar arrows, located at the ends of the scroll bars, may be clicked to slowly move the view within a window up, down, or across.

### Scroll Box

The scroll box is the box within a window's horizontal or vertical scroll bar that indicates your position within the window. Use it to navigate windows horizontally and vertically in very large increments by clicking-and-dragging them along the scroll bar.

### Scrolling

Scrolling is the act of moving up and down (vertical scrolling) or across a window (horizontal scrolling) using the scroll bars, the scroll arrows, or the scroll boxes.

### Select

In order to work with an object, you must first select or activate it. One way to select an object is by clicking it with the mouse.

### SHIFT

The [SHIFT] key on the keyboard is used in conjunction with other keys and mouse actions to capitalize letters and perform various commands and functions.

### SHIFT+Click Selection

Click to place the insertion point where you want to begin your selection, then [SHIFT+Click] the location where you want to end your selection. The area in-between will become selected.

### SHIFT+TAB

In a table, [SHIFT+TAB] moves the insertion point to the previous cell in a row.

### Shrink-To-Fit

Shrink-To-Fit is a Word command, available in Print Preview mode, that can reduce the pages of a document by adjusting its spacing and formatting.

### Size

Size refers to the width and height of a graphic.

### Spacing

Spacing refers to the space above and below a paragraph. Spacing is measured in points.

### Spelling And Grammar Dialog Box

Use the Spelling and Grammar dialog box to fix spelling or grammar errors or to add words to the spelling dictionary.

### Spelling And Grammar Options

Set the grammar and spelling rules on the Spelling and Grammar card in the Options dialog box.

### Standard Toolbar

Located under the menu bar, the standard toolbar gives quick access to various often used commands and functions such as opening, saving, and printing files.

### Start Button

Use the Start button on the Taskbar to show the Start menu to open applications.

**Status Bar**

Located at the bottom of the window, the status bar contains information about many formatting options such as current font, insert and overtype mode, and page number.

**Status Box**

The status box is an informational panel on one end of the Taskbar that provides information about the system.

**Style Gallery**

The Style Gallery, opened from the Format menu, allows you to preview the styles associated with the current template as well as other templates.

**Symbol Font**

Symbol fonts contain special characters that are not part of the alphabet. A common example of a symbol font is Wingdings.

**Tab**

Tab is the key you press to move the insertion point to the next indicated tab stop. Word automatically sets tabs every half inch.

**Table Auto Format**

Use Table Auto Format on the Table menu to apply borders, fonts, colors, and shading to a table by choosing one of the preset formats.

**Tables And Borders Toolbar**

Use the Tables and Borders toolbar to select and apply various border styles, or to create and format tables.

**Table Columns**

In a table, a column is a vertical series of cells.

**Taskbar**

The Taskbar is a panel on the Desktop that contains the Start button, the Tray, and task buttons that correspond to any open windows.

**Template**

A template is a preformatted document that serves as a model for other documents. Templates include common formats such as addresses and date entries and allow you to create professional looking letters, memos, reports, and other documents easily.

**Text Wrapping**

Choose a Text Wrapping option in the Frame dialog box to specify whether text should move around the edges of a frame or stop above the frame and resume below the frame.

**Times New Roman**

Times New Roman is a serif font that is available on every Windows-based computer. Word's default font is Times New Roman.

**Title**

The memo title will appear at the top of the memo and can appear in the header of each page of the memo.

**Title Bar**

The title bar shows you the name of the current document and contains the standard Windows control buttons.

**Toolbar**

A toolbar is a group of tools of usually related functions. Toolbars can contain buttons, menus, or combinations of both that can be used to quickly perform actions in Word.

**Tool**

A tool is a shortcut button, usually shown on a bar near the top of a window, that provides quick access to a commonly used command.

**Underline**

Underlining places a thin line beneath selected text. It is used primarily for emphasis, but not as often as bold or italic.

**View**

There are four views available in Word: Normal, Page Layout, Online Layout, and Outline. Some show you how the document will look when it is printed, and some make working in Word quick and easy.

**Window Menu**

The Window menu provides a list of all the available windows and allows you to switch to any of them or arrange all of them so that they can be seen at one time.

**Widow/Orphan Control**

Use the Widow/Orphan Control command to prevent Word from placing the last line of a

paragraph at the top of a page (widow) or the first line of a paragraph at the bottom of a page (orphan).

### Windows Clipboard

The Windows Clipboard is a holding place in a computer's memory where data is stored after you use the Cut or Copy command.

### Wizard

A wizard is a feature of Microsoft applications that lets you work through a series of dialog boxes to help you complete a task.

### Wrapping Text

Wrapping text is an automatic feature of Word. When you reach the end of a line while typing, Word forces the text to break onto a new line.

### Writing Style

Use the various writing styles to define the grammar rules for checking grammar. Choose from casual, standard, formal, or technical styles, or create your own custom style. You also can change the rules that each style uses to check the grammar.

## Multiple Choice Question

1. Which of the following is not available on the Ruler of MS Word screen ?
   (A) Tab stop box (B) Left Indent
   (C) Right Indent (D) Center Indent
   (E) All of them are available on ruler
2. Background color or effects applied on a document is not visible in—
   (A) Web layout view (B) Print Layout view
   (C) Reading View (D) Print Preview
3. Which file starts MS Word ?
   (A) Winword.exe (B) Word.exe
   (C) Msword.exe (D) Word2003.exe
4. What is the short cut key to open the Open dialog box ?
   (A) F12 (B) Shift F12
   (C) Alt + F12 (D) Ctrl + F12
5. A feature of MS Word that saves the document automatically after certain interval is available on—
   (A) Save tab on Options dialog box
   (B) Save As dialog box
   (C) Both of above
   (D) None of the above
6. Where can you find the horizontal split bar on MS Word screen ?
   (A) On the left of horizontal scroll bar
   (B) On the right of horizontal scroll bar
   (C) On the top of vertical scroll bar
   (D) On the bottom of vertical scroll bar
7. Which of the following is not valid version of MS Office?
   (A) Office XP (B) Office Vista
   (C) Office 2007 (D) None of these
8. What is place to the left of horizontal scroll bar ?
   (A) Tab stop buttons (B) View buttons
   (C) Split buttons (D) Indicators
   (E) None of the above
9. The key F12 opens a—
   (A) Save As dialog box
   (B) Open dialog box
   (C) Save dialog box
   (D) Close dialog box
10. How many ways you can save a document ?
    (A) 3 (B) 4
    (C) 5 (D) 6
11. If you want to keep track of different editions of a document which features will you use ?
    (A) Editions (B) Versions
    (C) Track Change (D) All of these
12. You cannot close MS Word application by—
    (A) Choosing File menu then Exit submenu
    (B) Press Alt + F4
    (C) Click X button on title bar
    (D) From File menu choose Close submenu
13. What is a portion of a document in which you set certain page formatting options ?
    (A) Page (B) Document
    (C) Section (D) Page Setup
14. Borders can be applied to—
    (A) Cells (B) Paragraph
    (C) Text (D) All of these

15. Which of the following is not a type of page margin ?
    (A) Left (B) Right
    (C) Center (D) Top
16. What is the default left margin in Word 2003 document ?
    (A) 1" (B) 1.25"
    (C) 1.5" (D) 2"
17. What is gutter margin ?
    (A) Margin that is added to the left margin when printing
    (B) Margin that is added to right margin when printing
    (C) Margin that is added to the binding side of page when printing
    (D) Margin that is added to the outside of the page when printing
18. Portrait and Landscape are—
    (A) Page Orientation (B) Paper Size
    (C) Page Layout (D) All of these
19. If you need to change the typeface of a document, which menu will you choose ?
    (A) Edit (B) View
    (C) Format (D) Tools
20. Which of the following is not a font style ?
    (A) Bold (B) Italics
    (C) Regular (D) Superscript
21. You can convert existing excel worksheet data an charts to an HTML document by using—
    (A) FTP wizard
    (B) Internet assistant wizard
    (C) Intranet wizard
    (D) Import wizard
22. A circular reference is—
    (A) Geometric modeling tool
    (B) A cell that points to a drawing object
    (C) A formula that either directly or indirectly depends on itself
    (D) Always erroneous
23. Which of following is Not one of Excel's what-if function ?
    (A) Goal see (B) Solver
    (C) Scenario manager (D) Auto Outline
24. When you insert an excel file into a word document. The data are—
    (A) Hyperlinked placed in a word table
    (B) Linked
    (C) Embedded
    (D) Use the word menu bar and toolbars
25. Which of the following is not information you can specify using the solver ?
    (A) Input cells (B) Constraints
    (C) Target cell (D) Changing cells
26. Each excel file is called a workbook because—
    (A) It can contain text and data
    (B) It can be modified
    (C) It can contain many sheets including worksheets and chart sheets
    (D) You have to work hard to create it
27. Excel probably considers the cell entry January 1, 2000 to be a—
    (A) Label (B) Value
    (C) Formula (D) Text string
28. You can enter which types of data into worksheet cells ?
    (A) Labels, values, and formulas
    (B) Labels and values but not formulas
    (C) Values and formulas but not labels
    (D) Formulas only
29. All worksheet formula—
    (A) Manipulate values
    (B) Manipulate labels
    (C) Return a formula result
    (D) Use the addition operator
30. Which of the following is a correct order of precedence in formula calculation ?
    (A) Multiplication and division exponentiation positive and negative values
    (B) Multiplication and division, positive and negative values, addition and subtraction
    (C) Addition and subtraction, positive and negative values, exponentiation
    (D) All of the above
31. The Paste Special command lets you copy and paste—
    (A) Multiply the selection by a copied value
    (B) Cell comments

(C) Formatting options
(D) The resulting values of a formula instead of the actual formula

32. The numbers in our worksheet look like this: 1000. You want them to look like this: $1,000.00. How can you accomplish this ?
(A) None of these
(B) Select Format > Money from the menu
(C) Click the Currency Style button on the formatting toolbar
(D) You have to retype everything and manually add the dollar signs, commas, and decimals.

33. Which of the following is not a valid data type in excel—
(A) Number (B) Character
(C) Label (D) Date/time

34. Excel worksheet cells work very similarly to what common element of the windows graphical user interface—
(A) Option buttons (B) List boxes
(C) Text boxes (D) Combo boxes

35. Which of the following options is not located in the Page Setup dialog box ?
(A) Page Break Preview
(B) Page Orientation
(C) Margins
(D) Headers and Footers

36. You want to track the progress of the stock market on a daily basis. Which type of chart should you use ?
(A) Pie chart (B) Row chart
(C) Line chart (D) Column chart

37. Without using the mouse or the arrow keys, what is the fastest way of getting to cell A1 in a spreadsheet ?
(A) Press Ctrl + Home
(B) Press Home
(C) Press Shift + Home
(D) Press Alt + Home

38. Which of the following methods can not be used to edit the contents of a cell ?
(A) Press the Alt key
(B) Clicking the formula bar
(C) Pressing the F2 key
(D) Double clicking the cell

39. If you begin typing an entry into a cell and then realize that you don't want your entry placed into a cell, you :
(A) Press the Erase key
(B) Press Esc
(C) Press the Enter button
(D) Press the Edit Formula button

40. Which of the following methods can not be used to enter data in a cell—
(A) Pressing an arrow key
(B) Pressing the Tab key
(C) Pressing the Esc key
(D) Clicking on the formula bar

41. Which of the following will not cut information ?
(A) Pressing Ctrl + C
(B) Selecting Edit > Cut from the menu
(C) Clicking the Cut button on the standard
(D) Pressing Ctrl + X

42. Which of the following is not a way to complete a cell entry ?
(A) Pressing enter
(B) Pressing any arrow key on the keyboard
(C) Clicking the Enter button on the Formula bar
(D) Pressing spacebar

43. You can activate a cell by—
(A) Pressing the Tab key
(B) Clicking the cell
(C) Pressing an arrow key
(D) All of the above

44. Text formulas—
(A) Replace cell references
(B) Return ASCII values of characters
(C) Concatenate and manipulate text
(D) Show formula error value

45. How do you insert a row ?
(A) Right-click the row heading where you want to insert the new row and select Insert from the shortcut menu
(B) Select the row heading where you want to insert the new row and select Edit > Row from the menu
(C) Select the row heading where you want to insert the new row and click the Insert Row button on the standard toolbar
(D) All of the above

46. Which of the following is not a basic step in creating a worksheet ?
    (A) Save workbook
    (B) Modifiy the worksheet
    (C) Enter text and data
    (D) Copy the worksheet
47. How do you select an entire column ?
    (A) Select Edit > Select > Column from the menu
    (B) Click the column heading letter
    (C) Hold down the shift key as you click anywhere in the column.
    (D) Hold down the Ctrl key as you click anywhere in the column
48. Which is not a view for displaying a report object ?
    (A) Datasheet view (B) Design view
    (C) Print preview (D) Layout preview
49. The report footer section is most useful for displaying—
    (A) Grand totals (B) Column headings
    (C) Subtotals (D) Page numbers
50. Which function can not be used for calculated controls in a report?
    (A) SUM (B) AVG
    (C) MPT (D) COUNT
51. Which setting you must modify to print a report using letterhead?
    (A) Group (B) Margin
    (C) Section (D) Orientation
52. In the datasheet formatting dialogue box, which is not an option in the border and line styles dropdown list box ?
    (A) Datasheet border
    (B) Datasheet underline
    (C) Column Header underline
    (D) Vertical gridline
53. Which is not an option for customizing a datasheet window ?
    (A) Change one row's height
    (B) Hide one column
    (C) Change one column's width
    (D) Freeze one column
54. Which is not a command that is selectable from right click menu of a field column ?
    (A) Hide columns (B) Unhide columns
    (C) Freeze columns (D) Sort descending
55. What do you call the process of restricting the display of records in a table to those matching a particular criterion ?
    (A) Filtering (B) Restricting
    (C) Sorting (D) Sifting
56. In the relationships window, what does the appearance of symbols, such as 1 and the infinity symbol, at the endpoints of a relationship line mean ?
    (A) Referential integrity is enforced
    (B) Referential integrity isn't enforced
    (C) An inner join is set
    (D) An outer join is set
57. Which of the following is not an action query ? />
    (A) add (B) delete
    (C) make-table (D) update
58. When sharing data in Office, the..... document is the document in which the data was first entered.
    (A) source (B) destination
    (C) original (D) primary
59. Which command is used to establish a link between a source document and a destination document ?
    (A) Tools, Link, Documents
    (B) Tools, Link
    (C) Edit, Link
    (D) Edit, Paste Special
60. Which option enables automatic updates in destination documents ?
    (A) Embedding (B) Objects
    (C) Links (D) Relationships
61. Which is an Office feature that makes it easy to edit embedded objects ?
    (A) Pasting
    (B) Visual editing
    (C) Tools, update, links
    (D) Edit, links
62. Which is true when you insert an excel worksheet into a word document ?
    (A) Word is the destination document
    (B) Excel is the destination document
    (C) The worksheet is the destination document
    (D) The document is the source document

63. What would you do when you want to update the data in an embedded worksheet range ?
    (A) Double click the worksheet range object
    (B) Right click worksheet range object choose format object
    (C) Edit the data in the destination document
    (D) Edit the data in the source document

64. Which can be used for quick access to commonly used commands and tools ?
    (A) Status bar (B) Tool bar
    (C) Menu bar (D) Title bar

65. With which view can you see how text and graphics will appear on the printed page ?
    (A) Normal (B) Print Layout
    (C) Outline (D) Web Layout

66. Which simplifies the process of formatting text if the same formatting is required in more than one location ?
    (A) Auto Text
    (B) Format Painter
    (C) Font dialog box
    (D) None of the above

67. Which of the following is best for quick copy operation?
    (A) Copy and Paste
    (B) Windows Clipboard
    (C) Drag and Drop
    (D) Auto Text

68. Ctrl + U
    (A) Undelete the previously deleted text
    (B) Undo the last changes
    (C) Underline the document name
    (D) Underline the selected text

69. Ctrl + V
    (A) Paste Texts in the beginning of Document
    (B) Paste Images in the beginning of Document
    (C) Paste Tables at the middle of Document
    (D) None of the above

70. Ctrl + W
    (A) Save and Print the Document
    (B) Save and Close Word Application
    (C) Save and Close document
    (D) Without Save, Close Document

71. Ctrl + X
    (A) Close Document
    (B) Close Word Application
    (C) Cut the Selected Contents
    (D) Copy the Selected Contents

72. Ctrl + Y
    (A) Undo the last Action
    (B) Repeat the last Action
    (C) Delete the last page
    (D) Delete the first page

73. Ctrl + Z
    (A) Undo the last Action
    (B) Redo the last Action
    (C) Add the new page
    (D) Paste the contents from clipboard

74. Page Up Key
    (A) Moves the cursor one line up
    (B) Moves the cursor one screen up
    (C) Moves the cursor one page up
    (D) Moves the cursor one paragraph up

75. Page Down Key
    (A) Moves the cursor one line down
    (B) Moves the cursor one page down
    (C) Moves the cursor one screen down
    (D) Moves the cursor one paragraph down

## Answers

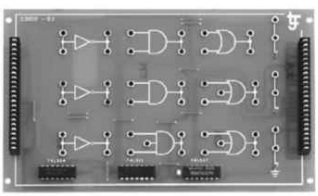
| | | | | |
|---|---|---|---|---|
| 1. (A) | 2. (D) | 3. (A) | 4. (D) | 5. (A) |
| 6. (C) | 7. (D) | 8. (B) | 9. (A) | 10. (A) |
| 11. (B) | 12. (D) | 13. (C) | 14. (D) | 15. (C) |
| 16. (B) | 17. (C) | 18. (A) | 19. (C) | 20. (D) |
| 21. (B) | 22. (C) | 23. (D) | 24. (B) | 25. (A) |
| 26. (C) | 27. (B) | 28. (A) | 29. (C) | 30. (D) |
| 31. (D) | 32. (C) | 33. (B) | 34. (C) | 35. (A) |
| 36. (C) | 37. (A) | 38. (A) | 39. (B) | 40. (C) |
| 41. (A) | 42. (D) | 43. (D) | 44. (C) | 45. (A) |
| 46. (D) | 47. (B) | 48. (A) | 49. (A) | 50. (C) |
| 51. (B) | 52. (C) | 53. (A) | 54. (B) | 55. (A) |
| 56. (A) | 57. (A) | 58. (A) | 59. (D) | 60. (C) |
| 61. (B) | 62. (A) | 63. (A) | 64. (B) | 65. (B) |
| 66. (B) | 67. (C) | 68. (D) | 69. (D) | 70. (C) |
| 71. (C) | 72. (B) | 73. (A) | 74. (B) | 75. (C) |

❑❑

# 5 Digital Electronics

## Digital System

Now these days digital system find application in a wide variety of industrial and consumer products such as automated industrial machinery, pocket calculators, microprocessors, digital computers, digital watch, TV games, signal processing and so on.



## Salient features of Digital System

The digital system has the following salient features over analog system.

(a) A digital system may be defined as an interconnection of digital modules and it is a system that manipulates discrete elements of information that is represented internally in binary form.
(b) Digital system manipulate discrete elements of information.
(c) Discrete elements are nothing but the digits such as 10 decimal digits, 26 letters of alphabets and so on.
(d) Digital system makes use of physical quantities called signals represent discrete elements.
(e) In digital systems, the signal has two discrete values and therefore said to be binary.
(f) A signal system represent one binary digit is called a bit. The bit has a value either 0 or 1.
(g) The digital system like a digital computer is a programmable device which may be programmed to perform a variety of tasks.

## Digital Electronics Terminology

### 1's Complement

A binary number formed through inverting each bit of the original number. Used for subtraction of binary numbers where the 1's compliment of the subtrahend (number being subtracted) is added to the minuend (the number the subtrahend is being subtracted from).

### 2's Complement

A binary number is formed by inverting each bit of the original binary number and then adding one. Used for subtraction of binary number where the 2's compliment of the subtrahend is added to the minuend.

### 7483 IC

A TTL integrated circuit (4 bit adder) that can be used for addition and subtraction of binary numbers.

### Alternating Current

A form of electrical current in which the direction of electron flow changes over time.

### Analog-To-Digital (ADC)

Circuit that converts an analog input to the corresponding digital output.

### AND

Digital gate that implements the AND operation. The Output of this circuit is High (1) only if all of its inputs are High.

**ASCII Code**

(American Standard Code for Information Interchange) Seven BitAlphanumeric code used by most computer manufacturers.

**Astable**

Digital circuit that oscillates between two unstable output states.

**Asynchronous**

Data transmission that occurs one bit at a time, without a time constraint; there is no specific time between transmitted characters.

**Asynchronous Counter**

Type of counter in which each flip flop output serves as the clock input signal for the following flip flop in the chain.

**Batteries**

A voltage storage device that stores electricity chemically and provides a direct current.

**Baud Rate**

The number of bits per second transmitted or received.

**BCD Decoder**

A device that translates Binary Coded Decimal into another number system, usually decimal.

**Bi-directional Bus**

A bus that allows information to flow in both directions using Tristate gates.

**Binary**

Numerical value represented in the Binary or Base-2 number system.

**Binary Coded Decimal (BCD)**

Four-bit code used to portray each digit of a decimal number by its 4 bit binary equivalent.

**Binary Ladder 2R**

A circuit constructed in such a way that resistor values successively increase by a factor of 2. This network will provide a proportional voltage to a binary number input.

**Binary Number**

Base-2 number system. The Binary system has only 0s and 1s.

**Bistable**

Name that is sometimes used to characterize a flip flop.

**Bit**

Digit in the binary system.

**Boolean Expression**

Terms written in Boolean algebra that express the output of a circuit in terms of the input.

**Breadboard**

A method of construction used to test and verify circuit operation.

**Buffer**

Circuit designed to have a larger output current and/or voltage capability than an ordinary logic circuit.

**Bus**

An arrangement of parallel wire that permits the simultaneous transmission of data.

**Byte**

Eight-Bit word.

**Carry**

Digit or bit that is generated when two numbers are added and the outcome is greater than the base for the number system being used.

**Cascade**

Adjoining logic circuits in a serial fashion with the output of one circuit driving the input of the next and so on.

**Circuit**

A complete path for the flow of electricity.

**Clear**

A FF input used to make Q=0.

**Clock**

Digital signal in the form of a rectangular pulse train or a square wave.

**Color Code**

Colored strips on a resistor used to determine its value in ohms.

**Combinational Logic**

Circuits made up of mixture of logic gates, with no feedback from outputs to inputs.

**Comparator**

A device that examines two inputs and indicates if they are identical.

**Complementary Metal-Oxide Semiconductor (CMOS)**

Integrated-circuit technology that uses MOSFETs as the principal circuit component. This logic family belongs to the class of unipolar digital ICs.

**Conductor**

Any material that allows the flow of electricity through it.

**Control**

A switch.

**Counter**

A device which adds or subtracts numbers for display without saving to memory.

**Current**

The total amount of electrons flowing through a circuit per unit time; measured in Amperes (one coulomb of electrons passing a single point per second).

**Data Book**

An industrial standardized document which describes the properties, families and pin outs of modern integrated circuits.

**Data Shifting**

The process of moving bit from one flip flop to the next.

**Decoder**

Digital circuit that converts an input binary code into a corresponding single numeric output.

**DeMorgan's Theorems**

Theorem stating that the complement of a sum (OR operation) equals the product (AND operation) of the complements, and theorem stating that the complement of a product (AND operation) equals the sum (OR operation) of the complements.

**Demultiplexer (DEMUX)**

Logic circuit that depending on the position of its select inputs, will channel its data input to one of several data outputs.

**Digital-To-Analog (DAC)**

Circuit that converts a digital input to a corresponding analog output.

**Digital Multimeter**

A instrument used typically to measure voltage, current, and resistance. The data is sent to a digital display.

**Digital State**

The voltage condition existing anywhere in a digital circuit. Typically read as "high" or "low"; can be tested with a logic probe or a meter.

**Digital Waveform**

A wave form that changes between solely High and Low in a given time.

**Direct Current**

A form of electrical current in which the direction of electron flow does not change over time.

**Divide By N**

A counter system that will count up to the number N and then reset by using a NAND gate.

**Dual Logic**

The application of DeMorgan's Theorems.

**Duty Cycle**

The ratio of HIGH time to the total cycle time, expressed as a per cent.

**Edge-Triggered D Flip Flop**

A flip-flop circuit in which the inputs are clocked and the outputs appear on the same clock edge.

**Enable**

To start or activate.

**Encode**

To convert information into a coded form.

**Exclusive NOR**

A logic gate with two inputs that outputs a 1 (high) when both inputs are alike.

**Exclusive OR**

A logic gate with two inputs that outputs a 1 (high) when its inputs are opposite.

**Expanding Function**

To add more gates in order to increase the number of inputs to a specific gate.

**Fan Out**

Maximum number of standard logic inputs that the output of a digital circuit can drive reliably.

**Fast Carry**

During subtraction operations a carry signal is generated concurrently with the rest of the subtraction operation, without having to ripple through the gates.

**Feedback**

Returning the signal from output back to the circuit input.

**Flash Converter**

Type of analog to digital converter that has a very high operating speed.

**Frequency**

The number of cycles completed by as waveform each second; measured in Hertz (Hz).

**Full Adder**

Logic circuit with three inputs and two outputs. The inputs are a carry bit (Cin) from a former stage, a bit from the augend, and a bit from the added, respectively. The outputs are the sum bit and carry out bit (Cout) produced by the addition of the bit from the addend with the bit from the augend and Cin.

**Full Decoder**

A decoder that has an output for each possible binary number output.

**Gated Flip Flop**

A Flip Flop in which a Gate Enables the Flip Flop.

**Glitch**

Momentary, compressed, spurious, and sharply defined change in voltage.

**Half Adder**

Logic circuit with two inputs and two outputs. The inputs are a bit from the augend and a bit from the addend, respectively. The outputs are the sum bit produced by the addition of the bit from and addend with the bit from the augend and the ensuing carry (Cout) bit, which will be added to the next stage.

**Hexadecimal**

Number system which has a base of 16; digits 0 through 9 plus letters A through F are used to express a hexadecimal number.

**High**

Logic level 1.

**IC Speed**

The time it takes for a change in the input to reach the output.

**Impedance**

The total resistance in an Alternating Current circuit due to resistive and reactive components; symbolized by Z.

**Inhibit**

To shut down or cause to cease functioning; typically a control signal which keeps data from passing through the gate.

**Insulator**

Any material which doesn't allow the flow of electricity through it.

**Interface**

A device that joins or links two or more non-compatible devices together for data transfer.

**Interfacing**

Joining of dissimilar devices in such a way that they are able to function in a compatible and coordinated manner; connection of the output of a system to the inputs of a contrasted system with different electrical characteristics.

**Inverter**

Also referred to as the NOT gate: logic circuit that implements the NOT operation. An INVERTER has only one input, and its output logic level is always the opposite of this input's logic level.

**JK Flip Flop**

A flip flop that can be turned on, turned off, toggled, or left the same according to control signals on the J and K inputs.

**Karnaugh Mapping**

Two dimensional form of a truth table used to simplify a sum of products expression.

**Kirchhoff's Laws**

The sum of the voltage drops in any closed path is equal to the sum of the battery voltage; the algebraic sum of the currents at a node is zero.

**Ladder**

One possible structure of A to D and D to A converters.

**Latch**

Type of Flip Flop. A circuit that assumes an on state or an off state according to the input signal.

**Least Significant Bit (LSB)**

Right most bit (smallest weight) of a binary expressed quantity.

**Light Emitting Diode (LED)**

A diode that emits light in a forward biased manner.

**Liquid Crystal Display (LCD)**

A method of displaying information that uses the selective reflection of light.

**Load**

That part of the circuit that produces work. Anything that uses electricity.

**Logic**

In digital electronics, the decision-making capability of gate circuits, in that a HIGH represents a true condition and a LOW represents a false condition.

**Logic Analyzer**

A piece of test equipment used for monitoring one or more digital wave forms.

**Logic Gates**

The basic building block of digital electronics. The basic logic gate has one or more inputs and one output and is used to perform one of the following logic functions : AND, OR, NOR, NAND, INVERT, exclusive-OR, or exclusive-NOR.

**Logic Probe**

Digital troubleshooting tool which senses and indicates the logic level at a particular point in a circuit.

**Logic Symbols**

The schematic symbol for gates.

**Look Ahead Carry**

A carry signal is developed at the same time the other outputs are being generated. Carry does not have to "ripple through" other stages. (A fast carry).

**Loops**

Complete path or sub-path in a circuit.

**Low**

Logic level 0 or False state.

**Master-Slave Flip Flop**

A type of flip flop in which the input data are entered into the device on the leading edge of the clock pulse and appear at the output on the trailing edge.

**Maxterm Boolean Expression**

Product of sums.

**Memory**

Ability of a circuit's output to remain at one state even after the input condition that caused that state is removed.

**Modulo(MOD)**

The number of counting states in a number system.

**Monostable**

Circuit that belongs to the flip-flop family, but which has only one stable state (Normally $Q = 0$).

**Most Significant Bit(MSB)**

Leftmost binary bit (Largest weight) of a binary expressed quantity.

**Multiplexer(MUX)**

Logic circuit that, depending on the status of its selected inputs, will channel one of several data inputs to its output.

**NAND**

Logic circuit which operates like an AND gate followed by an INVERTER. The output of a NAND gate is LOW (logic level 0) only if all inputs are HIGH (logic level 1).

**Non-Overlapping Clock**

Delayed clock or a dual clock system. The two rectangular waves are offset so that only one is HIGH at a time.

**NOR**

Logic circuit which operates like an OR gate followed by an INVERTER. The output of a NOR gate is LOW (logic level 0) when any or all inputs are HIGH (logic level 1).

**Octal**

Number system which has a base 8; digits from 0 to 7 are used to express an octal number.

**Ohm's Law**

I=V/R, V=IR, R=V/I

**Open Collector**

Type of output structure of some TTL circuits in which only one transistor with a floating collector is used.

**OR**

Digital circuit that implements the OR operation. The output of this circuit is HIGH (logic level 1) if any or all of its inputs are HIGH.

**Overflow**

When in the process of adding signed binary numbers a carry of 1 is generated from the MSB position of the number into the sign bit position.

**Partial Decoder**

A logic circuit which will give an active signal on one output line for a binary number input to the circuit. The circuit does not have a solitary output line for each possible binary number input to it as a full decoder has.

**Phase**

The relative position of one signal relative to another signal.

**Pin-Out**

The pin numbers which correspond to the gate or device location.

**Preset**

An input used to set Q = 1

**Prohibited**

A set of inputs that are not supposed to be used.

**Pulse**

A sudden change from one level to another, followed after a time by a sudden change back to the original level.

**Q and Q'**

The complementary outputs of a flip flop.

**R-C Circuit**

An analog circuit whose output provides a filtering or charge storage function.

**R-S Flip Flop**

A flip flop that can be turned on with the set input and turn off with the reset.

**Reset**

Term synonymous with "CLEAR" (Q = 0 Logic level).

**Reset Not**

Opposite of Reset.

**Resistance**

The opposition to current flow.

**Ripple Counter**

Type of counter in which each flip flop output serves as the clock input signal for the next flip flop in the chain.

**RS-232**

Serial data transmission standard (Recommend Standard).

**Sequential Logic**

Logic that is based on the output of a previous state.

**Set**

To preset or turn on a flip-flop and cause the output, Q, of a flip flop to assume a 1 level.

**Set Not**

Opposite of set.

**Seven Segment Display**

An alphanumeric display made up of seven segments.

**Shift Counter**

A counter in which data is shifted through to another flip-flop or shifted back to the input of the first flip-flop.

**Shift Register**

Digital circuit that accepts binary data from some input source and then shifts these data through a chain of flip-flops one bit at a time to a higher order or lower order.

**Signal Generator**

A device used to create different wave forms.

**Signed Bit**

Leftmost bit of a binary number which designates whether the number is positive (0) or negative (1).

**Sine Wave**

A waveform of a single constant frequency and amplitude that continues for all time.

**Source**

The origin of a digital input.

**Square Wave**

A wave that varies from a 0 logic (low) to a 1 logic (high) in a symmetrical pattern (50% duty cycle).

**Steering Logic**

The selection of one out of a number of inputs to be chosen through multiplexing.

**Subtractor**

A circuit that subtracts two binary numbers.

**Successive Approximation**

The process of refining an A-D measurement using a sequence of steps.

**Synchronous**

To occur or happen at the same time.

**Synchronous Counter**

Counter in which all the flip-flops are clocked at the same time.

**Timing Diagram**

A visual depiction of logic levels in relation to time.

**Toggle**

When a digital device changes state, it is said to toggle.

**Totem Pole**

A digital term used to illustrate the way two transistors are arranged at the output of most logic circuits.

**Transistor**

An active semiconductor component used as an amplifier, detector, or switch.

**Transistor-Transistor Logic (TTL)**

Integrated circuits that use the bipolar transistor as the principle component.

**Transparent D Flip Flop**

Flip-flop whose output will respond to the D input during the active level of the clock.

**Tri-State**

Type of output configuration which allows three types of output states. The three types of output states being high impedance, LOW, and high.

**Troubleshoot**

A systematic procedure for finding a fault in a circuit.

**Truth Table**

Method for describing how a logic circuit's output is dependent upon the logic levels present at the circuit's inputs.

**Unchanged**

Not changed, or the memory state of a flip flop.

**Up/Down Counter**

A counter which can be made to count up or down depending upon the input condition.

**Voltage**

The electromotive force in a circuit.

**Voltage Divider**

A tapped resistor, series resistors, or potentiometer across a source voltage to produce multiple output voltages.

**Voltage/Time Graph**

A graph which depicts the voltage of a circuit over an chosen period of time.

**Waveform**

Representation of an electronic signal on an oscilloscope.

**XNOR**

The "exclusive NOR gate" is abbreviated as XNOR, referred to as the "none or all" gate.

**XOR**

The exclusive OR gate is sometimes referred to as the "any but not all gate." Exclusive OR is sometimes abbreviated as XOR gate.

## Multiple Choice Questions

1. When signed numbers are used in binary arithmetic, then which one of the following notations would have unique representation for zero.
   (A) Sign-magnitude (B) 1's complement
   (C) 2's complement (D) 9's complement
2. The logic 0 level of a CMOS logic device is approximately—
   (A) 1.2 volts (B) 0.4 volts
   (C) 5 volts (D) 0 volts
3. For JK flip flop with J=1, K=0, the output after clock pulse will be—
   (A) 0 (B) 1
   (C) high impedance (D) no change
4. CMOS logic low level is 0 volts approx.
   Karnaugh map is used for the purpose of
   (A) Reducing the electronic circuits used
   (B) To map the given Boolean logic function.
   (C) To minimize the terms in a Boolean expression.
   (D) To maximize the terms of a given a Boolean expression.
5. For JK flip flop with J=1, K=0, the output after clock pulse will be—
   (A) 0 (B) 1
   (C) high impedance (D) no change
6. Which of following are known as universal gates—
   (A) NAND & NOR (B) AND & OR
   (C) XOR & OR (D) None
7. The 2's complement of the number 1101101 is—
   (A) 0101110 (B) 0111110
   (C) 0110010 (D) 0010011
8. The device which changes from serial data to parallel data is—
   (A) COUNTER
   (B) MULTIPLEXER
   (C) DEMULTIPLEXER
   (D) FLIP-FLOP
9. A device which converts BCD to Seven Segment is called—
   (A) Encoder
   (B) Decoder
   (C) Multiplexer
   (D) Demultiplexer
10. In a JK Flip-Flop, toggle means—
    (A) Set Q = 1 and Q□ = 0
    (B) Set Q = 0 and Q□ = 1
    (C) Change the output to the opposite state
    (D) No change in output
11. (734)8 = ( )16
    (A) C 1 D (B) D C 1
    (C) 1 C D (D) 1 D C
12. DeMorgan's first theorem shows the equivalence of—
    (A) OR gate and Exclusive OR gate.
    (B) NOR gate and Bubbled AND gate.
    (C) NOR gate and NAND gate.
    (D) NAND gate and NOT gate
13. The code where all successive numbers differ from their preceding number by single bit is—
    (A) Binary code (B) BCD
    (C) Excess – 3 (D) Gray
14. The Gray code for decimal number 6 is equivalent to—
    (A) 1100 (B) 1001
    (C) 0101 (D) 0110

15. The output of a logic gate is 1 when all its inputs are at logic 0. The gate is either—
    (A) a NAND or an EX-OR
    (B) an OR or an EX-NOR
    (C) an AND or an EX-OR
    (D) a NOR or an EX-NOR

16. How many Flip-Flops are required for mod–16 counter ?
    (A) 5 (B) 6
    (C) 3 (D) 4

17. EPROM contents can be erased by exposing it to—
    (A) Ultraviolet rays
    (B) Infrared rays
    (C) Burst of microwaves
    (D) Intense heat radiations

18. How many two input AND gates and two input OR gates are required to realize—
    $Y = BD + CE + AB$
    (A) 1, 1 (B) 4, 2
    (C) 3, 2 (D) 2, 3

19. Convert decimal 153 to octal. Equivalent in octal will be—
    (A) $(231)_8$ (B) $(331)_8$
    (C) $(431)_8$ (D) None of these

20. A universal logic gate is one, which can be used to generate any logic function. Which of the following is a universal logic gate ?
    (A) OR (B) AND
    (C) XOR (D) NAND

21. Storage of 1 KB means the following number of bytes—
    (A) 1000 (B) 964
    (C) 1024 (D) 1064

22. What is the octal equivalent of the binary number—
    10111101
    (A) 675 (B) 275
    (C) 572 (D) 573

23. Pick out the CORRECT statement—
    (A) In a positional number system, each symbol represents the same value irrespective of its position
    (B) The highest symbol in a position number system as a value equal to the number of symbols in the system
    (C) It is not always possible to find the exact binary
    (D) Each hexadecimal digit can be represented as a sequence of three binary symbols.

24. The binary code of (21.125)10 is—
    (A) 10101.001 (B) 10100.001
    (C) 10101.010 (D) 10100.111

25. A NAND gate is called a universal logic element because—
    (A) it is used by everybody
    (B) any logic function can be realized by NAND gates alone
    (C) all the minization techniques are applicable for optimum NAND gate realization
    (D) many digital computers use NAND gates.

26. Digital computers are more widely used as compared to analog computers, because they are—
    (A) less expensive
    (B) always more accurate and faster
    (C) useful over wider ranges of problem types
    (D) easier to maintain.

27. Most of the digital computers do not have floating point hardware because—
    (A) floating point hardware is costly
    (B) it is slower than software
    (C) it is not possible to perform floating point addition by hardware
    (D) No specific reason.

28. The number 1000 would appear just immediately after—
    (A) FFFF (hex)
    (B) 1111 (binary)
    (C) 7777 (octal)
    (D) All of the above

29. $(110101)_2$ is—
    (A) $(51)_{10}$ (B) $(69)_{10}$
    (C) $(41)_{10}$ (D) $(5)_{10}$

30. The number of Boolean functions that can be generated by $n$ variables is equal to—
    (A) $2n$ (B) $22n$
    (C) $2n - 1$ (D) $-2n$

31. Consider the representation of six-bit numbers by two's complement, one's complement, or by sign and magnitude: In which representation is there overflow from the addition of the integers 011000 and 011000 ?
    (A) Two's complement only
    (B) Sign and magnitude and one's complement only
    (C) Two's complement and one's complement only
    (D) All three representations.

32. Positive logic in a logic circuit is one in which—
    (A) logic 0 and 1 are represented by 0 and positive voltage respectively
    (B) logic 0 and, 1 are represented by negative and positive voltages respectively
    (C) logic 0 voltage level is higher than logic 1 voltage level
    (D) logic 0 voltage level is lower than logic 1 voltage level.

33. Which of the following gate is a two-level logic gate—
    (A) OR gate
    (B) NAND gate
    (C) EXCLUSIVE OR gate
    (D) NOT gate

34. Among the logic families, the family which can be used at very high frequency greater than 100 MHz in a 4 bit synchronous counter is—
    (A) TTLAS (B) CMOS
    (C) ECL (D) TTLLS

35. An AND gate will function as OR if—
    (A) all the inputs to the gates are "1"
    (B) all the inputs are '0'
    (C) either of the inputs is "1"
    (D) all the inputs and outputs are complemented.

36. An OR gate has 6 inputs. The number of input words in its truth table are—
    (A) 6 (B) 32
    (C) 64 (D) 128

37. NAND. gates are preferred over others because these—
    (A) have lower fabrication area
    (B) can be used to make any gate
    (C) consume least electronic power
    (D) provide maximum density in a chip.

38. In case of OR gate, no matter what the number of inputs, a—
    (A) 1 at any input causes the output to be at logic 1
    (B) 1 at any input causes the output to be at logic 0
    (C) 0 any input causes the output to be at logic 0
    (D) 0 at any input causes the output to be at logic 1.

39. The fan put of a 7400 NAND gate is—
    (A) 2TTL (B) 5TTL
    (C) 8TTL (D) 10TTL

40. Excess-3 code is known as—
    (A) Weighted code
    (B) Cyclic redundancy code
    (C) Self-complementing code
    (D) Algebraic code.

41. Indicate which of the following three binary additions are correct ?
    I. 1011 + 1010 = 10101
    II. 1010 + 1101 = 10111
    III. 1010 + 1101 = 11111
    (A) I and II (B) II and III
    (C) III only (D) II and III

42. 80486 is a.....bit processor—
    (A) 8 (B) 16
    (C) 32 (D) 64

43. The Digital multiplexer performs the operation of—
    (A) AND-OR (B) OR-AND
    (C) NAND-OR (D) NAND-NOR

44. D Flip-flop is created by—
    (A) Inserting an inverter between S & R
    (B) Inserting an inverter between J & K
    (C) Joining two inputs of S & R
    (D) Joining two inputs of J & K

45. What is flip-flop—
(A) A Binary cell capable of storing one bit information
(B) An analog device capable of giving the synchronization
(C) A Set of registers
(D) A clock

46. A.....is a group of devices that stores digital data—
(A) Circuit (B) Bit
(C) Registers (D) Variations

47. 58 + 68 = (?)8
(A) 118 (B) 138
(C) 178 (D) 188

48. 1368 = ( )16
(A) 7E16 (B) 5E16
(C) 5A16 (D) 5D16

49. How many nibbles are in 1111000011001 001 ?
(A) 256 (B) 14*2
(C) 16,384 (D) None of these

50. Minimun number of NAND gates are required to implement A + A'B + AB' C is ?
(A) 0 (B) 2
(C) 4 (D) None of these

51. 4 bits is equal to—
(A) 1 nibble (B) 1 byte
(C) 2 byte (D) None of these

52. Which is non-volatile memory—
(A) RAM (B) ROM
(C) Both (D) None of these

53. The contents of these chips are lost when the computer is switched off ?
(A) ROM chips (B) RAM chips
(C) DRAM chips (D) None of these

54. What are responsible for storing permanent data and instructions ?
(A) RAM chips (B) ROM chips
(C) DRAM chips (D) None of these

55. Which parts of the computer perform arithmetic calculations ?
(A) ALU (B) Registers
(C) Logic bus (D) None of these

56. How many bits of information can each memory cell in a computer chip hold ?
(A) 0 bits (B) 1 bit
(C) 8 bits (D) 2 bits

57. What type of computer chips are said to be volatile ?
(A) RAM chips (B) ROM chips
(C) DRAM (D) None of these

58. Which generation of computer uses more than one microprocessor ?
(A) Second generation
(B) Fifth generation
(C) Third generation
(D) None of the above

59. Which generation of computer developed using integrated circuits ?
(A) Second generation
(B) Fifth generation
(C) Third generation
(D) None of the above

60. Which generation of computer was developed from microchips ?
(A) Second generation
(B) Third generation
(C) Fourth generation
(D) None of the above

61. Digital technologies being used now-a-days are—
(A) DTL and EMOS
(B) TTL, ECL, CMOS and RTL
(C) TTL, ECL and CMOS
(D) TTL, ECL, CMOS and DTL

62. Radix of binary number system is ..... ?
(A) 0 (B) 1
(C) 2 (D) (A) and (B)

63. A simple flip-flop—
(A) is 2 bit memory
(B) is 1 bit memory
(C) is a four state device
(D) has nothing to do with memory

64. Advanced schottky is a part of—
(A) ECL family (B) CMOS family
(C) TTL family (D) None of these

65. For wired AND connection we should use—
(A) TTL gates with active pull up
(B) TTL gates with open collector
(C) TTL gates without active pull up and with open collector
(D) Any of the above

66. Time delay of a TTL family is about—
(A) 180ns (B) 50ns
(C) 18ns (D) 3 ns

67. As compared to TTL, ECL has—
(A) lower power dissipation
(B) lower propagation delay
(C) higher propagation delay
(D) higher noise margin

68. As compared to TTL, CMOS logic has—
(A) higher speed of operation
(B) higher power dissipation
(C) smaller physical size
(D) All of the above

69. 74HCT00 series is—
(A) NAND IC
(B) interface between TTL and CMOS
(C) inverting IC
(D) NOR IC

70. CD 4010 is a—
(A) inverting buffer
(B) non inverting hex buffer
(C) NOR IC
(D) NAND IC

71. Current requirement of a piezo buffer is about—
(A) 100mA (B) 20mA
(C) 4 mA (D) 0.4 mA

72. TSL inverter has—
(A) one input
(B) two inputs
(C) one or two inputs
(D) three inputs

73. Parallel adder is—
(A) sequential circuits
(B) combinational circuits
(C) either sequential or combinational circuits
(D) None of above

74. The inputs to a 3 bit binary adder are $(111)_2$ and $(110)_2$. The output will be—
(A) 101 (B) 1101
(C) 1111 (D) 1110

75. A half adder can be used only for adding—
(A) 1s (B) 2s
(C) 4s (D) 8s

## Answers

| | | | | |
|---|---|---|---|---|
| 1. (A) | 2. (D) | 3. (B) | 4. (C) | 5. (B) |
| 6. (A) | 7. (D) | 8. (C) | 9. (B) | 10. (C) |
| 11. (D) | 12. (B) | 13. (D) | 14. (C) | 15. (D) |
| 16. (D) | 17. (A) | 18. (A) | 19. (A) | 20. (D) |
| 21. (C) | 22. (B) | 23. (C) | 24. (A) | 25. (B) |
| 26. (C) | 27. (A) | 28. (D) | 29. (A) | 30. (B) |
| 31. (D) | 32. (D) | 33. (C) | 34. (C) | 35. (D) |
| 36. (C) | 37. (B) | 38. (A) | 39. (D) | 40. (C) |
| 41. (D) | 42. (C) | 43. (A) | 44. (A) | 45. (A) |
| 46. (A) | 47. (B) | 48. (B) | 49. (D) | 50. (B) |
| 51. (A) | 52. (B) | 53. (B) | 54. (B) | 55. (A) |
| 56. (B) | 57. (A) | 58. (B) | 59. (C) | 60. (B) |
| 61. (B) | 62. (C) | 63. (B) | 64. (B) | 65. (B) |
| 66. (D) | 67. (B) | 68. (A) | 69. (A) | 70. (D) |
| 71. (B) | 72. (D) | 73. (B) | 74. (B) | 75. (B) |

❑❑

# 6 Programming in C Language

## C Programming

C is a general-purpose computer programming language developed between 1969 and 1973 by Dennis Ritchie at the Bell Telephone Laboratories for use with the Unix operating system.

The origin of C is closely tied to the development of the Unix operating system, originally implemented in assembly language on a PDP-7 by Ritchie and Thompson, incorporating several ideas from colleagues.

Although C was designed for implementing system software, it is also widely used for developing portable application software.

## Uses of C

C was initially used for system development work, in particular the programs that make-up the operating system. C was adopted as a system development language because it produces code that runs nearly as fast as code written in assembly language. Some examples of the use of C might be :

- Operating Systems
- Language Compilers
- Assemblers
- Text Editors
- Print Spoolers
- Network Drivers
- Modern Programs
- Data Bases
- Language Interpreters
- Utilities

In spite of its age, C is still being heavily used in industry. Several surveys have placed C as one of the most popular languages currently in use.

C is a very good choice for writing software to control hardware. The Unix (and derivatives) operating system's kernel is written in C (with some small pieces in assembly). Most firmware and device drivers are written in C as well.

C is also used in many real-time systems programming. While the language itself does not have any real-time features, it can be combined with platform-specific libraries or libraries that implement the POSIX real-time interfaces. C is a very efficient language that does not require many supporting libraries to run and does not have much overhead, which is desirable in low-memory embedded systems. Combining real-time libraries with C give it the timing constraints and other features needed for real-time programming.

## Structure of C Program

A C program may be made up of one or more files called "source files". There is a kind of source file that is used to define constants, macros, function prototypes, type definitions, etc. called a "header file". Header files are basically used to share things between other source files. By convention, source file names have the extension ".c" and header file names have the extension ".h".

Each compiler is different; you must consult your compiler's documentation for information on how to run it and how to set different options. There are also Integrated Development Environments (IDEs) that let you edit, compile, run and sometimes debug a program, all with a friendly user interface. The examples in this tutorial were written using a text editor on a Linux system and compiled with the gcc compiler.

**Example**—"Hello world Program"

```
1.  #include <stdio.h>
2.   #include < conio.n>
3.  int main(void)
4.  {
5.  printf("Hello World ");
6.  return 0;
7.  }
```

## Input/Output Function in C

### Input

In any programming language input means to feed some data into program. This can be given in the form of file or from command line. C

programming language provides a set of built-in functions to read given input and feed it to the program as per-requirement.

### Output

In any programming language output means to display some data on screen, printer or in any file. C programming language provides a set of built-in functions to output required data.

Here we will discuss only one input function and one put function just to understand the meaning of input and output.

### printf() function

This is one of the most frequently used functions in C for output. (We will discuss what is function in subsequent chapter).

Try following program to understand **printf()** function.

```
#include <stdio.h>
#include <conio.h>
main()
{
 int dec = 5;
 char str[ ] = "abc";
 char ch = 's';
 float pi = 3.14;
 printf("%d %s %f %c\n", dec, str, pi, ch);
}
```

The output of the above would be :

```
5 abc 3.140000 c
```

Here %d is being used to print an integer, %s is being used to print a string, %f is being used to print a float and %c is being used to print a character.

### scanf() function

This is the function which can be used to read an input from the command line.

Try following program to understand **scanf()** function.

```
#include <stdio.h>
#include <conio.h>
main()
{
 int x;
 int args;
 printf("Enter an integer: ");
 if (( args = scanf("%d", &x)) == 0) {
    printf("Error: not an integer\n");
 } else {
    printf("Read in %d\n", x);
 }
}
```

Here %d is being used to read an integer value and we are passing &x to store the vale read input. Here and indicates the address of variable x.

This program will prompt you to enter a value. Whatever value you will enter at command prompt that will be output at the screen using printf( ) function. If you enter a non-integer value then it will display an error message.

### C Data Type

Every programming language deals with some data. For example to print any message it requires charterer or string type of data. To solve any mathematic expression it requires integral as well as real number (floating type) of data. C is very rich in data type. We can broadly divide all data type in c in three categories :

1. Primitive or fundamental data type
2. Derived data type
3. User defined data type

### 1. Primitive or Fundamental Data Type

Primitive or most fundamental data type in c can be categorized in three groups on the basis of its application :

1. Integral type number: char , int
2. Real type number: float , double
3. Void or nothing type: void

### Control statements

C provides two styles of flow control :

- Branching
- Looping

Branching is deciding what actions to take and looping is deciding how many times to take a certain action.

### Branching

Branching is so called because the program chooses to follow one branch or another.

**If( ) statement–**This is the most simple form of the branching statements.

It takes an expression in parenthesis and an statement or block of statements. if the expression is true then the statement or block of statements gets executed otherwise these statements are skipped.

**If( )** statements take the following form :

```
if (expression)
  statement;
or
if (expression)
  {
    Block of statements;
  }
or
if (expression)
  {
    Block of statements;
  }
else
  {
    Block of statements;
  }
or
if (expression)
  {
    Block of statements;
  }
else if(expression)
  {
    Block of statements;
  }
else
  {
    Block of statements;
  }
```

## ? : Operator

The ? : Operator is just like an if ... else statement except that because it is an operator you can use it within expressions.

**? :** is a ternary operator in that it takes three values, this is the only ternary operator C has.

**? :** takes the following form:

```
if condition is true ? then X return value :
otherwise Y value;
```

## Switch( ) statement:

The switch statement is much like a nested if .. else statement. Its mostly a matter of preference which you use, switch statement can be slightly more efficient and easier to read.

```
switch( expression )
   {
     [case constant-expression1:     statements1;]
     [case constant-expression2:     statements2;]
     [case constant-expression3:     statements3;]
     [default : statements4;]
   }
```

## Looping

Looping is the process of repeating of same code until a specific condition doesn't satisfy. In c there are three types of loop :

(a) For loop
(b) while loop
(c) do while

### (a) for( ) loop

This loop is used when we have to execute a part of code in finite times. It is per tested loop. Syntax of for loop:

```
for( expression1; expression2; expression3)
{
  Single statement
  or
  Block of statements;
}
```

### (b) while( ) loop

The most basic loop in C is the while loop.A while statement is like a repeating if statement. Like an If statement, if the test condition is true: the statments get executed. The difference is that after the statements have been executed, the test condition is checked again. If it is still true the statements get executed again.This cycle repeats until the test condition evaluates to false.

Basic syntax of while loop is as follows :

```
while ( expression )
{
  Single statement
  or
  Block of statements;
}
```

### (c) do...while( ) loop

**do ... while** is just like a while loop except that the test condition is checked at the end of the loop rather than the start. This has the effect that the content of the loop are always executed at least once.

Basic syntax of do...while loop is as follows :

```
do
{
  Single statement
  or
  Block of statements;
}while(expression);
```

### C Pre-processor

The C Preprocessor is not part of the compiler, but is a separate step in the compilation process. In simplistic terms, a C Preprocessor is just a text substitution tool. We'll refer to the C Preprocessor as the CPP.

All preprocessor lines begin with #

- The unconditional directives are :
  - #include - Inserts a particular header from another file
  - #define - Defines a preprocessor macro
  - #undef - Undefines a preprocessor macro
- The conditional directives are :
  - #ifdef - If this macro is defined
  - #ifndef - If this macro is not defined
  - #if - Test if a compile time condition is true
  - #else - The alternative for #if
  - #elif - #else an #if in one statement
  - #endif - End preprocessor conditional
- Other directives include :
  - # - Stringization, replaces a macro parameter with a string constant
  - ## - Token merge, creates a single token from two adjacent ones

### Pre-Processors Examples

Analyze following examples to understand various directives.

```
#define MAX_ARRAY_LENGTH 20
```

Tells the CPP to replace instances of MAX_ARRAY_LENGTH with 20. Use *#define* for constants to increase readability.

```
#include <stdio.h>
#include "myheader.h"
```

Tells the CPP to get stdio.h from **System Libraries** and add the text to this file. The next line tells CPP to get myheader.h from the local directory and add the text to the file.

```
#undef FILE_SIZE
#define FILE_SIZE 42
```

Tells the CPP to undefine FILE_SIZE and define it for 42.

```
#ifndef MESSAGE
#define MESSAGE "You wish!"
#endif
```

Tells the CPP to define MESSAGE only if MESSAGE isn't defined already.

#ifdef DEBUG

```
/* Your debugging statements here */
#endif
```

Tells the CPP to do the following statements if DEBUG is defined. This is useful if you pass the-*DDEBUG* flag to gcc. This will define DEBUG, so you can turn debugging on and off on the fly!

## C Programming Terminology

### Address

Reference to a memory location. In C pointers are used to hold addresses.

### API

Application Programming Interface.

### Argument

A value passed to a function.

### Array

Array is a collection of same type elements under the same variable identifier referenced by index number. Arrays are widely used within programming for different purposes such as sorting, searching and etc. Arrays allow you to store a group of data of a single type.

### Block

A sequence of definitions, declarations and statements, enclosed within braces {}.

A set of elements of type char. (Can be used to store a string).

### Compilation error

Error which occurs during the translation of source code into machine code.

### Compiler

A program which converts source code into machine code.

### Compound Statement

A sequence of simple statements.

**Constant (common all garden)**

An item that represents a value that cannot be changed. For Example :

```
123
'x'
```

**Constant (symbolic)**

A symbol defined in a #define preprocessor directive to represent a constant value.

**Data type**

Definition of the data. *int*, *char*, *float*.

**Declaration**

A construct which associates attributes to a variable name or function. No storage is reserved.

**For example:**

```
extrn int  a;
extrn char c;
```

variable declaration

A structure decleration could look like:

```
struct per_rec
{
  int age;
  char *surname;
  char *firstname;
};
```

**Definition**

1. Variable definition is a declaration with storage allocation.

```
2.      int a;
3.      char c;
4.      struct per_rec person;
```

5. A construct which specifies the name, parameters and return type of a function. For example a function definition would be:

```
6.      long sqr(int num)
7.      {
8.        return(num*num);
9.      }
```

**Escape Sequence**

Control codes comprising combinations of a backslash followed by letters or digits which represent non printing characters.

**Executable Program**

Program which will run in the environment of the operating system or within an appropriate run time environment.

**Executable (Stand-alone) Program**

Program which will run within the environment of the operating system without additional utilities or support.

**Expression**

A sequence of operators and operands which may yield a single value.

**File**

Data stored as an electronic file.

**File Descriptor**

This is used in low level I/O (open/read/write/close functions) to identify a file. It is an integer number assigned to a file name by open and then used as a unique identifier by read/write and close.

**Floating-point Number**

Number having a decimal place or exponent.

**Format specification**

A string which controls how input or output shall be presented.

**Identifier**

The names used to refer to stored data values such as *constants*, *variables* or *functions*.

**Integer**

A number without a fractional part.

**Keyword**

A word which has a predefined meaning to a 'C' compiler and therefore must not be used for any other purpose.

**library file**

The file which contains compiled versions of commonly used functions which can be linked to an object file to make an executable program.

**Library function**

A function whose code is contained in the external *library file*.

**Line**

One line of input from the standard input device (keyboard) which is terminated with a newline character. The newline character is replaced by a null character.

**Literal**

Characters, letters or strings which are to be taken literally and used as constants rather than identifiers.

**Object Code**

Code which is directly understandable by the machine (machine code).

**Operand**

An expression acted on by an operator. For example:

$z = a + b$;

$a$ and $b$ are both operands of the + operator.

**Parameter**

A value received by a *function*.

**Pointer**

Pointer is a user defined data type which creates special types of variables which can hold the address of primitive data type like char, int, float, double or user defined data type like function, pointer etc. or derived data type like array, structure, union, enum.

**Examples :**

**int** *ptr;

**int** (*ptr)();

**int** (*ptr)[2];

**POSIX**

Portable Operating System Interface.

**Precedence (of operators)**

The order in which operators are dealt with during the evaluation of an expression.

**Preprocessor**

A processor which manipulates the initial directives of the source file which contains instructions about how the source file shall be processed and compiled.

**Preprocessor directive**

Source file instruction about how the file shall be processed and compiled.

**Program**

A text file comprising code which can be compiled.

**Run time error**

An error which occurs when a program is executed.

**Reserved word (keyword)**

A word which has a predefined meaning to a 'C' compiler and therefore must not be used for any other purpose.

**Source code**

A text file comprising code which can be compiled.

**Statement**

A simple statement is an *expression* followed by a semicolon.

**String**

A string in 'C' is an array of characters terminated by a Null character ('\0').

**Syntax error**

A mistake in the source code which prevents the compiler from converting it into object code.

**Threads**

A process has five fundamental parts : code ("text"), data (VM), stack, file I/O, and signal tables. Theads are spawned from a process and can share these parts to communicate with each other.

The traditional method of spawning processes (fork) could only communicate with other forked processes via pipes and and "shared memory". The result is threads can communicate easily and have a low CPU overhead.

**Variable**

A variable is named location of data. In other word we can variable is container of data.

In real world you have used various type containers for specific purpose. For example you have used suitcase to store clothes, match box to store match sticks etc. In the same way variables of different data type is used to store different types of data. For example integer variables are used to store integers char variables is used to store characters etc. On the basis of how many data a variable will store, we can categorize the all c variable in three groups.

(a) Variables which can store only one data at time. Example : integer variables, char variables, pointer variables etc.

(b) Variables which can store more than one data of similar type at a time. Example : array variables.

(c) Variables, which can store more than one value of dissimilar type at a time. Example: structure or union variables.

## Multiple Choice Questions

1. C Language is developed by—
   (A) Dennis Ritchie (B) Ken Thompson
   (C) Bill Gates (D) Peter Norton
2. C was developed in year—
   (A) 1970 (B) 1972
   (C) 1976 (D) 1980
3. C is .....a language.
   (A) High Level (B) Low Level
   (C) Middle Level (D) Machine Level
4. C Language is available for which of the operating system ?
   (A) DOS (B) Unix
   (C) Windows (D) All of these
5. Header file in C contains—
   (A) Compiler Command
   (B) Library Function
   (C) Header information of C program
   (D) Operators for file
6. The opening and closing block statement is indicating with ?
   (A) {} (B) [ ]
   (C) < > (D) ( )
7. String constant enclosed between—
   (A) Single quote (B) Double Quote
   (C) Both (A) and (B) (D) Non of these
8. Which of these are the token in the C ?
   (A) Keywords (B) Variables
   (C) Constant (D) All of these
9. The maximum length of variable in C is—
   (A) 8 (B) 16
   (C) 32 (D) 64
10. A declaration of float a, b; occupies.....of memory.
    (A) 1 byte (B) 2 byte
    (C) 4 byte (D) 8 byte
11. What will be the maximum size of a double variable ?
    (A) 1 byte (B) 2 byte
    (C) 4 byte (D) 8 byte
12. The size of string variable is—
    (A) 1 byte (B) 8 byte
    (C) 16 byte (D) None of these
13. A Link is—
    (A) A compiler
    (B) An active debugger
    (C) A C interpreter
    (D) A analyze tool in C
14. Which of the following is a key word is used as a storage class ?
    (A) printf (B) external
    (C) auto (D) scanf
15. The number of relational operator in c is ?
    (A) 4 (B) 6
    (C) 3 (D) 1
16. Which of the following is a valid keyword ?
    (A) Number (B) Boolean
    (C) Varchar 2 (D) Sizeof
17. Which operator is used to assign a value to a variable ?
    (A) # (B) ==
    (C) > (D) =
18. C is which type of language ?
    (A) Machine (B) Procedural
    (C) Assembly (D) Object-oriented
19. What is the range of an int variable?
    (A) – 32768 to 32767
    (B) – 32768 to 32768
    (C) – 128 to 127
    (D) 3.4e – 38 to 3.4e + 38
20. Which of the following format specifier does not read the floating point values ?
    (A) %d (B) %e
    (C) %f (D) %g
21. A statement differ from expression by terminating with a—
    (A) ; (B) :
    (C) NULL (D) .
22. Which of the following is a scalar data type ?
    (A) Float (B) Union
    (C) Array (D) Pointer

23. What is the escape sequence for backspace ?
(A) \n (B) \f
(C) \b (D) \\

24. After which character in the control string can you print *a* % character ?
(A) % (B) \
(C) / (D) &

25. Which of the operator in C is called ternary operator ?
(A) if...then (B) ++
(C) ? (D) ( )

26. Name the statement supported by C to branch unconditionally from one step to another in the program?
(A) Break (B) Goto
(C) Loop (D) For

27. Which of the following is a unconditional control structure ?
(A) Do-While (B) if-else
(C) goto (D) for

28. Which detail is not included in the signature of the function ?
(A) Number of parameter
(B) Name of the function
(C) Types of parameter
(D) Return type of function

29. Pointers are of ?
(A) Integer data type
(B) Character data type
(C) Unsigned integer data type
(D) None of the above

30. Malloc() function used in dynamic allocation is available in which header file ?
(A) stdio.h (B) stdlib.h
(C) conio.h (D) mem.h

31. A pointer to pointer in a form of—
(A) Multiple indirection
(B) A chain of pointer
(C) Both (A) and (B)
(D) None of the above

32. Which of the function is used to allocate a block of memory ?
(A) free() (B) realloc()
(C) malloc() (D) allocate()

33. Select the function which returns an integer value ?
(A) getw() (B) getc()
(C) getchar() (D) putc()

34. The typedef is used to make pointer to member functions easier to—
(A) Write (B) Read
(C) Recognize (D) Verify

35. The manner in which the data is presented to the application programmer or the user of the data is referred to as—
(A) Physical data description
(B) File
(C) Logical data description
(D) Field

36. To delete a dynamically allocated array named 'a' the correct statement is—
(A) delete a; (B) delete a[0]
(C) delete a[] (D) delete [0] a

37. Which of the following is correct way of declaring a float pointer ?
(A) float ptr (B) float *ptr
(C) *float ptr (D) None of these

38. In C expression ,how is a logical AND represented ?
(A) @@ (B) !!
(C) AND (D) &&

39. Which one of the following C operator is right associative ?
(A) = (B) ,
(C) [ ] (D) ^

40. In which type of loop, is the inner loop is executed completely for every execution of the outer loop ?
(A) Do- While (B) IF
(C) Nested (D) For

41. What is the use of && and □ operators ?
(A) Compare two numeric value
(B) Combine two numeric value
(C) Combine two Boolean values
(D) Compare two Boolean value

42. C Support how many basic loop construct ?
(A) 2 (B) 3
(C) 4 (D) 6

43. Which of the following language is the predecessor to C programming language ?
(A) A (B) B
(C) BPCL (D) C++

44. Which of the following statement is true ?
(A) C library function provide I/O facilities
(B) C inherent I/O facilities
(C) C does't have I/O facilities
(D) Both (A) and (C)

45. Input/output function prototypes and macros are defined in which header file ?
(A) conio.h (B) tdlib.h
(C) stdio.h (D) dos.h

46. Which of the following special symbol allowed in a variable name ?
(A) * (asterisk) (B) | (pipeline)
(C) - (hyphen) (D) _ (underscore)

47. The keyword used to transfer control from a function back to the calling function is—
(A) Switch (B) Goto
(C) Go back (D) Return

48. By default a real number is treated as a—
(A) Float (B) Double
(C) Long double (D) Far double

49. When we mention the prototype of a function?
(A) Defining (B) Declaring
(C) Prototyping (D) Calling

50. How will you free the allocated memory ?
(A) remove(var-name);
(B) free(var-name);
(C) delete(var-name);
(D) dalloc(var-name);

51. In C/CPP Programming strcmp() function is used for—
(A) Convert String to Char
(B) Copy two Strings
(C) Compare two Strings
(D) None of the above

52. In C/CPP Programming '\a' is used for—
(A) Form feed (B) Line Brake
(C) Select All (D) Alarm

53. Which of the following is the correct statement ?
(A) Variable name must start with underscore
(B) Variable name must have digit
(C) Variable name must have white space character
(D) Keyword can not be a variable name

54. While coding in C/CPP Programming for "Call by Reference" we pass ?
(A) Address of variable
(B) Value of the variable
(C) Either Value or Address
(D) Both value and address

55. Which of the following is the symbol for AND operator ?
(A) || (B) &
(C) && (D) S$

56. Which of the following is not the type of variable ?
(A) Extrern (B) Register
(C) Global (D) None of these

57. Which of the following is the incorrect statement ?
(A) All array variables have same type
(B) An array is the collection of variables
(C) Array variables can be used individually
(D) None of the above

58. In C/CPP Programming array index is always starts from—
(A) 0 (B) 1
(C) 2 (D) 3

59. In C/CPP Programming a function can return—
(A) Single value (B) Double Values
(C) Many values (D) None of these

60. Which of the following is required to write and run C/CPP program ?
(A) Compiler (B) Text editor
(C) Operating system (D) All of above

61. C/C++ program starts executing from—
(A) here() (B) main()
(C) start() (D) begin()

62. In CPP Programming '++' is..... operator.
(A) Increment (B) Decrement
(C) Assigning (D) Overloading

63. In C++ Programming a pointer variable stores..... .
    (A) Value of anther Value
    (B) Value of anther variable
    (C) Address of another value
    (D) Address of another variable

64. In C/CPP Programming array can be..... .
    (A) Single Dimensional
    (B) Multi Dimensional
    (C) Non Dimensional
    (D) (A) and (B)

65. In C/CPP Programming an uninitialized variable may have—
    (A) Null value (B) Null String
    (C) Garbage value (D) Zero value

66. In C/CPP Programming which function is not related to file handling—
    (A) fprintf(); (B) printf();
    (C) fclose(); (D) fopen();

67. In C/CPP Programming binary operator needs ..... operand.
    (A) No operand (B) One operand
    (C) Two operand (D) Three operand

68. A function which invokes itself repeatedly until some condition is satisfied is called.....
    (A) Friend Function
    (B) Virtual Function
    (C) Recursive Function
    (D) Overloading Function

69. In C Programming which one of the following is string termination character ?
    (A) '\0' (B) '\n'
    (C) '\b' (D) '\t'

70. In C/CPP Programming array can be sorted by using—
    (A) Quick Sort (B) Bubble Sort
    (C) Merge Sort (D) All of these

71. Which of the following is/are storage class ?
    (A) Automatic (B) Static
    (C) Allocated (D) All of Above

72. What will the output of following code ?
```
{
int x = 10, y = 15;
x = x++;
y = ++y;
printf("%d, %d \n", x, y);
}
```
    (A) 10, 15 (B) 10, 16
    (C) 11, 16 (D) 11, 15

73. NULL Pointer can be used as—
    (A) To stop indirection in a recursive data structure
    (B) As an error value
    (C) As a sentinel value
    (D) All of the above

74. Which one of the following is not the advantages of functions ?
    (A) Debugging is easier
    (B) Testing is easier
    (C) Recursive call is possible
    (D) It consumes low disk space

75. What is the result of the following statement ?
    x = y = z = 0;
    (A) x = 0, y = Null, z = Null
    (B) x = 0, y = 0, z = 0
    (C) x = 0, y = 1, z = 2
    (D) the statement is incorrect

## Answers

| | | | | |
|---|---|---|---|---|
| 1. (A) | 2. (B) | 3. (C) | 4. (D) | 5. (B) |
| 6. (A) | 7. (B) | 8. (D) | 9. (C) | 10. (C) |
| 11. (D) | 12. (D) | 13. (D) | 14. (C) | 15. (B) |
| 16. (D) | 17. (B) | 18. (B) | 19. (A) | 20. (A) |
| 21. (A) | 22. (A) | 23. (C) | 24. (A) | 25. (C) |
| 26. (B) | 27. (C) | 28. (D) | 29. (D) | 30. (B) |
| 31. (C) | 32. (C) | 33. (A) | 34. (B) | 35. (C) |
| 36. (A) | 37. (B) | 38. (D) | 39. (A) | 40. (C) |
| 41. (C) | 42. (B) | 43. (B) | 44. (D) | 45. (C) |
| 46. (D) | 47. (D) | 48. (B) | 49. (B) | 50. (B) |
| 51. (C) | 52. (D) | 53. (D) | 54. (A) | 55. (C) |
| 56. (D) | 57. (D) | 58. (A) | 59. (A) | 60. (D) |
| 61. (B) | 62. (A) | 63. (D) | 64. (D) | 65. (C) |
| 66. (B) | 67. (C) | 68. (C) | 69. (A) | 70. (D) |
| 71. (D) | 72. (C) | 73. (D) | 74. (D) | 75. (B) |

❑❑

# 7 Data Structure

## Data Structure

A scheme for storing related data in memory so it can be retrieved quickly. The most simple data structure is the array, which is am indexed list of data. More complex data structure such as binary trees, hash maps and heaps are more difficult to implement, but searching for individual elements is faster with data structures than with an array.

List of the areas in which data structures are applied extensively.

Compiler Design,

Operating System,

Database Management System,

Statistical analysis package,

Numerical Analysis,

Graphics,

Artificial Intelligence,

Simulation

## Types of Data Structure

There is two types of data structure

(a) Linear data structures

(b) Nonlinear data structures

### (a) Linear data structures

Linear data structures organize their data elements in a linear fashion, where data elements are attached one after the other. Data elements in a liner data structure are traversed one after the other and only one element can be directly reached while traversing. Linear data structures are very easy to implement, since the memory of the computer is also organized in a linear fashion. Some commonly used linear data structures are arrays, linked lists, stacks and queues. An arrays is a collection of data elements where each element could be identified using an index. A linked list is a sequence of nodes, where each node is made up of a data element and a reference to the next node in the sequence. A stack is actually a list where data elements can only be added or removed from the top of the list. A queue is also a list, where data elements can be added from one end of the list and removed from the other end of the list.

## Examples

### 1. Lists

Linear data structures, contain elements, each of which point to the "next" in the sequence as demonstrated in the examples below (Simple, Circular and Double Linked Lists are some common kinds of lists). Additions and removals can be made at any point in the list - in this way it differs from stacks and queues.

### Types of Link List

- Simple Linked Lists
- Circular Linked Lists
- Double Linked Lists

### 2. Queues

First In First Out (or first come first served) : FIFO. Like a queue of passengers waiting to buy tickets. The one who has been standing the longest is served first.

### 3. Dequeues

Double Ended Queue, insertition and deletion can be from both of the sides.

### 4. Stacks

Last in first out (LIFO). Like a pack of cards.

### (b) Nonlinear Data Structures

In nonlinear data structures, data elements are not organized in a sequential fashion. A data item in a nonlinear data structure could be attached to several other data elements to reflect a special relationship among them and all the data items

cannot be traversed in a single run. Data structures like multidimensional arrays, trees and graphs are some examples of widely used nonlinear data structures. A multidimensional array is simply a collection of one-dimensional arrays. A tree is a data structure that is made up of a set of linked nodes, which can be used to represent a hierarchical relationship among data elements. A graph is a data structure that is made up of a finite set of edges and vertices. Edges represent connections or relationships among vertices that stores data elements.

**Examples**

Tree, Table, Graph, Hash Table, etc.

**Data Structure operations**

- **Traversal**—One of the most important operations which involves processing each element in the list.
- **Searching**—Searching or finding any element with a given value or the record with a given key.
- **Insertion**—Adding a new element to the list.
- **Deletion**—Removing an element from the list.
- **Sorting**—Arranging the elements in some order.
- **Merging**—Combining two lists into a single list.

## Data Structure Terminology

**Abstract Data Type**

A set of data values and associated operations that are precisely specified independent of any particular implementation. Also known as ADT.

**Algorithm**

A computable set of steps to achieve a desired result.

**Ancestor**

A parent of a node in a tree, the parent of the parent, etc.

**Argument**

A value passed to a called function by the calling function.

**Array**

In programming, a list of data values, all of the same type, any element of which can be referenced by an expression consisting of the array name followed by an indexing expression. Arrays are part of the fundamentals of data structures, which, in turn, are a major fundamental of computer programming.

**AVL Tree**

A balanced binary search tree where the height of the two sub trees (children) of a node differs by at most one.

**Balanced Binary Tree**

A binary tree where no leaf is more than a certain amount farther from the root than any other. After inserting or deleting a node, the tree may rebalanced with "rotations."

**Big-O notation**

A theoretical measure of the execution of an algorithm, usually the time or memory needed, given the problem size n, which is usually the number of items. Informally, saying some equation $f(n) = O(g(n))$ means it is less than some constant multiple of $g(n)$. The notation is read, "f of n is big oh of g of n".

**Binary Heap**

A complete binary tree where every node has a key more extreme (greater or less) than or equal to the key of its parent.

**Binary Search**

A type of search algorithm that seeks an item, with a known name, in an ordered list by first comparing the sought item to the item at the middle of the list's order. The search then divides the list in two, determines in which half of the order the item should be, and repeats this process, until the sought item is found.

**Binary Search Tree**

A data structure with in which every node refers to a left subtree and a right subtree such that all values in the left subtree are smaller than the value in the node and all elements in the right subtree are greater than (or equal to) the value in the node. The top node is called the root. The nodes with no children (left and right subtrees empty) are called leaves.

**Binary Tree**

A specific type of tree data structure in which each node has at most two subtrees, one left and one right. Binary trees are often used for sorting information; each node of the binary search tree contains a key, with values less than that key added to left subtree and values greater than that key added to the right subtree.

**Bounded Queue**

A queue limited to a fixed number of items.

**Bubble Sort**

Sort by comparing each adjacent pair of items in a list in turn, swapping the items if necessary, and repeating the pass through the list until no swaps are done.

**Build-Heap**

Convert an array into a heap by executing heapify progressively closer to the root. For an array of n nodes, this takes O(n) time under the comparison model.

**Child**

An item of a tree referred to by a parent item. Every item, except the root, is the child of some parent.

**Circular List**

A linked list in which the rear item refers back to the head item.

**Circular Queue**

An implementation of a bounded queue using an array.

**Collision**

When two or more items should be kept in the same location, especially in hash tables, that is, when two or more different keys hash to the same value.

**Collision Resolution Scheme**

A way of handling collisions, that is, when two or more items should be kept in the same location, especially in a hash table. The general ways are keeping subsequent items within the table (open addressing), keeping a list for items which collide (direct chaining hashing or separate chaining hashing), keeping a special overflow area, etc. Perfect hashes avoid collisions, but may be time-consuming to create.

**Complete Binary Tree**

A complete binary tree of depth d is the strictly binary tree all of whose leaves are at level d.

**Data Object**

An object capable of storing data. A variable or a constant. (A function is allocated memory within the computer and is therefore an object; but it is not a data object because it cannot store data).

**Data Structure**

The term data structure refers to the way data is organized for use within a program. Correct organization of data can lead to simpler and more efficient algorithms. Common data structures are linked-lists, stacks, queues and trees.

**Descendant**

A child of a node in a tree, any of the children of the children, etc.

**Disjoint Set**

A set whose members do not overlap, are not duplicated, etc.

**Doubly Linked List**

A data structure in which each element contains pointers to the next and previous elements in the list, thus forming a bidirectional linear list.

**Dynamic Array**

An array whose size may change over time. Items are not only added or removed, but memory used changes, too.

**FIFO**

First in first out is a policy that items are processed in order of arrival. A queue implements this.

**Full Binary Tree**

A binary tree in which each node has exactly zero or two children.

**Hash Function**

A function that maps keys to integers, usually to get an even distribution on a smaller set of values.

**Hash Table**

A dictionary in which keys are mapped to array positions by a hash function. Having more

than one key map to the same position is called a collision. There are many ways to resolve collisions, but they may be divided into open addressing, in which all elements are kept within the table, and chaining, in which additional data structures are used.

**Head**

The first item of a list.

**Heap**

An area of memory from which space for dynamic structures are allocated.

**Heap Property**

Each node in a tree has a key which is more extreme (greater or less) than or equal to the key of its parent.

**Heap**

A complete tree where every node has a key more extreme (greater or less) than or equal to the key of its parent. Usually understood to be a binary heap.

**Heapify**

Rearrange a heap to maintain the heap property, that is, the key of the root node is more extreme (greater or less) than or equal to the keys of its children. If the root node's key is not more extreme, swap it with the most extreme child key, then recursively heapify that child's subtree. The child subtrees must be heaps to start.

**Height**

The maximum distance of any leaf from the root of a tree. If a tree has only one node (the root), the height is zero.

**Huffman Encoding**

A minimal variable-length character encoding based on the frequency of each character. First, each character becomes a trivial tree, with the character as the only node. The character's frequency is the tree's frequency. The two trees with the least frequencies are joined with a new root which is assigned the sum of their frequencies. This is repeated until all characters are in one tree. One code bit represents each level. Thus more frequent characters are near the root and are encoded with few bits, and rare characters are far from the root and are encoded with many bits.

**In-order Traversal**

Process all nodes of a tree by recursively processing the left subtree, then processing the root, and finally the right subtree.

**Infix Notation**

A notation in which operators appear between the operands, as in 3 + 5.

**Insertion Sort**

Sort by repeatedly taking the next item and inserting it into the final data structure in its proper order with respect to items already inserted.

**Instance**

A class is a definition of a set of data and member functions. When space for the data is actually allocated, we say that a member of the class has been instantiated. The instantiation is called an instance of the class. Each instance has its own set of data (there is also a mechanism in C++ to define data that is only allocated once per class, and shared amongst all instances of the class).

**Internal Node**

A node of a tree that has one or more child nodes, equivalently, one that is not a leaf.

**Key**

The part of a group of data by which it is sorted, indexed, cross referenced, etc.

**Leaf**

Any node (location) in a tree structure that is at the farthest distance from the root (primary node), no matter which path is followed. Thus, in any tree, a leaf is a node at the end of a branch—one that has no descendants.

**Left Rotation**

In a binary search tree, pushing a node N down and to the left to balance the tree. N's right child replaces N, and the right child's left child becomes N's right child.

**Level-order Traversal**

Process all nodes of a tree by depth: first the root, then the children of the root, etc.

**LIFO**

Last in first out is a policy that the most recently arrived item is processed first. A stack implements this.

### Linear Search

A simple, though inefficient, search algorithm that operates by sequentially examining each element in a list until the target element is found or the last has been completely processed. Linear searches are primarily used only with very short lists. Also called sequential search.

### Linked List

A data structure in which a list of nodes or elements of a data structure connected by pointers. A singly linked list has one pointer in each node pointing to the next node in the list; a doubly linked list has two pointers in each node pointing to the next and previous nodes. In a circular list, the first and last nodes of the list are linked together.

### Max-heap Property

Each node in a tree has a key which is less than or equal to the key of its parent.

### Merge

Combine two or more sorted sequences of data into a single sorted sequence.

### Merge Sort

A sort algorithm that splits the items to be sorted into two groups, recursively sorts each group, and merges them into a final, sorted sequence.

### Min-heap Property

Each node in a tree has a key which is greater than or equal to the key of its parent.

### Name Tag

A name tag in C++ is a set of text characters formed into a symbolic word used to refer to an object. Name tags must start with an alpha character or an underscore. The second or subsequent characters can be alpha or numeric characters or the underscore character. All other characters are not allowed. Capital alpha characters can be used and are interpreted by C++ as different to their lower case equivalents.

### Node

(1) A unit of reference in a data structure. Also called a vertex in graphs and trees.

(2) A collection of information which must be kept at a single memory location.

### Null tree

A tree which is empty.

### Object

Any program entity which uses physical memory in the computer.

### Object Oriented Programming

A concept of programming in which elements of the program are coded as stand alone objects. Each object is completely self contained in that it incorporates methods whereby the object can manipulate its own characteristics. A "Door" object, for instance would know how to open and close itself. It would also be able to respond to interrogation and advise the enquirer whether it is currently open or closed.

### Open Addressing

A general collision resolution scheme for a hash table in which all items are stored within the table. In case of collision, other positions are computed and checked (a probe sequence) until an empty position is found. Some ways of computing possible new positions are less efficient because of clustering.

### Overload

A term used to refer to the use of one symbol for more than one purpose. For instance, in mathematics the "-" symbol is used both as a negation symbol and as a subtraction symbol. In C++ the "<

### Parameter

A value received by a called function from a calling function.

### Perfect Binary Tree

A binary tree with all leaf nodes at the same depth. All internal nodes have degree 2.

### Postorder Traversal

Process all nodes of a tree by recursively processing the left subtree, then processing the right subtree, and finally the root.

### Prefix Notation

A notation in which operators appear before the operands, as in + A B.

**Preorder Traversal**

Process all nodes of a tree by recursively processing the root, then processing the left subtree, and finally the right subtree.

**Queue**

A data structure with first-in first-out behavior, supporting the operations enqueue (to insert) and dequeue (to remove).

**Quicksort**

An in-place sort algorithm that uses the divide and conquer paradigm. It picks an element from the array (the pivot), partitions the remaining elements into those greater than and less than this pivot, and recursively sorts the partitions.

**Recursion**

An algorithmic technique where a function, in order to accomplish a task, calls itself with some part of the task.

**Right Rotation**

In a binary search tree, pushing a node N down and to the right to balance the tree. N's left child replaces N, and the left child's right child becomes N's left child.

**Root**

The distinguished initial or fundamental item of a tree. The only item which has no parent.

**Rotation**

To switch children and parents among two or three adjacent nodes to restore balance to a tree.

**Run Time**

The amount of time needed to execute an algorithm.

**Selection Sort**

A sort algorithm that repeatedly looks through remaining items to find the least one and moving it to its final location. The run time is (n2), where n is the number of comparisons. The number of swaps is O(n).

**Sibling**

A node in a tree that has the same parent as another node is its sibling.

**Singly Linked List**

A data structure in which a list of nodes or elements of a data structure connected by pointers. A singly linked list has one pointer in each node pointing to the next node in the list.

**Sort**

Arrange items in a predetermined order. There are dozens of algorithms, the choice of which depends on factors such as the number of items relative to working memory, knowledge of the orderliness of the items or the range of the keys, the cost of comparing keys *Vs* the cost of moving items, etc.

**Stack**

A data structure with last-in first-out behavior, supporting the operations push (to insert) and pop (to remove).

**Strictly Binary Tree**

A binary tree is said to be a strictly binary tree if every non-leaf node in a binary tree has non-empty left and right subtrees.

**String**

A list of characters, usually implemented as an array. Informally a word, phrase, sentence, etc. Since text processing is so common, a special type with substring operations is often available.

**Structure**

A mechanism which allows objects of different types to be grouped together as a single compound type.

**Tail**

The last item of a list.

**Threaded Tree**

A binary search tree in which each node uses an otherwise-empty left child link to refer to the node's in-order predecessor and an empty right child link to refer to its in-order successor.

**Tree**

A data structure containing zero or more nodes that are linked together in a hierarchical fashion.

**Tree Traversal**

A technique for processing the nodes of a tree in some order.

**Uniform Hashing**

A conceptual method of open addressing for a hash table. A collision is resolved by putting the item in the next empty place given by a probe sequence which is independent of sequences for all other key.

**Union**

The union of two sets is a set having all members in either set.

**Vertex**

An item in a graph. Sometimes referred to as a node.

**Worst Case**

The situation or input that forces an algorithm or data structure to take the most time or resources.

## Multiple Choice Question

1. Which of the following sorting algorithms has average-case and worst-case running time of O (n log n) ?
   (A) Bubble sort
   (B) Insertion sort
   (C) Merge sort
   (D) Quick sort
2. What will be printed by the write statements marked (1) and (2) in the program if the variables are statically scoped ?
   (A) 3,6
   (B) 6,7
   (C) 3,7
   (D) None of the above
3. Two main measures for the efficiency of an algorithm are—
   (A) Processor and memory
   (B) Complexity and capacity
   (C) Time and space
   (D) Data and space
4. The time factor when determining the efficiency of algorithm is measured by—
   (A) Counting microseconds
   (B) Counting the number of key operations
   (C) Counting the number of statements
   (D) Counting the kilobytes of algorithm
5. The space factor when determining the efficiency of algorithm is measured by—
   (A) Counting the maximum memory needed by the algorithm
   (B) Counting the minimum memory needed by the algorithm
   (C) Counting the average memory needed by the algorithm
   (D) Counting the maximum disk space needed by the algorithm
6. Which of the following case does not exist in complexity theory ?
   (A) Best case
   (B) Worst case
   (C) Average case
   (D) Null case
7. The Worst case occur in linear search algorithm when—
   (A) Item is somewhere in the middle of the array
   (B) Item is not in the array at all
   (C) Item is the last element in the array
   (D) Item is the last element in the array or is not there at all
8. The Average case occur in linear search algorithm—
   (A) When Item is somewhere in the middle of the array
   (B) When Item is not in the array at all
   (C) When Item is the last element in the array
   (D) When Item is the last element in the array or is not there at all
9. The complexity of the average case of an algorithm is—
   (A) Much more complicated to analyze than that of worst case
   (B) Much more simpler to analyze than that of worst case

(C) Sometimes more complicated and some other times simpler than that of worst case
(D) None of the above

10. The complexity of linear search algorithm is—
(A) O(n) (B) O(log n)
(C) $O(n^2)$ (D) O(n log n)

11. The complexity of Binary search algorithm is—
(A) O(n) (B) O(log n)
(C) $O(n^2)$ (D) O(n log n)

12. The complexity of Bubble sort algorithm is—
(A) O(n) (B) O(log n)
(C) $O(n^2)$ (D) O(n log n)

13. The complexity of merge sort algorithm is—
(A) O(n) (B) O(log n)
(C) $O(n^2)$ (D) O(n log n)

14. The indirect change of the values of a variable in one module by another module is called—
(A) internal change
(B) inter-module change
(C) side effect
(D) side-module update

15. Which of the following data structure is not linear data structure ?
(A) Arrays (B) Linked lists
(C) Both of above (D) None of these

16. Which of the following data structure is linear data structure ?
(A) Trees (B) Graphs
(C) Arrays (D) None of these

17. The operation of processing each element in the list is known as—
(A) Sorting (B) Merging
(C) Inserting (D) Traversal

18. Finding the location of the element with a given value is—
(A) Traversal (B) Search
(C) Sort (D) None of these

19. Arrays are best data structures—
(A) for relatively permanent collections of data
(B) for the size of the structure and the data in the structure are constantly changing
(C) for both of above situation
(D) for none of above situation

20. Linked lists are best suited—
(A) For relatively permanent collections of data
(B) For the size of the structure and the data in the structure are constantly changing
(C) For both of above situation
(D) For none of above situation

21. Each array declaration need not give, implicitly or explicitly, the information about—
(A) the name of array
(B) the data type of array
(C) the first data from the set to be stored
(D) the index set of the array

22. The elements of an array are stored successively in memory cells because—
(A) By this way computer can keep track only the address of the first element and the addresses of other elements can be calculated
(B) The architecture of computer memory does not allow arrays to store other than serially
(C) Both of above
(D) None of the above

23. Which data structure allows deleting data elements from front and inserting at rear ?
(A) Stacks
(B) Queues
(C) Deques
(D) Binary search tree

24. Identify the data structure which allows deletions at both ends of the list but insertion at only one end—
(A) Input-restricted deque
(B) Output-restricted deque
(C) Priority queues
(D) None of the above

25. Which of the following data structure is non-linear type ?
(A) Strings (B) Lists
(C) Stacks (D) None of these

26. Which of the following data structure is linear type ?
(A) Strings (B) Lists
(C) Queues (D) All of these

27. To represent hierarchical relationship between elements, which data structure is not suitable?
(A) Deque (B) Priority
(C) Tree (D) All of these

28. A binary tree whose every node has either zero or two children is called—
(A) Complete binary tree
(B) Binary search tree
(C) Extended binary tree
(D) None of the above

29. The depth of a complete binary tree is given by—
(A) Dn = n log2n (B) Dn = n log2n+1
(C) Dn = log2n (D) Dn = log2n+1

30. When representing any algebraic expression E which uses only binary operations in a 2-tree ?
(A) The variable in E will appear as external nodes and operations in internal nodes
(B) The operations in E will appear as external nodes and variables in internal nodes
(C) The variables and operations in E will appear only in internal nodes
(D) The variables and operations in E will appear only in external nodes

31. A binary tree can easily be converted into a 2-tree—
(A) By replacing each empty sub tree by a new internal node
(B) By inserting an internal nodes for non-empty node
(C) By inserting an external nodes for non-empty node
(D) By replacing each empty sub tree by a new external node

32. When converting binary tree into extended binary tree, all the original nodes in binary tree are ?
(A) Internal nodes on extended tree
(B) External nodes on extended tree
(C) Vanished on extended tree
(D) None of the above

33. The post order traversal of a binary tree is DEBFCA. Find out the pre order traversal—
(A) ABFCDE (B) ADBFEC
(C) ABDECF (D) ABDCEF

34. Which of the following sorting algorithm is of divide-and-conquer type ?
(A) Bubble sort (B) Insertion sort
(C) Quick sort (D) All of these

35. An algorithm that calls itself directly or indirectly is known as—
(A) Sub algorithm
(B) Recursion
(C) Polish notation
(D) Traversal algorithm

36. In a binary tree, certain null entries are replaced by special pointers which point to nodes higher in the tree for efficiency. These special pointers are called—
(A) Leaf (B) Branch
(C) Path (D) Thread

37. The in order traversal of tree will yield a sorted listing of elements of tree in—
(A) Binary trees
(B) Binary search trees
(C) Heaps
(D) None of the above

38. In a Heap tree—
(A) Values in a node is greater than every value in left sub tree and smaller than right sub tree
(B) Values in a node is greater than every value in children of it
(C) Both of above conditions applies
(D) None of above conditions applies

39. In a graph if e = [u, v], Then u and v are called—
(A) end points of e (B) adjacent nodes
(C) neighbors (D) All of these

40. A connected graph T without any cycles is called—
(A) a tree graph (B) free tree
(C) a tree (D) All of these

41. In a graph if e=(u, v) means—
    (A) u is adjacent to v but v is not adjacent to u
    (B) e begins at u and ends at v
    (C) u is processor and v is successor
    (D) Both (B) and (C)

42. If every node u in G is adjacent to every other node v in G, A graph is said to be—
    (A) Isolated
    (B) Complete
    (C) Finite
    (D) Strongly connected

43. The memory address of the first element of an array is called—
    (A) Floor address
    (B) Foundation address
    (C) First address
    (D) Base address

44. The memory address of fifth element of an array can be calculated by the formula—
    (A) LOC(Array[5]=Base(Array)+w(5-lower bound), where w is the number of words per memory cell for the array
    (B) LOC(Array[5]) = Base(Array[5]) + (5-lower bound), where w is the number of words per memory cell for the array
    (C) LOC(Array[5])=Base(Array[4])+(5-Upper bound), where w is the number of words per memory cell for the array
    (D) None of the above

45. Which of the following data structures are indexed structures ?
    (A) Linear arrays (B) Linked lists
    (C) Both of above (D) None of these

46. Which of the following is not the required condition for binary search algorithm?
    (A) The list must be sorted
    (B) There should be the direct access to the middle element in any sublist
    (C) There must be mechanism to delete and/or insert elements in list
    (D) None of the above

47. Which of the following is not a limitation of binary search algorithm ?
    (A) Must use a sorted array
    (B) Requirement of sorted array is expensive when a lot of insertion and deletions are needed
    (C) There must be a mechanism to access middle element directly
    (D) Binary search algorithm is not efficient when the data elements are more than 1000.

48. Two dimensional arrays are also called—
    (A) Tables arrays (B) Matrix arrays
    (C) Both of above (D) None of these

49. A variable P is called pointer if—
    (A) P contains the address of an element in DATA.
    (B) P points to the address of first element in DATA
    (C) P can store only memory addresses
    (D) P contain the DATA and the address of DATA

50. Which of the following data structure can't store the non-homogeneous data elements ?
    (A) Arrays (B) Records
    (C) Pointers (D) None

51. Which of the following data structure store the homogeneous data elements ?
    (A) Arrays (B) Records
    (C) Pointers (D) None

52. Each data item in a record may be a group item composed of sub-items; those items which are indecomposable are called—
    (A) Elementary items (B) Atoms
    (C) Scalars (D) All of these

53. The difference between linear array and a record is—
    (A) An array is suitable for homogeneous data but the data items in a record may have different data type
    (B) In a record, there may not be a natural ordering in opposed to linear array.
    (C) A record form a hierarchical structure but a lienear array does not
    (D) All of the above

54. Which of the following statement is false ?
    (A) Arrays are dense lists and static data structure

(B) Data elements in linked list need not be stored in adjecent space in memory
(C) Pointers store the next data element of a list
(D) Linked lists are collection of the nodes that contain information part and next pointer

55. Binary search algorithm can not be applied to—
(A) Sorted linked list
(B) Sorted binary trees
(C) Sorted linear array
(D) Pointer array

56. When new data are to be inserted into a data structure, but there is no available space; this situation is usually called ?
(A) Underflow (B) Overflow
(C) Housefull (D) Saturated

57. The situation when in a linked list START= NULL is—
(A) Underflow (B) Overflow
(C) Housefull (D) Saturated

58. Which of the following is two way list ?
(A) grounded header list
(B) circular header list
(C) linked list with header and trailer nodes
(D) None of the above

59. Which of the following name does not relate to stacks ?
(A) FIFO lists (B) LIFO list
(C) Piles (D) Push-down lists

60. The term "push" and "pop" is related to the—
(A) Array (B) Lists
(C) Stacks (D) All of these

61. A data structure where elements can be added or removed at either end but not in the middle—
(A) Linked lists (B) Stacks
(C) Queues (D) Deque

62. When inorder traversing a tree resulted E A C K F H D B G; the preorder traversal would return ?
(A) FAEKCDBHG (B) FAEKCDHGB
(C) EAFKHDCBG (D) FEAKDCHBG

63. A cyclic graph has—
(A) A shape like a unicycle
(B) A graph that cycles from vertices to edges
(C) A cycle of two or more nodes
(D) A cycle of three or more nodes

64. A(n) ..... graph is a graph in which each vertex has a connection to every other vertex.
(A) directed (B) cyclic
(C) acyclic (D) None

65. A(n) ..... is a graph in which each connection has two directions.
(A) undirected graph
(B) bigraph
(C) bidirectional graph
(D) None

66. In a selection sort of n elements, how many times is the swap function called in the complete execution of the algorithm ?
(A) 1 (B) n - 1
(C) n log n (D) $n^2$

67. Selectionsort and quicksort both fall into the same category of sorting algorithms. What is this category ?
(A) O(n log n) sorts
(B) Divide-and-conquer sorts
(C) Interchange sorts
(D) Average time is quadratic.

68. Suppose that a selectionsort of 100 items has completed 42 iterations of the main loop. How many items are now guaranteed to be in their final spot (never to be moved again)?
(A) 21 (B) 41
(C) 42 (D) 43

69. Suppose we are sorting an array of ten integers using a some quadratic sorting algorithm. After four iterations of the algorithm's main loop, the array elements are ordered as shown here :

1 2 3 4 5 0 6 7 8 9

Which statement is correct? (Note : Our selection sort picks largest items first.)
(A) The algorithm might be either selection sort or insertion sort.

(B) The algorithm might be selectionsort, but could not be insertionsort.

(C) The algorithm might be insertionsort, but could not be selectionsort.

(D) The algorithm is neither selectionsort nor insertionsort.

70. Suppose we are sorting an array of eight integers using a some quadratic sorting algorithm. After four iterations of the algorithm's main loop, the array elements are ordered as shown here—

2 4 5 7 8 1 3 6

Which statement is correct ? (Note : Our selectionsort picks largest items first.)

(A) The algorithm might be either selectionsort or insertionsort.

(B) The algorithm might be selectionsort, but it is not insertionsort.

(C) The algorithm is not selectionsort, but it might be insertionsort.

(D) The algorithm is neither selectionsort nor insertionsort.

71. When is insertionsort a good choice for sorting an array ?

(A) Each component of the array requires a large amount of memory.

(B) Each component of the array requires a small amount of memory.

(C) The array has only a few items out of place.

(D) The processor speed is fast.

72. What is the worst-case time for mergesort to sort an array of n elements ?

(A) O(log n) (B) O(n)

(C) O(n log n) (D) $O(n^2)$

73. What is the worst-case time for quicksort to sort an array of n elements ?

(A) O(log n) (B) O(n)

(C) O(n log n) (D) $O(n^2)$

74. Mergesort makes two recursive calls. Which statement is true after these recursive calls finish, but before the merge step ?

(A) The array elements form a heap.

(B) Elements in each half of the array are sorted amongst themselves.

(C) Elements in the first half of the array are less than or equal to elements in the second half of the array.

(D) None of the above.

75. Suppose we are sorting an array of eight integers using quicksort, and we have just finished the first partitioning with the array looking like this—

2 5 1 7 9 12 11 10

Which statement is correct ?

(A) The pivot could be either the 7 or the 9.

(B) The pivot could be the 7, but it is not the 9.

(C) The pivot is not the 7, but it could be the 9.

(D) Neither the 7 nor the 9 is the pivot.

## Answers

| | | | | |
|---|---|---|---|---|
| 1. (C) | 2. (C) | 3. (C) | 4. (B) | 5. (A) |
| 6. (D) | 7. (D) | 8. (A) | 9. (A) | 10.(A) |
| 11. (B) | 12. (C) | 13. (D) | 14. (C) | 15. (D) |
| 16. (C) | 17. (D) | 18. (B) | 19. (A) | 20. (B) |
| 21. (C) | 22. (A) | 23. (B) | 24. (A) | 25. (D) |
| 26. (D) | 27. (C) | 28. (C) | 29. (D) | 30. (A) |
| 31. (D) | 32. (A) | 33. (C) | 34. (C) | 35. (B) |
| 36. (D) | 37. (B) | 38. (B) | 39. (D) | 40. (D) |
| 41. (D) | 42. (B) | 43. (D) | 44. (A) | 45. (A) |
| 46. (C) | 47. (D) | 48. (C) | 49. (A) | 50. (A) |
| 51. (B) | 52. (D) | 53. (D) | 54. (C) | 55. (A) |
| 56. (B) | 57. (A) | 58. (D) | 59. (A) | 60. (C) |
| 61. (D) | 62. (B) | 63. (D) | 64. (D) | 65. (D) |
| 66. (B) | 67. (C) | 68. (C) | 69. (C) | 70. (C) |
| 71. (C) | 72. (C) | 73. (D) | 74. (B) | 75. (A) |

❑❑

# 8 Computer Network and Communication

## Computer Network

A system of interconnected computers and computerized peripherals (such as printers, Scanner) is called network. This interconnection among computers facilitates information sharing among them. Computers may connect to each other by wired media or wireless media.

The technological advancements in the field of computer networking started in 1969. During that time, the Advanced Research Projects Agency (ARPA) decided to implement a project called the Advanced Research Projects Agency Network (ARPANET). This was the world's first network, which only consisted of four nodes. Since then, computer networking has come a long way.

## Connection

In networking, a connection refers to pieces of related information that are transferred through a network. This generally infers that a connection is built before the data transfer (by following the procedures laid out in a protocol) and then is deconstructed at the end of the data transfer.

## Packet

A packet is, generally speaking, the most basic unit that is transferred over a network. When communicating over a network, packets are the envelopes that carry your data (in pieces) from one end point to the other.

Packets have a header portion that contains information about the packet including the source and destination, timestamps, network hops, etc. The main portion of a packet contains the actual data being transferred. It is sometimes called the body or the payload.

## Network Interface

A network interface can refer to any kind of software interface to networking hardware. For instance, if you have two network cards in your computer, you can control and configure each network interface associated with them individually.

A network interface may be associated with a physical device, or it may be a representation of a virtual interface. The "loopback" device, which is a virtual interface to the local machine, is an example of this.

## LAN

LAN stands for "local area network". It refers to a network or a portion of a network that is not publicly accessible to the greater internet. A home or office network is an example of a LAN.

## WAN

WAN stands for "wide area network". It means a network that is much more extensive than a LAN. While WAN is the relevant term to use to describe large, dispersed networks in general, it is usually meant to mean the internet, as a whole.

## MAC Layer

Media Access Control sub layer in the network stack.

## Loopback

A diagnostic test that returns the transmitted signal back to the sending device after it has passed through a network or across a particular

link. The returned signal can then be compared to the transmitted one. The discrepancy between the two help to trace the fault. When trying to locate a faulty piece of equipment, loopbacks will be repeated, eliminating satisfactory machines until the problem is found.

### NTFS

Short for NT File System, one of the file system for the Windows NT operating system (Windows NT also supports the FAT file system). NTFS has features to improve reliability, such as transaction logs to help recover from disk failures. To control access to files, you can set permissions for directories and/or individual files. NTFS files are not accessible from other operating such as DOS.

### Router

A hardware device designed to take incoming packets, analyze the packets, moving the packets to another network, converting the packets to another network interface, dropping the packets, directing packets to the appropriate locations, and performing any other number of other actions.

### Bridge

A **computer bridge** is a device that connects two local-area networks (LANs), or two segments of the same LAN. Unlike a router, bridges are protocol -independent. They forward packets without analyzing and re-routing messages.

### Protocol

A protocol is a set of rules and standards that basically define a language that devices can use to communicate. There are a great number of protocols in use extensively in networking, and they are often implemented in different layers.

Some low level protocols are TCP, UDP, IP, and ICMP. Some familiar examples of application layer protocols, built on these lower protocols, are HTTP (for accessing web content), SSH, TLS/SSL, and FTP.

### Port

A port is an address on a single machine that can be tied to a specific piece of software. It is not a physical interface or location, but it allows your server to be able to communicate using more than one application.

### Firewall

A firewall is a program that decides whether traffic coming into a server or going out should be allowed. A firewall usually works by creating rules for which type of traffic is acceptable on which ports. Generally, firewalls block ports that are not used by a specific application on a server.

### NAT

NAT stands for Network Address Translation. It is a way to translate requests that are incoming into a routing server to the relevant devices or servers that it knows about in the LAN. This is usually implemented in physical LANs as a way to route requests through one IP address to the necessary backend servers.

### VPN

VPN stands for virtual private network. It is a means of connecting separate LANs through the internet, while maintaining privacy. This is used as a means of connecting remote systems as if they were on a local network, often for security reasons.

There are many other terms that you may come across, and this list cannot afford to be exhaustive. We will explain other terms as we need them. At this point, you should understand some basic, high-level concepts that will enable us to better discuss the topics to come.

### Network Layers

While networking is often discussed in terms of topology in a horizontal way, between hosts, its implementation is layered in a vertical fashion throughout a computer or network.

What this means is that there are multiple technologies and protocols that are built on top of each other in order for communication to function more easily. Each successive, higher layer abstracts the raw data a little bit more, and makes it simpler to use for applications and users.

It also allows you to leverage lower layers in new ways without having to invest the time and energy to develop the protocols and applications that handle those types of traffic.

The language that we use to talk about each of the layering scheme varies significantly depending on which model you use. Regardless of the model used to discuss the layers, the path of data is the same.

As data is sent out of one machine, it begins at the top of the stack and filters downwards. At the lowest level, actual transmission to another machine takes place. At this point, the data travels back up through the layers of the other computer.

Each layer has the ability to add its own "wrapper" around the data that it receives from the adjacent layer, which will help the layers that come after decide what to do with the data when it is passed off.

### OSI Model

Historically, one method of talking about the different layers of network communication is the OSI model. OSI stands for Open Systems Interconnect.

This model defines seven separate layers. The layers in this model are :

### Application

The application layer is the layer that the users and user-applications most often interact with. Network communication is discussed in terms of availability of resources, partners to communicate with, and data synchronization.

### Presentation

The presentation layer is responsible for mapping resources and creating context. It is used to translate lower level networking data into data that applications expect to see.

### Session

The session layer is a connection handler. It creates, maintains, and destroys connections between nodes in a persistent way.

### Transport

The transport layer is responsible for handing the layers above it a reliable connection. In this context, reliable refers to the ability to verify that a piece of data was received intact at the other end of the connection. This layer can resend information that has been dropped or corrupted and can acknowledge the receipt of data to remote computers.

### Network

The network layer is used to route data between different nodes on the network. It uses addresses to be able to tell which computer to send information to. This layer can also break apart larger messages into smaller chunks to be reassembled on the opposite end.

### Data Link

This layer is implemented as a method of establishing and maintaining reliable links between different nodes or devices on a network using existing physical connections.

### Physical

The physical layer is responsible for handling the actual physical devices that are used to make a connection. This layer involves the bare software that manages physical connections as well as the hardware itself (like Ethernet).

### TCP/IP Model

The TCP/IP model, more commonly known as the Internet protocol suite, is another layering model that is simpler and has been widely adopted. It defines the four separate layers, some of which overlap with the OSI model :

### Application

In this model, the application layer is responsible for creating and transmitting user data between applications. The applications can be on remote systems, and should appear to operate as if locally to the end user.The communication is said to take place between peers.

### Transport

The transport layer is responsible for communication between processes. This level of networking utilizes ports to address different services. It can build up unreliable or reliable connections depending on the type of protocol used.

### Internet

The internet layer is used to transport data from node to node in a network. This layer is aware of the endpoints of the connections, but does not worry about the actual connection needed to get from one place to another. IP addresses are defined in this layer as a way of reaching remote systems in an addressable manner.

### Link

The link layer implements the actual topology of the local network that allows the internet layer to present an addressable interface. It establishes

connections between neighboring nodes to send data.

As you can see, the TCP/IP model, is a bit more abstract and fluid. This made it easier to implement and allowed it to become the dominant way that networking layers are categorized.

### Interfaces

Interfaces are networking communication points for your computer. Each interface is associated with a physical or virtual networking device.

Typically, your server will have one configurable network interface for each Ethernet or wireless internet card you have.

In addition, it will define a virtual network interface called the "loopback" or localhost interface. This is used as an interface to connect applications and processes on a single computer to other applications and processes.

Many times, administrators configure one interface to service traffic to the internet and another interface for a LAN or private network.

### Protocols

Networking works by piggybacking a number of different protocols on top of each other. In this way, one piece of data can be transmitted using multiple protocols encapsulated within one another.

### Media Access Control

Media access control is a communications protocol that is used to distinguish. specific devices. Each device is supposed to get a unique MAC address during the manufacturing process that differentiates it from every other device on the internet.

Addressing hardware by the MAC address allows you to reference a device by a unique value even when the software on top may change the name for that specific device during operation.

Media access control is one of the only protocols from the link layer that you are likely to interact with on a regular basis.

### IP

The IP protocol is one of the fundamental protocols that allow the internet to work. IP addresses are unique on each network and they allow machines to address each other across a network. It is implemented on the internet layer in the IP/TCP model.

Networks can be linked together, but traffic must be routed when crossing network boundaries. This protocol assumes an unreliable network and multiple paths to the same destination that it can dynamically change between.

There are a number of different implementations of the protocol. The most common implementation today is IPv4, although IPv6 is growing in popularity as an alternative due to the scarcity of IPv4 addresses available and improvements in the protocols capabilities.

### ICMP

ICMP stands for internet control message protocol. It is used to send messages between devices to indicate the availability or error conditions. These packets are used in a variety of network diagnostic tools, such as ping and traceroute.

Usually ICMP packets are transmitted when a packet of a different kind meets some kind of a problem. Basically, they are used as a feedback mechanism for network communications.

### TCP

TCP stands for transmission control protocol. It is implemented in the transport layer of the IP/TCP model and is used to establish reliable connections.

TCP is one of the protocols that encapsulates data into packets. It then transfers these to the remote end of the connection using the methods available on the lower layers. On the other end, it can check for errors, request certain pieces to be resent, and reassemble the information into one logical piece to send to the application layer.

The protocol builds up a connection prior to data transfer using a system called a three-way handshake. This is a way for the two ends of the communication to acknowledge the request and agree upon a method of ensuring data reliability.

After the data has been sent, the connection is torn down using a similar four-way handshake.

TCP is the protocol of choice for many of the most popular uses for the internet, including WWW, FTP, SSH, and email. It is safe to say that the internet we know today would not be here without TCP.

### UDP

UDP stands for User Datagram Protocol. It is a popular companion protocol to TCP and is also implemented in the transport layer.

The fundamental difference between UDP and TCP is that UDP offers unreliable data transfer. It does not verify that data has been received on the other end of the connection. This might sound like a bad thing, and for many purposes, it is. However, it is also extremely important for some functions.

Because it is not required to wait for confirmation that the data was received and forced to resend data, UDP is much faster than TCP. It does not establish a connection with the remote host, it simply fires off the data to that host and doesn't care if it is accepted or not.

Because it is a simple transaction, it is useful for simple communications like querying for network resources. It also doesn't maintain a state, which makes it great for transmitting data from one machine to many real-time clients. This makes it ideal for VOIP, games, and other applications that cannot afford delays.

### HTTP

HTTP stands for hypertext transfer protocol. It is a protocol defined in the application layer that forms the basis for communication on the web.

HTTP defines a number of functions that tell the remote system what you are requesting. For instance, GET, POST, and DELETE all interact with the requested data in a different way.

### FTP

FTP stands for file transfer protocol. It is also in the application layer and provides a way of transferring complete files from one host to another.

It is inherently insecure, so it is not recommended for any externally facing network unless it is implemented as a public, download-only resource.

### DNS

DNS stands for domain name system. It is an application layer protocol used to provide a human friendly naming mechanism for internet resources. It is what ties a domain name to an IP address and allows you to access sites by name in your browser.

## Multiple Choice Question

1. In OSI network architecture, the dialogue control and token management are responsibility of—
   (A) session layer (B) network layer
   (C) transport layer (D) data link layer
2. In OSI network architecture, the routing is performed by—
   (A) Network layer (B) Data link layer
   (C) Transport layer (D) Session layer
3. Which of the following performs modulation and demodulation ?
   (A) Fiber optics (B) Satellite
   (C) Coaxial cable (D) Modem
4. The process of converting analog signals into digital signals so they can be processed by a receiving computer is referred to as—
   (A) Modulation (B) Demodulation
   (C) Synchronizing (D) Digitising
5. How many OSI layers are covered in the X.25 standard ?
   (A) Two (B) Three
   (C) Seven (D) Six
6. Layer one of the OSI model is—
   (A) Physical layer (B) Link layer
   (C) Transport layer (D) Network layer
7. The x.25 standard specifies a—
   (A) Technique for start-stop data
   (B) Technique for dial access
   (C) DTE/DCE interface
   (D) Data bit rate
8. Which of the following communication modes support two-way traffic but in only one direction at a time ?
   (A) Simplex
   (B) Half duplex
   (C) Three-quarters duplex
   (D) All of the above
9. Which of the following might be used by a company to satisfy its growing communications needs ?
   (A) Front end processor
   (B) Multiplexer
   (C) Controller
   (D) All of the above

10. What is the number of separate protocol layers at the serial interface gateway specified by the X.25 standard ?
    (A) 4 (B) 2
    (C) 6 (D) 3

11. The interactive transmission of data within a time sharing system may be best suited to—
    (A) Simplex lines (B) Half-duplex lines
    (C) Full duplex lines (D) Biflex-lines

12. Which of the following statement is incorrect ?
    (A) The difference between synchronous and asynchronous transmission is the clocking derived from the data in synchronous transmission.
    (B) Half duplex line is a communication line in which data can move in two directions, but not at the same time.
    (C) Teleprocessing combines telecommunications and DP techniques in online activities
    (D) Batch processing is the prefered processing mode for telecommunication operation.

13. Which of the following is considered a broad band communication channel ?
    (A) Coaxial cable
    (B) Fiber optics cable
    (C) Microwave circuits
    (D) All of the above

14. Which of the following is not a transmission medium ?
    (A) Telephone lines
    (B) Coaxial cables
    (C) Modem
    (D) Microwave systems

15. Which of the following does not allow multiple uses or devices to share one communication line ?
    (A) Doubleplexer (B) Multiplexer
    (C) Concentrator (D) Controller

16. Which of the following signal is not standard RS-232-C signal ?
    (A) VDR (B) RTS
    (C) CTS (D) DSR

17. Which of the following statement is incorrect ?
    (A) Multiplexers are designed to accept data from several I/O devices and transmit a unified stream of data on one communication line
    (B) HDLC is a standard synchronous communication protocol.
    (C) RTS/CTS is the way the DTE indicates that it is ready to transmit data and the way the DCW indicates that it is ready to accept data
    (D) RTS/CTS is the way the terminal indicates ringing

18. Which of the following is an advantage to using fiber optics data transmission ?
    (A) Resistance to data theft
    (B) Fast data transmission rate
    (C) Low noise level
    (D) All of the above

19. Which of the following is required to communicate between two computers ?
    (A) Communications software
    (B) Protocol
    (C) Communication hardware
    (D) All of above including access to transmission medium

20. The transmission signal coding method of TI carrier is called—
    (A) Bipolar (B) NRZ
    (C) Manchester (D) Binary

21. Which data communication method is used to transmit the data over a serial communication link ?
    (A) Simplex (B) Half-duplex
    (C) Full-duplex (D) (B) and (C)

22. What is the minimum number of wires needed to send data over a serial communication link layer ?
    (A) 1 (B) 2
    (C) 4 (D) 6
    (E) None of these

23. Which of the following types of channels moves data relatively slowly ?
    (A) Wide band channel
    (B) Voice band challen
    (C) Narrow band channel

24. Most data communications involving telegraph lines use—
    (A) Simplex lines
    (B) Wideband channel
    (C) Narrowband channel
    (D) Dialed service

25. A communications device that combines transmissions from several I/O devices into one line is a—
    (A) Concentrator (B) Modifier
    (C) Multiplexer (D) Full-duplex line

26. How much power (roughly) a light emitting diode can couple into an optical fiber ?
    (A) 100 microwatts (B) 440 microwatts
    (C) 100 picowatts (D) 10 miliwatts

27. The synchronous modems are more costly than the asynchronous modems because—
    (A) they produce large volume of data
    (B) they contain clock recovery circuits
    (C) they transmit the data with stop and start bits
    (D) they operate with a larger bandwidth

28. Which of the following statement is correct ?
    (A) Terminal section of a synchronous modem contains the scrambler
    (B) Receiver section of a synchronous modem contains the scrambler
    (C) Transmission section of a synchronous modem contains the scrambler
    (D) Control section of a synchronous modem contains the scrambler

29. In a synchronous modem, the digital-to-analog converter transmits signal to the—
    (A) Equilizer (B) Modulator
    (C) Demodulator (D) Terminal

30. Which of the following communications lines is best suited to interactive processing applications ?
    (A) Narrow band channel
    (B) Simplex lines
    (C) Full duplex lines
    (D) Mixed band channels

31. Wi-Fi is a—
    (A) Type of computer
    (B) Type of network cable
    (C) Set of popular technologies and standards for wireless computer networking
    (D) Set of computer programs that help people make money on the Internet

32. An IP address is a numeric quantity that identifies—
    (A) A network adapter to other devices on the network
    (B) The manufacturer of a computer
    (C) The physical location of a computer
    (D) None of the above

33. Parity is—
    (A) A byte stored in the FAT to indicated remaining slots
    (B) The optimal transmission speed of data over a CAT 13 cable
    (C) An extra bit stored with data in RAM that is used to check for errors when the data is read back
    (D) The optimal transmission speed of data over a CAT 5 cable

34. Which is the best choice for a specification for a video card ?
    (A) AGP (B) SCSI
    (C) Both (A) and (B) (D) None of these

35. You can make telephone calls over the Internet using a technology called—
    (A) Intertel (B) Telenet
    (C) VoIP (D) VoRP

36. The purpose of a firewall on computer networks is to—
    (A) Prevent computers from overheating
    (B) Prevent unwanted network connections from being made
    (C) Allow more than 4 computers to share the same Internet connection
    (D) Allow pictures and video to be downloaded from a camera to a computer

37. Which of the following transmission systems provide the highest data rate to in individual device ?
    (A) Computer bus (B) Telephone lines
    (C) Voice and mode (D) Lease lines

38. A band is always equivalent to—
    (A) a byte
    (B) a bit

(C) 100 bits
(D) None of the above

39. In communication satellite, multiple repeaters are known as—
(A) Detector (B) Modulator
(C) Stations (D) Transponders

40. Which data communication method is used to transmit the data over a serial communication link ?
(A) Simplex (B) Half-duplex
(C) Full-duplex (D) (B) and (C)
(E) None of these

41. Which of the following communications lines is best suited to interactive processing applications ?
(A) Narrow band channel
(B) Simplex lines
(C) Full duplex lines
(D) Mixed band channels

42. Which of the following is required to communicate between two computers ?
(A) Communications software
(B) Protocol
(C) Communication hardware
(D) All of above including access to transmission medium

43. In OSI network architecture, the routing is performed by—
(A) Network layer (B) Data link layer
(C) Transport layer (D) Session layer
(E) None of the above

44. The x.25 standard specifies a—
(A) Technique for start-stop data
(B) Technique for dial access
(C) DTE/DCE interface
(D) Data bit rate
(E) None of the above

45. Frames from one LAN can be transmitted to another LAN via the device—
(A) Router (B) Bridge
(C) Repeater (D) Modem

46. To connect a computer with a device in the same room, you might be likely to use—
(A) A coaxial cable (B) A dedicated line
(C) A ground station (D) All of the above
(E) None of the above

47. With an IP address of 100, you currently have 80 subnets. What subnet mask should you use to maximize the number of available hosts ?
(A) 192 (B) 224
(C) 240 (D) 252

48. The.....houses the switches in token ring.
(A) transceiver
(B) nine-pin connector
(C) MAU
(D) NIC

49. What device separates a single network into two segments but lets the two segments appear as one to higher protocols ?
(A) Switch (B) Bridge
(C) Gateway (D) Router

50. The Internet Control Message Protocol (ICMP)—
(A) Allows gateways to send error a control messages to other gateways or hosts
(B) Provides communication between the Internet Protocol Software on one machine and the Internet Protocol Software on another
(C) Only reports error conditions to the original source, the source must relate errors to individual application programs and take action to correct the problem
(D) All of the above

## Answers

| | | | | |
|---|---|---|---|---|
| 1. (A) | 2. (A) | 3. (D) | 4. (D) | 5. (B) |
| 6. (A) | 7. (C) | 8. (B) | 9. (D) | 10. (D) |
| 11. (B) | 12. (D) | 13. (D) | 14. (C) | 15. (A) |
| 16. (A) | 17. (D) | 18. (D) | 19. (D) | 20. (A) |
| 21. (C) | 22. (B) | 23. (C) | 24. (C) | 25. (C) |
| 26. (A) | 27. (B) | 28. (C) | 29. (A) | 30. (C) |
| 31. (C) | 32. (A) | 33. (C) | 34. (A) | 35. (C) |
| 36. (B) | 37. (A) | 38. (D) | 39. (D) | 40. (C) |
| 41. (C) | 42. (D) | 43. (A) | 44. (B) | 45. (B) |
| 46. (A) | 47. (D) | 48. (C) | 49. (B) | 50. (D) |

❑❑

# 9 Object Oriented Programming Concept Using C++

## Object Oriented Programming (OOP)

Object-oriented programming (OOP) is a programming paradigm that uses "Objects" and their interactions to design applications and computer programs.

Object-oriented programming is used to develop many applications like business applications and games, mobile and desktop applications. Developers choose to program in the object-oriented paradigm because the proper use of objects makes it easier to build, maintain, and upgrade an application. Also, developing an application with objects that have been tested increases the reliability of the application.

## Benefits of Object Oriented Technology

- Ease in software design as you could think in the problem space rather than the machine's bits and bytes. You are dealing with high-level concepts and abstractions. Ease in design leads to more productive software development.
- *Ease in software maintenance :* object-oriented software are easier to understand, therefore easier to test, debug, and maintain.
- *Reusable software:* you don't need to keep re-inventing the wheels and re-write the same functions for different situations. The fastest and safest way of developing a new application is to reuse existing codes - fully tested and proven codes.

## Attributes of OOP

(A Object (B) Class

### (A) Object

An **object** can be considered as a "*thing*" that can perform a set of **related** activities. The set of activities that the **object** performs defines the **object**'s behavior. For example, the hand can grip something or a *Student* (***object***) can give the name or address.

In pure *OOP* terms an **object** is an instance of a class.

### (B) Class

A *class* is simply a representation of a type of ***object***. It is the blueprint/ plan/ template that describe the details of an ***object***. A class is the blueprint from which the individual **object**s are created. *Class* is composed of three things : a name, attributes, and operations.

```
public class Student
{
}
```

According to the sample given below we can say that the *student* **object**, named ***object*** *Student*, has created out of the *Student* class.

Student **object** Student = new Student();

In real world, you'll often find many individual **object**s all of the same kind. As an example, there may be thousands of other bicycles in existence, all of the same make and model. Each bicycle has built from the same blueprint. In **object-oriented** terms, we say that the bicycle is an instance of the class of **object**s known as bicycles.

## Properties of Object Oriented Concept

(A) Encapsulation
(B) Polymorphisms
(C) Operator overloading
(D) Method overloading
(E) Method overriding
(F) Association
(G) Abstract class

### (A) Encapsulation

The encapsulation is the inclusion within a program **object** of all the resources need for the **object** to function - basically, the methods and the data. In *OOP* the encapsulation is mainly achieved by creating classes, the classes expose public

methods and properties. The class is kind of a container or capsule or a cell, which encapsulate the set of methods, attribute and properties to provide its indented functionalities to other classes. In that sense, encapsulation also allows a class to change its internal implementation without hurting the overall functioning of the system. That idea of encapsulation is to hide how a class does it but to allow requesting what to do.

In order to modularize/ define the functionality of a one class, that class can uses functions/ properties exposed by another class in many different ways. According to **Object Oriented Programming** there are several techniques, classes can use to link with each other and they are named association, aggregation, and composition.

### (B) Polymorphisms

Polymorphisms is a generic term that means 'many shapes'. More precisely *Polymorphisms* means the ability to request that the same operations be performed by a wide range of different types of things.

In *OOP* the *polymorphisms* is achieved by using many different techniques named method overloading, operator overloading and method overriding.

### (C) Operator Overloading

The operator overloading (less commonly known as ad-hoc *polymorphisms*) is a specific case of *polymorphisms* in which some or all of operators like +, – or == are treated as polymorphic functions and as such have different behaviors depending on the types of its arguments.

### (D) Method Overloading

The method overloading is the ability to define several methods all with the same name.

```
public class MyLogger
{
   public void LogError(Exception e)
   {
      // Implementation goes here
   }
   public bool LogError(Exception e, string message)
   {
      // Implementation goes here
   }
}
```

### (E) Method Overriding

Method overriding is a language feature that allows a subclass to override a specific implementation of a method that is already provided by one of its super-classes.

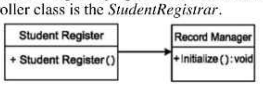
A subclass can give its own definition of methods but need to have the same signature as the method in its super-class. This means that when overriding a method the subclass's method has to have the same name and parameter list as the super-class's overridden method.

### (F) Association

Association is a relationship between two classes. It allows one **object** instance to cause another to perform an action on its behalf. Association is the more general term that define the relationship between two classes, where as the aggregation and composition are relatively special.

```
public class StudentRegistrar
{
   public StudentRegistrar ();
   {
      new RecordManager().Initialize();
   }
}
```

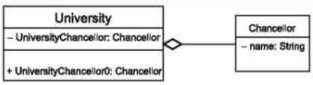
In this case we can say that there is an association between *StudentRegistrar* and *Record Manager* or there is a directional association from *StudentRegistrar* to *RecordManager* or Student Registrar use a (*Use*) *RecordManager*. Since a direction is explicitly specified, in this case the controller class is the *StudentRegistrar*.



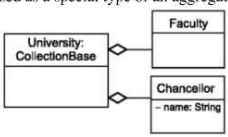

### Difference Between Association, Aggregation and Composition

Association is a relationship between two classes, where one class use another. But aggregation describes a special type of an association. Aggregation is the elationship between two classes. When **object** of one class has an **object** of another, if second is a part of first (containment relationship) then we called that there is an aggregation between two classes. Unlike association, aggregation always insists a direction.

```
public class University
{
   private Chancellor universityChancellor = new
Chancellor();
}
```

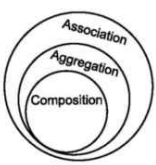



In this case the *University* aggregate *Chancellor* or *University* has an *Chancellor*. But even without a *Chancellor* a *University* can exists. But the *Faculties* cannot exist without the *University*, the life time of a *Faculty* (or Faculties) attached with the life time of the *University* . If *University* is disposed the *Faculties* will not exist. In that case we called that *University* is composed of *Faculties*. So that composition can be recognized as a special type of an aggregation.




Same way, as another example, you can say that, there is a composite relationship in-between a *KeyValuePairCollection* and a *KeyValuePair*. The two mutually depend on each other.

An aggregation is a special kind of an association and composition is a special kind of an aggregation. (*Association->Aggregation->Composition*)




## Abstraction and Generalization

Abstraction is an emphasis on the idea, qualities and properties rather than the particulars (a suppression of detail). The importance of abstraction is derived from its ability to hide irrelevant details and from the use of names to reference **object**s. Abstraction is essential in the construction of programs. It places the emphasis on what an **object** is or does rather than how it is represented or how it works. Thus, it is the primary means of managing complexity in large programs.

While abstraction reduces complexity by hiding irrelevant detail, generalization reduces complexity by replacing multiple entities which perform similar functions with a single construct. Generalization is the broadening of application to encompass a larger domain of **object**s of the same or different type. **Programming** languages provide generalization through variables, parameterization, generics and *polymorphism*. It places the emphasis on the similarities between **object**s. Thus, it helps to manage complexity by collecting individuals into groups and providing a representative which can be used to specify any individual of the group.

## (G) Abstract Class

Abstract classes, which declared with the abstract keyword, cannot be instantiated. It can only be used as a super-class for other classes that extend the abstract class. Abstract class is the concept and implementation gets completed when it is being realized by a subclass. In addition to this a class can inherit only from one abstract class (but a class may implement many interfaces) and must override all its abstract methods/ properties and may override virtual methods/ properties.

Abstract classes are ideal when implementing frameworks. As an example, let's study the abstract class named *LoggerBase* below. Please carefully read the comments as it will help you to understand the reasoning behind this code.

```
public abstract class LoggerBase
{
   /// <summary>
   /// field is private, so it intend to use inside the
class only
   /// </summary>
   private log4net.ILog logger = null;
   /// <summary>
   /// protected, so it only visible for inherited class
   /// </summary>
  protected LoggerBase()
  {
```

```
    // The private object is created inside the constructor
    logger = log4net.LogManager.GetLogger (this.LogPrefix);
    // The additional initialization is done immediately after
    log4net.Config.DOMConfigurator.Configure();
  }
  /// <summary>
  /// When you define the property as abstract,
    /// it forces the inherited class to override the LogPrefix
  /// So, with the help of this technique the log can be made,
  /// inside the abstract class itself, irrespective of it origin.
    /// If you study carefully you will find a reason for not to have "set" method here.
  /// </summary>
  protected abstract System.Type LogPrefix
  {
    get;
  }
  /// <summary>
  /// Simple log method,
 /// which is only visible for inherited classes
 /// </summary>
  /// <param name="message"></param>
  protected void LogError(string message)
    if (this.logger.IsErrorEnabled)
    {
      this.logger.Error(message);
    }
  }
  /// <summary>
   /// Public properties which exposes to inherited class
   /// and all other classes that have access to inherited class
  /// </summary>
  public bool IsThisLogError
  {
    get
    {
      return this.logger.IsErrorEnabled;
    }
  }
}
```

The idea of having this class as an abstract is to define a framework for exception logging. This class will allow all subclass to gain access to a common exception logging module and will facilitate to easily replace the logging library. By the time you define the *LoggerBase*, you wouldn't have an idea about other modules of the system. But you do have a concept in mind and that is, if a class is going to log an exception, they have to inherit the *LoggerBase*. In other word the *LoggerBase* provide a framework for exception logging.

## Object Oriented Programming Using C++ Terminology

### Abstract Class

A class primarily intended to define an instance, but can not be instantiated without additional methods.

### Abstract Data Type

An abstraction that describes a set of items in terms of a hidden data structure and operations on that structure.

### Abstraction

A mental facility that permits one to view problems with varying degrees of detail depending on the current context of the problem.

### Accessor

A public member subprogram that provides query access to a private data member.

### Actor

An object that initiates behavior in other objects, but cannot be acted upon itself.

### Access Specifiers

Public, private or protected.

### 'Alias'

Defining an alias for a structure or built-in type allows use of the alias as if it were a new type. In C, the keyword is typedef. It's a bad idea to alias (have two objects pointing to the same data) unless one of those objects is a temporary variable.

### Allocating Storage

"Don't unless you must." (USG)—"Instead of defining a Clone operator, overload the assignment operator; instead of allocating and returning an

object, have the caller pass one in by reference and set it. This allows your classes to be treated just like primitive types ... leave storage allocation up to the class client. Design your classes so that using them is just like using primitive types in C. In cases where you wish to avoid copying, pass arguments by reference ...Exception: anytime a function must choose what type of object to return, the function must allocate the object, not the caller.

**Agent**

An object that can both initiate behavior in other objects, as well as be operated upon by other objects.

**ADT**

Abstract data type.

**AKO**

A Kind Of. The inheritance relationship between classes and their superclasses.

**Allocatable Array**

A named array having the ability to dynamically obtain memory. Only when space has been allocated for it does it have a shape and may it be referenced or defined.

**Arguments, Function**

Arguments in function declarations may have names, but the names are ignored (they are positional). In C++ (unlike C), an empty argument list means a function with no arguments, since the C "wild card" style would prevent type-checking, e.g., int func2(); this behavior is different than the result you would have expected in C.

**Array**

An ordered collection that is indexed.

**Array Constructor**

A means of creating a part of an array by a single statement.

**Array Overflow**

An attempt to access an array element with a subscript outside the array size bounds.

**Array Pointer**

A pointer whose target is an array, or an array section.

**Array Section**

A sub-object that is an array and is not a defined type component.

**Assertion**

A programming means to cope with errors and exceptions.

**Assignment Operator**

= *= /= %= += -= <<= >>= &= ^= != "All require an lvalue as left operand, and the lvalue must be modifiable: it must not be an array, and must not have an incomplete type, or be a function." (At least the = operator is overloadable).

**Assignment Statement**

A statement of the form "variable = expression".

**Association**

Host association, name association, pointer association, or storage association.

**Attribute**

A property of a variable that may be specified in a type declaration statement.

**Automatic Array**

An explicit-shape array in a procedure, which is not a dummy argument, some or all of whose bounds are provided when the procedure is invoked.

**Base Class**

A previously defined class whose public members can be inherited by another class. (Also called a super class.)

**Behavior Sharing**

A form of polymorphism, when multiple entities have the same generic interface. This is achieved by inheritance or operator overloading.

**Binary Operator**

An operator that takes two operands.

**Bintree**

A tree structure where each node has two child nodes.

**Browser**

A tool to find all occurrences of a variable, object, or component in a source code.

**Call-by-Reference**

A language mechanism that supplies an argument to a procedure by passing the address of the argument rather than its value. If it is modified, the new value will also take effect outside of the procedure.

**Casting**

Forced conversion of one data type to another by the = assignment operator, *e.g.*, {short x; long y; y=x}

**Character Constant**

Single byte char enclosed by single quotes.

**Call-by-Value**

A language mechanism that supplies an argument to a procedure by passing a copy of its data value. If it is modified, the new value will not take effect outside of the procedure that modifies it.

**Class**

An abstraction of an object that specifies the static and behavioral characteristics of it, including their public and private nature. A class is an ADT with a constructor template from which object instances are created.

**Class Attribute**

An attribute whose value is common to a class of objects rather than a value peculiar to each instance of the class.

**Class Descriptor**

An object representing a class, containing a list of its attributes and methods as well as the values of any class attributes.

**Class Diagram**

A diagram depicting classes, their internal structure and operations, and the fixed relationships between them.

**Class Inheritance**

Defining a new derived class in terms of one or more base classes.

**Client**

A software component that users services from another supplier class.

**Concrete Class**

A class having no abstract operations and can be instantiated.

**Compiler**

Software that translates a high-level language into machine language.

**Component**

A data member of a defined type within a class declaration.

**Constructor**

An operation, by a class member function, that initializes a newly created instance of a class.

**Constructor Operations**

Methods which create and initialize the state of an object.

**Container Class**

A class whose instances are container objects. Examples include sets, arrays, and stacks.

**Container Object**

An object that stores a collection of other objects and provides operations to access or iterate over them.

**Control Variable**

The variable which controls the number of loop executions.

**Data Abstraction**

The ability to create new data types, together with associated operators, and to hide the internal structure and operations from the user, thus allowing the new data type to be used in a fashion analogous to intrinsic data types.

**Data Hiding**

The concept that some variables and/or operations in a module may not be accessible to a user of that module; a key element of data abstraction.

**Data Member**

A public data attribute, or instance variable, in a class declaration.

**Data Type**

A named category of data that is characterized by a set of values, together with a way to denote these values and a collection of operations that interpret and manipulate the values. For an intrinsic type, the set of data values depends on the values of the type parameters.

**Deallocation Statement**

A statement which releases dynamic memory that has been previously allocated to an allocatable array or a pointer.

**Debugger Software**

A program that allows one to execute a program in segments up to selected breakpoints, and to observe the program variables.

**Debugging**

The process of detecting, locating, and correcting errors in software.

**Declaration Statement**

A statement which specifies the type and, optionally, attributes of one or more variables or constants.

**Default Constructor**

A class member function with no arguments that assigns default initial values to all data members in a newly created instance of a class.

**Defined Operator**

An operator that is not an intrinsic operator and is defined by a subprogram that is associated with a generic identifier.

**Deque**

A container that supports inserts or removals from either end of a queue.

**Dereferencing**

The interpretation of a pointer as the target to which it is pointing.

**Derived Attribute**

An attribute that is determined from other attributes.

**Derived Class**

A class whose declaration indicates that it is to inherit the publicmembers of a previously defined base class.

**Derived Type**

A user defined data type with components, each of which is either of intrinsic type or of another derived type.

**Destructor**

An operation that cleans up an existing instance of a class that is no longer needed.

**Destructor Operations**

Methods which destroy objects and reclaim their dynamic memory.

**Domain**

The set over which a function or relation is defined.

**Dummy Argument**

An argument in a procedure definition which will be associated with the actual (reference or value) argument when the procedure is invoked.

**Dummy Array**

A dummy argument that is an array.

**Dummy Pointer**

A dummy argument that is a pointer.

**Dummy Procedure**

A dummy argument that is specified or referenced as a procedure.

**Dynamic Binding**

The allocation of storage at run time rather than compile time, or the run time association of an object and one of its generic operations.

**Edit descriptor**

An item in an input/output format which specifies the conversion between internal and external forms.

**Encapsulation**

A modeling and implementation technique (information hiding) that separates the external aspects of an object from the internal, implementation details of the object.

**Exception**

An unexpected error condition causing an interruption to the normal flow of program control.

**Explicit Interface**

For a procedure referenced in a scoping unit, the property of being an internal procedure, a module procedure, an external procedure that has an interface (prototype) block, a recursive procedure reference in its own scoping unit, or a dummy procedure that has an interface block.

**Explicit Shape Array**

A named array that is declared with explicit bounds.

**External File**

A sequence of records that exists in a medium external to the program.

**External Procedure**

A procedure that is defined by an external subprogram.

**FIFO**

A first in first out storage is called queue.

**Friend**

A method, in C++, which is allowed privileged access to the private implementation of another object.

**Function Body**

A block of statements that manipulate parameters to accomplish the subprogram's purpose.

**Function Definition**

Program unit that associates with a subprogram name a return type, a list of arguments, and a sequence of statements that manipulate the arguments to accomplish the subprogram's purpose.

**Function Header**

A line of code at the beginning of a function definition; includes the argument list, and the function return variable name.

**Generic Function**

A function which can be called with different types of arguments.

**Generic Identifier**

A lexical token that appears in an INTERFACE statement and is associated with all the procedures in the interface block.

**Generic Interface Block**

A form of interface block which is used to define a generic name for a set of procedures.

**Generic Name**

A name used to identify two or more procedures, the required one being determined by the types of the non-optional arguments in the procedure invocation.

**Generic Operator**

An operator which can be invoked with different types of operands.

**Hashing Technique**

A technique used to create a hash table, in which the array element where an item is to be stored is determined by converting some item feature into an integer in the range of the size of the table.

**Heap**

A region of memory used for data structures dynamically allocated and deallocated by a program.

**Host**

The program unit containing a lower (hosted) internal procedure.

**Host Association**

Data, and variables automatically available to an internal procedure from its host.

**Information Hiding**

The principle that the state and implementation of an object should be private to that object and only accessible via its public interface.

**Inheritance**

The relationship between classes whereby one class inherits part or all of the public description of another base class, and instances inherit all the properties and methods of the classes which they contain.

**Instance**

A individual example of a class invoked via a class constructor.

**Instance Diagram**

A drawing showing the instance connection between two objects along with the number or range of mapping that may occur.

**Instantiation**

The process of creating (giving a value to) instances from classes.

**Intent**

An attribute of a dummy argument that which indicates whether it may be used to transfer data into the procedure, out of the procedure, or both.

**Interaction diagram**

A diagram that shows the flow of requests, or messages between objects.

**Interface**

The set of all signatures (public methods) defined for an object.

**Internal File**

A character string that is used to transfer and/or convert data from one internal storage mode to a different internal storage mode.

**Internal Procedure**

A procedure contained within another program unit, or class, and which can only be invoked from within that program unit, or class.

**Internal Subprogram**

A subprogram contained in a main program or another subprogram.

**Intrinsic Constructor**

A class member function with the same name as the class which receives initial values of all the data members as arguments.

**Iterator**

A method that permits all parts of a data structure to be visited.

**Keyword**

A programming language word already defined and reserved for a single special purpose.

**LIFO**

Last In First Out storage; a stack.

**Link**

The process of combining compiled program units to form an executable program.

**Linked List**

A data structure in which each element identifies its predecessor and/or successor by some form of pointer.

**Linker**

Software that combines object files to create an executable machine language program.

**List**

An ordered collection that is not indexed.

**Map**

An indexed collection that may be ordered.

**Matrix**

A rank-two array.

**Member Data**

Variables declared as components of a defined type and encapsulated in a class.

**Member Function**

Subprograms encapsulated as members of a class.

**Method**

A class member function encapsulated with its class data members.

**Method Resolution**

The process of matching a generic operation on an object to the unique method appropriate to the object's class.

**Message**

A request, from another object, for an object to carry out one of its operations.

**Message Passing**

The philosophy that objects only interact by sending messages to each other that request some operations to be performed.

**Module**

A program unit which allows other program units to access variables, derived type definitions, classes and procedures declared within it by USE association.

**Module Procedure**

A procedure which is contained within a module, and usually used to define generic interfaces, and/or to overload or define operators.

**Nested**

Placement of a control structure inside another control structure.

**Object**

A concept, or thing with crisp boundaries and meanings for the problem at hand; an instance of a class.

**Object Diagram**

A graphical representation of an object model showing relationships, attributes, and operations.

**Object-Oriented (OO)**

A software development strategy that organizes software as a collection of objects that contain both data structure and behavior. (Abbreviated OO.)

**Object-Oriented Programming (OOP)**

Object-oriented programs are object-based, class-based, support inheritance between classes and base classes and allow objects to send and receive messages.

**Object-Oriented Programming Language**

A language that supports objects (encapsulating identity, data, and operations), method resolution, and inheritance.

**Operand**

An expression or variable that precedes or succeeds an operator.

**Operation**

Manipulation of an objects data by its member function when it receives a request.

**Operator Overloading**

A special case of polymorphism; attaching more than one meaning to the same operator symbol. 'Overloading' is also sometimes used to indicate using the same name for different objects.

**Overflow**

An error condition arising from an attempt to store a number which is too large for the storage location specified; typically caused by an attempt to divide by zero.

**Overloading**

Using the same name for multiple functions or operators in a single scope.

**Overriding**

The ability to change the definition of an inherited method or attribute in a subclass.

**Parameterized Classes**

A template for creating real classes that may differ in well-defined ways as specified by parameters at the time of creation. The parameters are often data types or classes, but may include other attributes, such as the size of a collection. (Also called generic classes.)

**Pass-by-Reference**

Method of passing an argument that permits the function to refer to the memory holding the original copy of the argument.

**Pass-by-Value**

Method of passing an argument that evaluates the argument and stores this value in the corresponding formal argument, so the function has its own copy of the argument value.

**Pointer**

A single data object which stands for another (a "target"), which may be a compound object such as an array, or defined type.

**Pointer Array**

An array which is declared with the pointer attribute. Its shape and size may not be determined until they are created for the array by means of a memory allocation statement.

**Pointer Assignment Statement**

A statement of the form "pointer-name) target".

**Polymorphism**

The ability of an function/operator, with one name, to refer to arguments, or return types, of different classes at run time.

**Post-Condition**

Specifies what must be true after the execution of an operation.

**Pre-Condition**

Specifies the condition(s) that must be true before an operation can be executed.

**Private**

That part of an class, methods or attributes, which may not be accessed by other classes, only by instances of that class.

**Protected**

Referring to an attribute or operation of a class in C++ accessible by methods of any descendent of the current class.

**Prototype**

A statement declaring a function's return type, name, and list of argument types.

**Pseudo Code**

A language of structured English statements used in designing a step-by-step approach to solving a problem.

**Public**

That part of an object, methods or attributes, which may be accessed by other objects, and thus constitutes its interface.

**Quadtree**

A tree structure where each tree node has four child nodes.

**Query Operation**

An operation that returns a value without modifying any objects.

**Rank**

Number of subscripted variables an array has. A scalar has rank zero, a vector has rank one, a matrix has rank two.

**Scope**

That part of an executable program within which a lexical token (name) has a single interpretation.

**Sequential**

A kind of file in which each record is written (read) after the previously written (read) record.

**Server**

An object that can only be operated upon by other objects.

**Service**

A class member function encapsulated with its class data members.

**Shape**

The rank of an array and the extent of each of its subscripts. Often stored in a rank-one array.

**Side Effect**

A change in a variable's value as a result of using it as an operand, or argument.

**Signature**

The combination of a subprogram's (operator's) name and its argument (operand) types. Does not include function result types.

**Size**

The total number of elements in an array.

**Stack**

Region of memory used for allocation of function data areas; allocation of variables on the stack occurs automatically when a block is entered, and deallocation occurs when the block is exited.

**Stride**

The increment used in a subscript triplet.

**Strong Typing**

The property of a programming language such that the type of each variable must be declared.

**Structure Component**

The part of a data object of derived type corresponding to a component of its type.

**Sub-Object**

A portion of a data object that may be referenced or defined independently of other portions. It may be an array element, an array section, a structure component, or a substring.

**Subprogram**

A function or subroutine subprogram.

**Subprogram Header**

A block of code at the beginning of a subprogram definition; includes the name, and the argument list, if any.

**Subscript Triplet**

A method of specifying an array section by means of the initial and final subscript integer values and an optional stride (or increment).

**Super Class**

A class from which another class inherits.

**Supplier**

Software component that implements a new class with services to be used by a client software component.

**Target**

The data object pointed to by a pointer, or reference variable.

**Template**

An abstract recipe with parameters for producing concrete code for class definitions or subprogram definitions.

**Thread**

The basic entity to which the operating system allocates CPU time.

**Tree**

A form of linked list in which each node points to at least two other nodes, thus defining a dynamic data structure.

**Unary Operator**

An operator which has only one operand.

**Undefined**

A data object which does not have a defined value.

**Underflow**

An error condition where a number is too close to zero to be distinguished from zero in the floating-point representation being used.

**Utility Function**

A private subprogram that can only be used within its defining class.

**Vector**

A rank-one array. An array with one subscript.

**Vector Subscript**

A method of specifying an array section by means of a vector containing the subscripts of the elements of the parent array that are to constitute the array section.

**Virtual Function**

A genetic function, with a specific return type, extended later for each new argument type.

**Void Subprogram**

A C++ subprogram with an empty argument list and/or a subroutine with no returned argument.

**Work Array**

A temporary array used for the storage of intermediate results during processing.

## Multiple Choice Questions

1. C++ was originally developed by—
   (A) Nicolas Wirth (B) Donald Knuth
   (C) Bjarne Stroustrup (D) Ken Thompson
2. State the object oriented languages—
   (A) C++ (B) Java
   (C) Eiffel (D) All of the above
3. What part of object-oriented technology defines superclass and subclass relationships ?
   (A) Inheritance (B) Scalability
   (C) Encapsulation (D) Polymorphism
4. In a student grading system, objects from different classes communicate with each other. These communications are known as..... .
   (A) inheritance (B) polymorphism
   (C) messages (D) concealment
5. The standard C++ comment—
   (A) / (B) //
   (C) /* and */ (D) None of these
6. What term is used to describe the internal representation of an object that is hidden from view outside the object's definition ?
   (A) Encapsulation (B) Expandable
   (C) Polymorphism (D) Inheritance
7. What programming language model is organized around "objects" rather than "actions" ?
   (A) Java (B) OOP
   (C) Perl (D) C+
8. What are the instructions called that tell a system what, how, and when to do something ?
   (A) Object-oriented technology approach
   (B) Object-oriented database
   (C) Program
   (D) Database management
9. What common technique attempts to save time and energy by reducing redundant work in object-oriented programming ?
   (A) Reduce lines of programming
   (B) Reuse of code
   (C) Reduce size of systems being developed
   (D) Merging different systems together
10. What kind of programming language is Java ?
    (A) Object-oriented programming language
    (B) Relational programming language
    (C) Sixth-generation programming language
    (D) Database management programming language
11. By default, members of a C++ class are—
    (A) Private
    (B) Public
    (C) Protected
    (D) None of the above
12. Which of the following statements is true in C++ ?
    (A) A Struct Cannot Have Member Functions

(B) A Struct Cannot Have Private Members
(C) The Default Access Modifier Of Struct Is Public
(D) None of the above

13. C++ supports—
(A) Multiple Inheritance
(B) Pointer to Functions
(C) Recursion
(D) All of the above

14. Which of the following is not a C++ keyword ?
(A) Extern
(B) Auto
(C) Inherits
(D) None of the above

15. Which of the following is not a bitwise operator ?
(A) && (B) <<
(C) ~ (D) ^

16. In C++, the expression 5/2 is evaluated to—
(A) 2.5
(B) 2
(C) 3
(D) None of the above

17. In C++, the string literal "C++" occupies exactly ..... of memory.
(A) 3 Bytes (B) 4 Bytes
(C) 5 Bytes (D) 6 Bytes

18. In C++, generic functions are created using the keyword—
(A) Generic (B) Template
(C) Class (D) Type

19. The implicit argument passed to a member function of a C++ class is called—
(A) "Implicit" Pointer
(B) "Sender" Object
(C) "This" Pointer
(D) "Me" Object

20. The default copy constructor performs—
(A) Deep Copy (B) Shallow Copy
(C) Hard Copy (D) Soft Copy

21. A C++ program contains a function with the header int function (double d, char c). Which of the following function headers could be used within the same program ?
(A) Char function (double d, char c)
(B) Int function (int d, char c)
(C) Both (A) and (B)
(D) Neither (A) nor (B)

22. A function that returns no values to the program that calls it is .....
(A) not allowed in C++
(B) type void
(C) type empty
(D) type barren

23. If container classes are carefully constructed, then these tools are available to work with structures that are not ..... .
(A) valid without container classes
(B) programmer-defined
(C) type-specific
(D) public

24. A function that is called automatically each time an object is destroyed is a—
(A) Constructor (B) Destructor
(C) Destroyer (D) Terminator

25. When you pass a variable ....., C++ passes only the contents of the variable to the receiving function.
(A) by reference (B) by value
(C) globally (D) locally

26. What does C++ append to the end of a string literal constant ?
(A) A space
(B) A number sign (#)
(C) An asterisk (*)
(D) A null character

27. Overloaded functions are required to—
(A) Have the same return type
(B) Have the same number of parameters
(C) Perform the same basic functions
(D) None of the above

28. Of the three ways to pass arguments to functions, only passing by ..... and passing by ..... allow the function to modify the argument in the calling program.
(A) reference, pointer

(B) array, location
(C) array, pointer
(D) None of the above

29. A base class may also be called a—
(A) Child class (B) Subclass
(C) Derived class (D) Parent class

30. The return type you code for all constructors is .....
(A) void
(B) the class type
(C) the same type as the first data member defined in the class
(D) no type

31. A constructor always has—
(A) Communicational cohesion
(B) Temporal cohesion
(C) Logical cohesion
(D) No cohesion

32. A function in a derived class that has the same name as a function in the parent class—
(A) Will override the base class function
(B) Will cause an error message to display
(C) Will be overridden by the base class function
(D) Will execute immediately often the base class function executes

33. The entire set of data & code of an object can be made a user-defined data type using the concept of class—
(A) User-Define (B) Static
(C) Global (D) Derived

34. The wrapping up of data & methods into a single unit is called as Encapsulation—
(A) Inheritance
(B) Polymorphism
(C) Encapsulation

35. Methods provide the interface between the object's data & the program—
(A) Data (B) Class
(C) Methods

36. The insulation of data from direct access by the program is called as data hiding—
(A) Encapsulation
(B) Data Hiding
(C) Private
(D) None of the above

37. Inheritance is the process by which object of one class acquires the properties of object of another class—
(A) Encapsulation
(B) Data Hiding
(C) Inheritance
(D) None of the above

38. The concept of inheritance provides the idea of reusability—
(A) Taking More Than One Form
(B) Reusability
(C) Data Hiding
(D) None of the above

39. The derived class is known as subclass—
(A) Superclass
(B) Subclass
(C) Parentclass
(D) All of the above

40. The class from which the subclass derives the properties is called as Super class—
(A) Superclass
(B) Subclass
(C) Baseclass
(D) None of the above

41. The property or the ability to take more than one form is called as Polymorphism—
(A) Encapsulation
(B) Polymorphism
(C) Inheritance
(D) None of the above

42. Polymorphism is extensively used in implementing Inheritance—
(A) Encapsulation
(B) Data Hiding
(C) Inheritance
(D) None of the above

43. The process of linking of a procedure call with the code to be executed is called as Binding—
(A) Binding
(B) Loading
(C) Assembling
(D) None of the above

44. The process in which the code to be link with the procedure call is not know till execution time it is called as Dynamic binding—
    (A) Binding
    (B) Early Binding
    (C) Static Binding
    (D) Dynamic Binding

45. When the code to be linked with the call is known at compile time that situation is called as Static binding—
    (A) Binding
    (B) Late Binding
    (C) Static Binding
    (D) Dynamic Binding

46. Instance variables are created when the objects are instantiated and therefore they are associated with the objects—
    (A) Declared
    (B) Defined
    (C) Instantiated
    (D) None of the above

47. Class variables are global to the class—
    (A) Local (B) Static
    (C) Global (D) Derived

48. Instance variables take different values for each object—
    (A) Different
    (B) Same
    (C) Non-Zero
    (D) None of the above

49. OOP treats Data as a critical element in the program development—
    (A) Data (B) Function
    (C) Object (D) Classes

50. OOP allows us to decompose a problem into a number of entities called object—
    (A) Object (B) Classes
    (C) Data (D) Function

51. In an assignment statement—
    a = b;
    Which of the following statement is true ?
    (A) The variable a and the variable b are equal.
    (B) The value of b is assigned to variable a but the later changes on variable b will not effect the value of variable a
    (C) The value of b is assigned to variable a and the later changes on variable b will effect the value of variable a
    (D) The value of variable a is assigned to variable b and the value of variable b is assigned to variable a.

52. All of the following are valid expressions in C++.
    a = 2 + (b = 5);
    a = b = c = 5;
    a = 11 % 3
    (A) True (B) False

53. To increase the value of c by one which of the following statement is wrong ?
    (A) c++; (B) c = c + 1;
    (C) c + 1 => c; (D) c += 1

54. When following piece of code is executed, what happens ?
    b = 3;
    a = b++;
    (A) a contains 3 and b contains 4
    (B) a contains 4 and b contains 4
    (C) a contains 4 and b contains 3
    (D) a contains 3 and b contains 3

55. The result of a Relational operation is always—
    (A) either True or False
    (B) is less than or is more than
    (C) is equal or less or more
    (D) All of the above

56. Which of the following is not a valid relational operator ?
    (A) == (B) =>
    (C) >= (D) >=

57. What is the final value of x when the code int *x*; for (*x* = 0; *x*<10; *x*++) {} is run ?
    (A) 10 (B) 9
    (C) 0 (D) 1

58. When does the code block following while (x<100) execute ?
    (A) When *x* is less than one hundred
    (B) When *x* is greater than one hundred
    (C) When *x* is equal to one hundred
    (D) None of the above

59. Which is not a loop structure ?
(A) For (B) Do while
(C) While (D) Repeat until

60. How many times is a do while loop guaranteed to loop ?
(A) 0 (B) Infinitely
(C) 1 (D) Variable

61. Streams are—
(A) Abstraction to perform input and output operations in sequential media
(B) Abstraction to perform input and output operations in direct access media
(C) Objects where a program can either insert or extract characters to and from it
(D) Both (A) and (C)

62. Which of the following is known as insertion operator ?
(A) ^ (B) v
(C) << (D) >>

63. Regarding the use of new line character (/n) and endl manipulator with cout statement—
(A) Both ways are exactly same
(B) Both are similar but endl additionally performs flushing of buffer
(C) Endl can't be used with cout
(D) \n can't be used with cout

64. Which of the following is output statement in C++ ?
(A) Print (B) Write
(C) Cout (D) Cin

65. Which of the following is input statement in C++ ?
(A) cin (B) Input
(C) Get (D) None of these

66. By default, the standard output device for C++ programs is—
(A) Printer (B) Monitor
(C) Modem (D) Disk

67. By default, the standard input device for C++ program is—
(A) Keyboard
(B) Mouse
(C) Scanner
(D) None of the above

68. Which of the following statement is true regarding cin statement ?
(A) Cin statement must contain a variable preceded by >> operator
(B) Cin does not process the input until user presses RETURN key
(C) You can use more than one datum input from user by using cin
(D) All of the above

69. Which of the following is extraction operator in C++ ?
(A) ^ (B) v
(C) << (D) >>

70. When requesting multiple datum, user must separate each by using ?
(A) A space
(B) A tab character
(C) A new line character
(D) All of the above

71. Find out the error in following block of code.
If ($x = 100$)
Cout << "$x$ is 100";
(A) 100 should be enclosed in quotations
(B) There is no semicolon at the end of first line
(C) Equals to operator mistake
(D) Variable $x$ should not be inside quotation

72. Looping in a program means—
(A) Jumping to the specified branch of program
(B) Repeat the specified lines of code
(C) Both of above
(D) None of the above

73. The difference between while structure and do structure for looping is—
(A) In while statement the condition is tested at the end of first iteration
(B) In do structure the condition is tested at the beginning of first iteration
(C) The do structure decides whether to start the loop code or not whereas while statement decides whether to repeat the code or not
(D) In while structure condition is tested before executing statements inside loop whereas in do structure condition is tested before repeating the statements inside loop

74. Which of the following is not a looping statement in C ?
(A) While (B) Until
(C) Do (D) For

75. Which of the following is not a jump statement in C++ ?
(A) Break (B) Goto
(C) Exit (D) Switch

## Answers

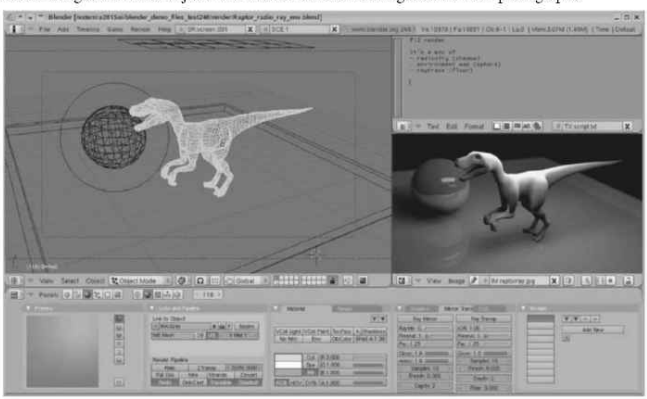
| | | | | |
|---|---|---|---|---|
| 1. (C) | 2. (D) | 3. (A) | 4. (C) | 5. (B) |
| 6. (A) | 7. (B) | 8. (C) | 9. (B) | 10. (A) |
| 11. (A) | 12. (C) | 13. (D) | 14. (C) | 15. (A) |
| 16. (B) | 17. (B) | 18. (B) | 19. (C) | 20. (B) |
| 21. (B) | 22. (B) | 23. (C) | 24. (B) | 25. (B) |
| 26. (D) | 27. (D) | 28. (A) | 29. (D) | 30. (D) |
| 31. (B) | 32. (A) | 33. (A) | 34. (C) | 35. (C) |
| 36. (B) | 37. (C) | 38. (B) | 39. (B) | 40. (A) |
| 41. (B) | 42. (C) | 43. (A) | 44. (D) | 45. (C) |
| 46. (C) | 47. (C) | 48. (A) | 49. (A) | 50. (A) |
| 51. (B) | 52. (A) | 53. (C) | 54. (A) | 55. (A) |
| 56. (B) | 57. (A) | 58. (A) | 59. (D) | 60. (C) |
| 61. (D) | 62. (C) | 63. (B) | 64. (C) | 65. (A) |
| 66. (B) | 67. (A) | 68. (D) | 69. (D) | 70. (D) |
| 71. (C) | 72. (B) | 73. (D) | 74. (B) | 75. (D) |

❑❑

# 10 Computer Graphics

### Computer Graphics

A branch of computer science that deals with the theory and techniques of computer image synthesis. Computers produce images by analyzing a collection of dots, or pixels (picture elements). Computer graphics is used to enhance the transfer and understanding of information in science, engineering, medicine, education, and business by facilitating the generation, production, and display of synthetic images of natural objects with realism almost indistinguishable from photographs.



## Computer Graphics Terminology

### Alpha Channel

An explanation of the alpha channels as it relates to graphics software.

### Anti-aliasing

Anti-aliasing makes text and shapes look smooth in bitmap graphics.

### Artifacts

JPEG artifacts are the result of an aggressive data compression scheme that discards some image data.

### Aspect Ratio and Cropping to the Proper Print Proportions

The definition of aspect ratio as it relates to graphics software.

### Bitmap (or Raster)

The definition of bitmap and raster as it relates to graphics software.

### 2D Graphics

Displayed representation of a scene or an object along two axes of reference: height and width (x and y).

### 3D Graphics

Displayed representation of a scene or an object that appears to have three axes of reference: height, width, and depth (x, y, and z).

### 3D Pipeline

The process of 3D graphics can be divided into three-stages : tessellation, geometry, and rendering. In the tessellation stage, a described model of an object is created, and the object is then converted to a set of polygons. The geometry stage includes transformation, lighting, and setup. The rendering stage, which is critical for 3D image quality, creates a two dimensional display from the polygons created in the geometry stage.

### Alpha Plane

An extra Colour channel to hold transparency information; pixels become quad values (RGBA). In a 32-bit frame buffer there are 24 bits of colour, 8 each for red, green, and blue, along with an 8-bit alpha channel.

### Animation

A technique providing the illusion of movement using a sequence of (rendered) still images.

### Anti-aliasing

Anti-aliasing is sub pixel interpolation, a technique that reduces the jagged effect of edges and makes them appear to have better resolution.

### Application Programming Interface (API)

A standardized programming interface allowing developers to write their applications to a standard and without specific knowledge of hardware implementations. The software driver for the hardware intercepts the API instructions and translates them into specific instructions tailored to specific hardware.

### Bitmap

A Bitmap is a pixel by pixel image.

### Blending

Blending is the combining of two or more objects by adding them on a pixel-by-pixel basis. Bus mastering A feature of PCI buses that allows a card with this feature to retrieve data directly from system memory without any interaction with the host CPU.

### Buffer

Memory dedicated to a specific function or set of functions. For example: the graphics memory functions as a frame buffer, but can also be used as a Z buffer or a video buffer. Smaller buffers exist in many different places inside the display controller's memory as well and serve as temporary storage areas for data (e.g. bitmaps).

### Chroma Keying

This is the removal of a color from one image to reveal another image 'behind' it. The removed color becomes transparent. This technique is also referred to as "colour-separation overlay" ('CSO'), 'greenscreen' and 'bluescreen'. Since not all objects are easily modeled with polygons, chroma keying is used to include complex objects in a scene as texture maps.

### Clipping

This usually means avoiding the drawing of items outside a defined field of view (*e.g.* in 2D a rectangular area).

### Depth Cueing

Depth cueing is the lowering of intensity as objects move away from the viewpoint.

### Display List

A display list is a group of graphic commands and arguments that has been stored for subsequent execution. The list can be stored in the CPU RAM or in local graphic memory.

### Dithering

Dithering is a technique for archiving 24-bit quality in 8 or 16-bit frame buffers. Dithering uses two colors to create the appearance of a third, giving a smooth appearance to an otherwise abrupt transition.

### Double Buffering

A method of using two buffers, one for display and the other for rendering. While one of the buffers is being displayed, the other buffer is operated on by a rendering engine. When the new frame is rendered, the two buffers are switched. The viewer sees a perfect image all the time.

### Flat Shading

The flat shading method is also called constant shading. For rendering, it assigns a uniform color throughout an entire polygon. This shading results in the lowest quality, an object surface with a faceted appearance and a visible underlying geometry that looks 'blocky'.

### Fill Rate

The speed at which the display controller can render pixels. Usually measured in millions of pixels per second (Megapixels/sec).

### Fog/Fogging

Fog is the blending of an object with a fixed color as its pixels become farther away from the viewpoint. It is a technique used in 3D computer graphics to enhance the perception of distance. Objects in the distance that have been "fogged out" can be computed more quickly. Fogging is primarily used in games and entertainment systems.

### Frames per Second (FPS)

The rate at which the graphics processor renders new frames, or full screens of pixels. Benchmarks and games use this metric as a measurement of a display controller's performance. A faster display controller will render more frames per second, making the application more fluid and responsive to user input

### Gamma

The characteristics of displays using phosphors (as well as some cameras) are nonlinear. A small change in voltage when the voltage level is low produces a change in the output display brightness level; but this same small change in voltage at a high voltage level will not produce the same magnitude of change in the brightness output. This effect, or actually the difference between what you should have and what you actually measured, is known as gamma.

### Gouraud Shading

One of the most popular smooth shading algorithms, and named after its French originator, Henri Gouraud. Gouraud shading, or color interpolation, is a process by which color information is interpolated across the face of the polygon to determine the colors at each pixel. It assigns color to every pixel within each polygon based on linear interpolation from the polygon's vertices. This method improves the 'blocky' (see Flat Shading) look and provides an appearance of plastic or metallic surfaces. In practice, it is used to achieve smooth lighting on low-polygon surfaces without the heavy computational requirements of calculating lighting for each pixel.

### Graphics Controller/Graphics Processor/ Graphics Processing Unit (GPU)

A high-performance 2D or 3D processor that integrates the entire graphics pipeline (transformation, lighting, setup, and rendering). A GPU offloads all calculations from the CPU, freeing the CPU for other functions such as physics and artificial intelligence.

### Graphic Display Controller (GDC)

A GPU with integrates a flexible display controller for the connection of multiple standard displays.

### Graphics Pipeline

The series of functions, in logical order, that must be performed to compute and display computer graphics.

### Hidden Surface Removal

Also called visible surface determination, this entails displaying only those surfaces visible to a viewer because objects are a collection of surfaces or solids.

### Interpolation

Interpolation is a mathematical way of regenerating missing or needed information. For example, an image needs to be scaled up by a factor of two, from 100 pixels to 200 pixels. The missing pixels are generated by interpolating between the two pixels that are on either side of the pixel that needs to be generated. After all of the 'missing' pixels have been interpolated, 200 pixels exist where only 100 existed before, and the image is twice as big as it used to be.

### Jaggies

A slang term used to describe the stair-step effect you see along curves and edges in text or bit-mapped graphics. Anti-aliasing can smooth out jaggies.

### Layer

A level of an image that can be edited independently from the rest of the image. Our graphics controllers support up to 8 different layers in hardware (simultaneous).

### Lighting

There are many techniques for creating realistic graphical effects to simulate a real-life 3-D object on a 2-D display. One technique is lighting. Lighting is used to create realistic-looking scenes with greater depth instead of flat-looking or cartoonish environments.

### Line Buffer

A line buffer is a memory buffer used to hold one line of video. If the horizontal resolution of the screen is 640 pixels and RGB is used as the color space, the line buffer would have to be 640 locations long by 3 bytes wide. This amounts to one location for each pixel and each color plane. Line buffers are typically used in filtering algorithms.

### MIP Mapping

Multum in Parvum (Latin) means 'many in one'. MIP mapping is technique to improve graphics performance by generating and storing multiple versions of the original texture image, each with different levels of detail. The graphics processor chooses a different mipmap based on how large the object is on the screen, so that low-detail textures can be used on objects that contain only a few pixels and high-detail textures can be used on larger objects where the user will actually see the difference. This technique saves memory bandwidth and enhances performance.

### Occlusion

The effect of one object in 3-D space blocking another object from view.

### OpenGL

A graphics API that was originally developed by Silicon Graphics, Inc.™ (SGI) for use on professional graphics workstations. OpenGL subsequently grew to be the standard API for CAD and scientific applications and today is popular for consumer applications such as PC games as well. OpenGL ES is the version for embedded systems.

### Palletised Texture

Palletised Texture means compressed texture formats, such as 1-, 2-, 4-, and 8-bit instead of 24-bit; this allows more textures to be stored in less memory.

### PCI Bus

The Peripheral Component Interconnect standard (in practice almost always shortened to PCI) specifies a computer bus for attaching peripheral devices to a main CPU. The PCI bus is common in modern PCs, where it has displaced ISA and VESA Local Bus s the standard expansion bus, but it also appears in many other computer types. The peak transfer rate is 133MB/second for the 32-bit bus width standard at 33MHz.

### Phong Shading

Phong shading is a sophisticated smooth shading method, originated by Phong Bui-tuong. The Phong shading algorithm is best known for its ability to render precise, realistic specula highlights. During rendering, Phong shading achieves excellent realism by calculating the amount of light on the object at tiny points across the entire surface instead of at the vertices of the polygons. Each pixel representing the image is given its own color based on the lighting model applied at that point. Phong shading requires much more computation for the hardware than Gouraud shading.

### Pixel

Shortform for 'picture element'. A pixel is the smallest element of a graphics display or the smallest element of a rendered image.

### Pixels per Second

The units used to describe the fill rate of a display controller. It is usually measured in millions of pixels per second (Megapixels/sec).

### Polygon

The building blocks of all 2D or 3D objects (usually triangles) used to form the surfaces and skeletons of rendered objects.

### Projection

The process of reducing three dimensions to two dimensions for display is called Projection. It is the mapping of the visible part of a three dimensional object onto a two dimension screen.

### Refresh Rate

The frequency at which an analogue monitor or TFT redraw the image, measured in Hertz (Hz) or cycles per second. As an example, a refresh rate of 60 Hz means the screen is redrawn 60 times per second. Higher refresh rates reduce or eliminate image 'flicker' that can cause eye strain.

### Rendering

The process of creating life-like images on a screen using mathematical models and formulas to add shading, color, and lamination to a 2D or 3D wireframe. Hence: Rendering Engine - the part of the graphics engine that draws 3D primitives, usually triangles or other simple polygons. In most implementations, the rendering engine is responsible for interpolation of edges and 'filling in' the triangle.

### RGB Colour Resolution

The resolution of each RGB (red green blue) colour channel is represented by n bit. An RGB888 colour system has 8 bits per channel = 24 bits per pixel colour resolution. This gives a choice of over 16 million colours per pixel. Such a system is generally known as a true colour or full colour system. Other common standards are RGB666 or RGB555.

### SGRAM

Synchronous Graphics Random Access memory (SGRAM) is a type of memory that is optimized for graphics use. SGRAM is capable of running at much higher speeds than fast page or EDO DRAM. SGRAM is able to execute a small number of frequently executed operations, such as buffer clears, specific to graphics applications independently of the controller.

### Shading

Colouring a surface according to its incident light. The colour depends on the position, orientation and attributes of both the surface and the sources of the illumination.

### Span

In raster graphics architecture a primitive is formed by scan conversion where each scan line intersects the primitive at two ends, P left and P right. A contiguous sequence of pixels on the scan line between P left and P right is called a Span. Each pixel within the span contains the z, R, G, and B data values.

### Stencil Buffer

The section of the graphics memory that stores the stencil data. Stencil data can be used to mask pixels for a variety of reasons, such as stippling patterns for lines, simple shadows and more.

### Tessellation

Processing 3D graphics can be pipelined into three-stages: tessellation, geometry, and rendering. Tessellation is the process of subdividing a surface into smaller shapes. To describe object surface patterns, tessellation breaks down the surface of an object into manageable polygons. Triangles or quadrilaterals are two usually used polygons in drawing graphical objects because computer hardware can easy manipulate and calculate these two simple polygons. An object divided into quads and sub-divided into triangles for convenient calculation.

### Texture Anti-aliasing

An interpolation technique used to remove texture distortion, stair casing or jagged edges, at the edges of an object.

### Texture Filtering

Removing the undesirable distortion of a raster image, also called aliasing artifacts, such as sparkles and blockiness, through interpolation of stored texture images.

### Texture Mapping

Texture mapping is based on a stored bitmap consisting of texture pixels, or texels. It consists of wrapping a texture image onto an object to create a realistic representation of the object in 3D space. The object is represented by a set of polygons, usually triangles. The advantage is complexity reduction and rendering speed, because only one texel read is required for each pixel being written to the frame buffer. The disadvantage is the blocky image that results when the object moves.

### Vertex

A vertex is a point in 3D space with a particular location, usually given in terms of its x, y, and z coordinates. It is one of the fundamental structures in polygonal modeling : two vertices, taken together, can be used to define the endpoints of a line; three vertices can be used to define a triangle.

### Z-buffer

The area of the graphics memory used to store the Z or depth information about rendered objects. The Z-buffer value of a pixel is used to determine if it is behind or in front of another pixel. Z calculations prevent background objects from overwriting foreground objects in the frame buffer.

### Z-sorting

A process of removing hidden surfaces by sorting polygons in back-to-front order prior to rendering. Thus, when the polygons are rendered, the forward-most surfaces are rendered last. The rendering results are correct unless objects are close to or intersect each other. The advantage is not requiring memory for storing depth values. The disadvantage is the cost in more CPU cycles and limitations when objects penetrate each other.

## Multiple Choice Questions

1. ..... refers to any type of application or presentation that involves more than one type of media, such as text, graphics, video, animation, and sound.
   (A) An executable file
   (B) Desktop
   (C) Multimedia
   (D) Hypertext
2. One of the disadvantages of multimedia is—
   (A) Cost (B) Adaptability
   (C) Usability (D) Relativity
3. The text color in a presentation should contrast with the ..... color.
   (A) CPU (B) frame
   (C) stack (D) background
4. Images included in many software titles are called.....
   (A) clipart (B) popups
   (C) jpg files (D) tiff files
5. Paint programs and image editors are used for creating and editing ?
   (A) bitmap images (B) vector images
   (C) text (D) HTML
6. Raster images are also known as—
   (A) Bitmap images
   (B) Vector images
   (C) Clip art imagee
   (D) Multimedia images
7. Images made up of thousands of pixels are called ?
   (A) bitmap (B) vector
   (C) story boards (D) graphics
8. Which of the following programs is not a popular professional image editor program?
   (A) Adobe PageMaker
   (B) Microsoft Paint
   (C) Adobe Photoshop
   (D) Corel Photo Paint
9. Vector images are ?
   (A) composed of pixels
   (B) composed of thousands of dots
   (C) slightly more difficult to manipulate than other images
   (D) composed of objects such as lines, rectangles, and ovals
10. Programs used to create or modify vector images are called ?
    (A) illustration programs
    (B) image editors
    (C) graphical modifiers
    (D) bit publishing packages
11. Corel Draw is an example of a(n) .....
    (A) groupware application
    (B) bit publishing package
    (C) paint program
    (D) graphics suite
12. A collection of graphics programs and supporting data files is called a ?
    (A) groupware application
    (B) freehand package
    (C) graphics suite
    (D) shared program collection
13. An essential ingredient for effective multimedia presentations incorporates user participation or ?
    (A) links (B) buttons
    (C) interactivity (D) integration
14. The term that describes a user's participation with a multimedia presentation is ?
    (A) hyperactivity (B) interactivity
    (C) inactivity (D) reactivity
15. Multimedia can contain—
    (A) Graphics, animation, video, music, and voice
    (B) Only numeric-type data
    (C) Numeric, text, and picture data
    (D) Databases that, in turn, contain other databases, creating a massive data collection
16. Primary uses of business interactive multimedia include all of the following except ?
    (A) product demonstrations
    (B) Web page development

(C) entertainment
(D) high-quality presentations

17. The connection between a multimedia presentation and a file containing a song to be played is called a(n) ?
(A) link (B) chain
(C) pointer (D) tie

18. Clicking on special areas called ? activates the various features of a multimedia presentation.
(A) activators (B) starters
(C) pages (D) buttons

19. When determining the overall objective of the project, the resources required and the persons or team who will work on the project, you are in the ..... step of developing a multimedia presentation.
(A) planning (B) designing
(C) creating (D) supporting

20. The creation of a storyboard is essential to the development of the project. This is the ..... step of development.
(A) planning (B) designing
(C) creating (D) supporting

21. Errors are identified and the presentation is evaluated in terms of effectiveness in the ..... step.
(A) planning (B) designing
(C) creating (D) supporting

22. Before building a presentation with a multimedia authoring system, the designer would use a ..... .
(A) flowchart
(B) hypermedia database
(C) button file
(D) storyboard

23. A(n) ..... is a design tool that shows the overall flow of a multimedia presentation.
(A) link (B) graphical map
(C) storyboard (D) Gantt chart

24. A specialized program used to create multimedia presentations is a ..... .
(A) Web authoring program
(B) desktop publishing program
(C) multimedia authoring program
(D) illustration program

25. Popular multimedia authoring programs include the following except for—
(A) Macromedia Director
(B) QuarkXPress
(C) Authorware
(D) Toolbox

26. Creating Web sites is called—
(A) Web authoring
(B) HTML creating
(C) Storyboard designing
(D) Web mapping

27. The overall Web site design is commonly represented in a(n) ..... .
(A) Web map (B) graphical map
(C) Web board (D) Web storyboard

28. Most Web sites have moving graphics called—
(A) Animations (B) Vectors
(C) Links (D) Morphs

29. This type of animation is usually full-screen and highly dynamic and interactive—
(A) Storyboard (B) Applet
(C) Java D) Flash

30. A special effect in which one image seems to melt into another is referred to as—
(A) Drifting (B) Flashing
(C) Morphing (D) Polling

31. More specialized and powerful programs typically used to create sophisticated commercial sites are known as—
(A) Web page editors
(B) HTML editors
(C) Web authoring programs
(D) All of the above

32. Microsoft Front Page is an example of a(n) .....
(A) authorizing streaming program
(B) graphical map editor
(C) Web page editor
(D) robotics authoring program

33. The simulated experience where you can create and experience new forms of reality without actually being there is referred to as .....
(A) unstructured problems

(B) virtual reality
(C) VRML
(D) robotics

34. A simulated experience generated by computer, like visiting the surface of the sun or experiencing life inside a human blood cell, is called ..... .
(A) visual reality
(B) extended experience
(C) virtual reality
(D) vicarious actuality

35. The field of computer science known as artificial intelligence attempts to ..... .
(A) replace human thought and emotion
(B) serve as a buffer to free humans from decision-making tasks
(C) replace human intelligence
(D) mimic or simulate human senses, thought processes, and actions

36. People are best at solving ..... problems, using intuition and reasoning.
(A) numeric (B) logical
(C) unstructured (D) structured

37. More serious applications of virtual reality involve ..... .
(A) participating in amusement park rides
(B) video games and projects
(C) training environments
(D) knowledge-based systems

38. Another name for a knowledge-based system is—
(A) A perception system
(B) A conventional system
(C) An expert system
(D) A database management system

39. Expert systems use a(n) ..... that contains specific facts and rules to relate these facts.
(A) rule base
(B) knowledge base
(C) rule set
(D) expert knowledge

40. Fuzzy logic is—
(A) used to respond to questions in a humanlike was
(B) a new programming language used to program animation
(C) the result of fuzzy thinking
(D) a term that indicates logical values greater than one

41. A robot is a .....
(A) computer-controlled machine that mimics the motor activities of living things
(B) machine that thinks like a human
(C) machine that replaces a human by performing complex mental processing tasks
(D) type of virtual reality device that takes the place of humans in adventures

42. Perception system robots—
(A) act as a transportation system, like a 'mailmobile'
(B) imitate some human senses
(C) perform manufacturing tasks like painting cars
(D) are another name for virtual reality

43. A mobile robot—
(A) acts as a transportation system, like a 'mailmobile'
(B) imitates some human senses
(C) performs manufacturing tasks like painting cars
(D) is another name for virtual reality

44. Computer-controlled machines that mimic the motor activities of living things are—
(A) Virtual reality
(B) Robotics
(C) Knowledge-based systems
(D) Machines that think like a human

45. Robots used in automobile plants would be classified as—
(A) perception systems
(B) industrial robots
(C) mobile robots
(D) knowledge robots

46. Interactive computer graphics uses various kind of input devices such as—
(A) Mouse (B) Graphic
(C) Joystick (D) All of the above

47. Input function are used for—
    (A) Control the data flow from these interactive devices
    (B) Process the data flow from these interactive devices
    (C) Both (A) and (B)
    (D) None of the above

48. A graphics package contains—
    (A) No of housekeeping task such as clearing a display screen
    (B) No of housekeeping task such as initializing
    (C) Both (A) and (B)
    (D) None of above

49. The interactive computer graphics involves ..... way communication b/w computer and the user.
    (A) One (B) Two
    (C) Three (D) Four

50. Interactive computer graphics enables a user to customize the graphics in ..... .
    (A) Computer way
    (B) His own way
    (C) Both (A) and (B)
    (D) None of the above

## Answers

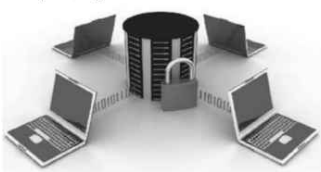
| | | | | |
|---|---|---|---|---|
| 1. (C) | 2. (A) | 3. (D) | 4. (A) | 5. (A) |
| 6. (A) | 7. (A) | 8. (A) | 9. (D) | 10. (A) |
| 11. (D) | 12. (C) | 13. (C) | 14. (B) | 15. (A) |
| 16. (C) | 17. (A) | 18. (D) | 19. (A) | 20. (B) |
| 21. (D) | 22. (D) | 23. (C) | 24. (C) | 25. (B) |
| 26. (A) | 27. (B) | 28. (A) | 29. (D) | 30. (C) |
| 31. (D) | 32. (C) | 33. (B) | 34. (C) | 35. (D) |
| 36. (C) | 37. (C) | 38. (C) | 39. (B) | 40. (A) |
| 41. (A) | 42. (B) | 43. (A) | 44. (B) | 45. (B) |
| 46. (D) | 47. (C) | 48. (C) | 49. (B) | 50. (B) |

❑❑

# 11 Database Management System

## Database

Databases are used to organized mechanism for storing, managing and retrieving information. They do so through the use of tables. If you're familiar with spreadsheets like Microsoft Excel, you're probably already accustomed to storing data in tabular form. It's not much of a stretch to make the leap from spreadsheets to databases.



## Database Tables

Just like Excel tables, database tables consist of columns and rows. Each column contains a different type of attribute and each row corresponds to a single record. For example, imagine that we were building a database table that contained names and telephone numbers. We'd probably set up columns named 'First Name', 'Last Name' and 'Telephone Number'. Then we'd simply start adding rows underneath those columns that contained the data we're planning to store.

## Databases and Spreadsheets

Databases are actually much more powerful than spreadsheets in the way you're able to manipulate data. Here are just a few of the actions that you can perform on a database that would be difficult if not impossible to perform on a spreadsheet—

- Retrieve all records that match certain criteria.
- Update records in bulk.
- Cross-reference records in different tables.
- Perform complex aggregate calculations.

You can correlate information from multiple tables in a database by creating foreign key relationships between the tables.

## Normalization

Normalization is the process of efficiently organizing data in a database. There are two goals of the normalization process—eliminating redundant data (for example, storing the same data in more than one table) and ensuring data dependencies make sense (only storing related data in a table). Both of these are worthy goals as they reduce the amount of space a database consumes and ensure that data is logically stored.

## The Normal Forms

The database community has developed a series of guidelines for ensuring that databases are normalized. These are referred to as normal forms and are numbered from one (the lowest form of normalization, referred to as first normal form or 1NF) through five (fifth normal form or 5NF).

## First Normal Form (1NF)

First normal form (1NF) sets the very basic rules for an organized database—

- Eliminate duplicative columns from the same table.
- Create separate tables for each group of related data and identify each row with a unique column or set of columns (the primary key).

## Second Normal Form (2NF)

Second normal form (2NF) further addresses the concept of removing duplicative data—

- Meet all the requirements of the first normal form.
- Remove subsets of data that apply to multiple rows of a table and place them in separate tables.
- Create relationships between these new tables and their predecessors through the use of foreign keys.

### Third Normal Form (3NF)

Third normal form (3NF) goes one large step further—

- Meet all the requirements of the second normal form.
- Remove columns that are not dependent upon the primary key.

### Boyce-Codd Normal Form (BCNF or 3.5NF)

The Boyce-Codd Normal Form, also referred to as the "third and half (3.5) normal form", adds one more requirement—

- Meet all the requirements of the third normal form.
- Every determinant must be a candidate key.

### Fourth Normal Form (4NF)

Finally, fourth normal form (4NF) has one additional requirement—

- Meet all the requirements of the third normal form.
- A relation is in 4NF if it has no multi-valued dependencies.

Remember, these normalization guidelines are cumulative. For a database to be in 2NF, it must first fulfill all the criteria of a 1NF database.

### Database Management Systems

A database management system (DBMS) is the software that allows a computer to perform database functions of storing, retrieving, adding, deleting and modifying data. Relational database management systems (RDBMS) implement the relational model of tables and relationships.

### Examples

Microsoft Access, MySQL, Microsoft SQL Server, Oracle and FileMaker Pro are all examples of database management systems.

## Database Management System Terminology

### Alternate (candidate) Key

A column or combination of columns, other than the primary key column(s), which may be used to uniquely identify a row in a table. The primary key is chosen from one of the candidate keys.

### Attribute

An attribute is a part of the description of the entity. The entity itself is described by one or more attributes; together, they describe all things of importance about the entity. Example—Typicalattributes for a customer would be name, address, telephone, etc.

### Candidate Keys

Each entity should have at least one candidate (that is: unique) key defined. This is in order to being able to identify each row in the table at hand.

### Cardinality

The cardinality of an entity indicates the number of instances (zero or many) of an entity.

Many describe the cardinality through relationships—One-to-one, One-to-many, Many-to-many. In addition, each end of a relationship may be optional or mandatory. The cardinality term is not restricted to relationships, however: We also try to distinguish between low and high cardinality on attributes: an attribute for GENDER will have a low cardinality (2); Male or Female. This may inflict on how we design indexes in the database.

Another meaning of cardinality is to describe how many rows you have in a specific table.

### Column

Database tables are composed of individual columns corresponding to the attributes of the object

### Data Definition Language (DDL)

The language used to define objects in a database—CREATE TABLE, CREATE INDEX, and so on. DDL provides the semantics for administering all the physical objects in your database. It is based on a given standard, but may deviate some from vendor to vendor. All of the objects created together, form the 'schema' of a given application.

### Data Manipulation Language (DML)

The language used to manipulate objects in a relational database: We only have four statements in DML—INSERT, SELECT, UPDATE and DELETE. DML provides the semantics for manipulating one or more occurrences (record) in a table in our database. It is based on a given standard,

but may deviate some from vendor to vendor, especially through 'extensions' found valuable by the given vendor.

### Data Model

A data model is not the model (conceptual/logical/physical) of your future or existing database—It is a generic model which you base your analysis and design upon. The relational model is one such data model.

### Database Model

A Database model is the logical conversion of an Entity Relationship model. While an ER model reflects the business case, the Database model visualizes the logical model, which in turn is the basis for the physical implementation in the form of database tables, indexes and other mechanisms in the database, necessary to construct the database in question.

### Database Normalization

Database Normalization is the process of analyzing your database model to ensure that information is stored only in one place in the database, and that there are no derivates of the information within the database.

### Data Type

Identifies the kind of information that an Attribute/column in an entity/table on a specific database platform represents. These are actual physical representations and are dependent on the actual RDBMS's. The datatype should be given by the domain definition for that attribute/column.

### Domain

A standardized definition which applies to many attributes/columns. For example, the domain MONEY may be specified as NUMBER, 15 digits long, with 2 decimals, not allowed to have a value of 0.00, and so on. Applying domain definitions to every attribute/column, eases the implementation of changes, and assures that the same kind of information is treated equally throughout the system.

### Entity

Any kind of information of importance to the business—Customers, Orders, Products, or whatever information we need in order to perform a certain task.Used in the building of the conseptial (business) model.

### Foreign Key

Column or combination of columns in a table, whose values are related to a primary key in another table.

### Index

An index is a physical mechanism applied to one (or a combination of) column(s). The purpose of the index is for the database system to use the index as a look-up mechanism instead of reading the whole row. Indexes are a prime resource for optimalization (and thereby increasing speed) of searches in the database.

### Join Relationship

A join relationship is a collection of information from two or more tables. The join is performed by relating columns which are foreign key columns in one table with equivalent columns which are primary key columns in the other table.

### Meta Data

'Data about Data'. This is the documentation stored in the database repository, and which holds information about your database objects. In Oracle, for example, the table USER_TABLES holds vital information about your tables.

### NULL Values

The concept of NULL, which means 'unknown value', (not the digit zero) is not a part of the relational model, but has been introduced by the different vendors. It can create unexpected problems when accessing the database.

### Open Data Base Connectivity (ODBC)

A general interface for communication with different vendor-specific Relational Database Systems.

### Primary Key

A column (or combination of columns) whose value(s) uniquely identify a row in a table. This has been a central concept in Relational Theory, and crucial to both identification and performance. Lately, the concept has been questioned, saying that a table should have one or more candidate keys only; however, for all practical reasons, a table should never be created before its (unique) primary key has been determined.

RDBMS—Short for Relational Database Management System, RDBMS refers to a rela-

tional database plus supporting software for managing users and processing SQL queries, performing backups/restores and associated tasks.

RDBMS usually include an API so that developers can write programs that use them.

### Typical RDBMS Include

- Microsoft Access
- Microsoft SQL Server
- Sybase (The forerunner of Microsoft SQL Server)
- IBM DB2
- Oracle
- Ingres
- MySQL
- Postgresql
- SQlite

### Ref Cursor

A ref cursor is a pointing feature for use in a procedural language. The use of a ref cursor, explicit, gives you the power to navigate a result set from a SELECT statement one record at a time. It is a basic concept in Oracle, but can also be used from other procedural languages such as Java.

### Referential Integrity

Referential integrity is a database concept that ensures that relationships between tables remain consistent. When one table has a foreign key to another table, the concept of referential integrity states that you may not add a record to the table that contains the foreign key unless there is a corresponding record in the linked table. It also includes the techniques known as cascading update and cascading delete, which ensure that changes made to the linked table are reflected in the primary table.

Consider the situation where we have two tables: Employees and Managers. The Employees table has a foreign key attribute entitled Managed By which points to the record for that employee's manager in the Managers table. Referential integrity enforces the following three rules—

1. We may not add a record to the Employees table unless the Managed By attribute points to a valid record in the Managers table.

2. If the primary key for a record in the Managers table changes, all corresponding records in the Employees table must be modified using a cascading update.

3. If a record in the Managers table is deleted, all corresponding records in the Employees table must be deleted using a cascading delete.

### Relationship

A relationship is an association between two entities. For example, the relationship between the ORDERS and CUSTOMERS tables will normally be that an order is placed by ONE AND ONLY ONE customer, while a given customer MAY HAVE placed ONE OR MORE orders. This will create a link between orders and customers, and thereby generating a business rule inside the database to enforce that relationship.

### Structured Query Language (SQL)

SQL is the industry standard language for designing and communicating with relational databases.

### Stored Function

A stored function is SQL (and procedural code, in most cases), placed in the database itself. It masks the business logic from the programmer. In addition, stored functions return only one value to the calling program, and can be used as part of DML statements and within calculations and conditional statements as a parameter.

### Stored Procedure

A stored procedure is SQL (and procedural code, in most cases), placed in the database itself. It masks the business logic from the programmer. In addition, stored procedures represent a powerful tool to let all programmers have a generic interface to different access mechanisms to each table in the database.

### Table

The physical implementation of an entity. This is where the actual data is stored as customers, orders, products, or whatever. Each table consists of one or more columns.

### Trigger

A trigger is a stored procedure assigned to a given table. It 'fires' whenever you do an operation on that table (BEFORE/AFTER INSERT/UPDATE/DELETE etc.) Triggers are powerful,

performance-enhancing mechanisms in the database.

**Unique Identifier**

The equivalent of a primary key. It may also be a candidate for creating unique indexes in addition to the primary key.

**View**

An imaginary table—A view may be constructed to give the user/programmer access to a limited result set from one or more tables. It is often used for security reasons; restricting access through views.

## Multiple Choice Questions

1. Which of the following products was an early implementation of the relational model developed by E.F. Codd of IBM ?
   (A) IDMS (B) DB2
   (C) dBase-II (D) R : base
2. Which of the following products was the first to implement true relational algebra in a PC DBMS ?
   (A) IDMS (B) Oracle
   (C) dBase-II (D) Rbase
3. SQL stands for ..... .
   (A) Structured Query Language
   (B) Sequential Query Language
   (C) Structured Question Language
   (D) Sequential Question Language
4. The following are functions of a DBMS except ..... .
   (A) Creating and processing forms
   (B) Creating databases
   (C) Processing data
   (D) Administrating database
5. An Enterprise Resource Planning application is an example of a(n) ..... .
   (A) Single-user database application
   (B) Multiuser database application
   (C) e-commerce database application
   (D) Data mining database application
6. A DBMS that combines a DBMS and an application generator is ..... .
   (A) Microsoft SQL Server
   (B) Microsoft Access
   (C) IBM DB2
   (D) Oracle Corporatios Oracle
7. You have run an SQL statement that asked the DBMS to display data in a table named USER_TABLES. The results include columns of data labeled 'TableName', 'Number Of Columns' and 'Primary Key'. You are looking at ..... .
   (A) User data (B) Metadata
   (C) A report (D) Indexes
8. Every time attribute A appears, it is matched with the same value of attribute B, but not the same value of attribute C. Therefore, it is true that—
   (A) $A \rightarrow B$ (B) $A \rightarrow C$
   (C) $A \rightarrow (B, C)$ (D) $(B, C) \rightarrow A$
9. The different classes of relations created by the technique for preventing modification anomalies are called—
   (A) Normal forms.
   (B) Referential integrity constraints.
   (C) Functional dependencies.
   (D) None of the above is correct.
10. A relation is in this form if it is in BCNF and has no multivalued dependencies—
    (A) Second normal form
    (B) Third normal form
    (C) Fourth normal form
    (D) Domain/key normal form
11. Row is synonymous with the term—
    (A) Record (B) Relation
    (C) Column (D) Field
12. The primary key is selected from the—
    (A) Composite keys (B) Determinants
    (C) Candidate keys (D) Foreign keys
13. Which of the following is a group of one or more attributes that uniquely identifies a row?
    (A) Key (B) Determinant
    (C) Tuple (D) Relation
14. A relation is considered a—
    (A) Column
    (B) One-dimensional table
    (C) Two-dimensional table
    (D) Three-dimensional table

15. In the relational model, relationships between relations or tables are created by using—
    (A) Composite keys (B) Determinants
    (C) Candidate keys (D) Foreign keys
16. When the values in one or more attributes being used as a foreign key must exist in another set of one or more attributes in another table, we have created a(n)—
    (A) Transitive dependency
    (B) Insertion anomaly
    (C) Referential integrity constraint
    (D) Normal form
17. Table is synonymous with the term—
    (A) Record (B) Relation
    (C) Column (D) Field
18. An attribute is a(n)—
    (A) Column of a table
    (B) Two dimensional table
    (C) Row of a table
    (D) Key of a table
19. Which of the following is not a restriction for a table to be a relation ?
    (A) The cells of the table must contain a single value
    (B) All of the entries in any column must be of the same kind
    (C) The columns must be ordered
    (D) No two rows in a table may be identical
20. A key—
    (A) Must always be composed of two or more columns
    (B) Can only be one column
    (C) Identifies a row
    (D) Identifies a column
21. A tuple is a(n)—
    (A) Column of a table
    (B) Two dimensional table
    (C) Row of a table
    (D) Key of a table
22. A relation in this form is free of all modification anomalies—
    (A) First normal form
    (B) Second normal form
    (C) Third normal form
    (D) Domain/key normal form
23. If attributes A and B determine attribute C, then it is also true that—
    (A) $A \rightarrow C$
    (B) $B \rightarrow C$
    (C) (A, B) is a composite determinant
    (D) C is a determinant
24. If attribute A determines both attributes B and C, then it is also true that—
    (A) $A \rightarrow B$ (B) $B \rightarrow A$
    (C) $C \rightarrow A$ (D) $(B, C) \rightarrow A$
25. Which of the following indicates the maximum number of entities that can be involved in a relationship ?
    (A) Minimum cardinality
    (B) Maximum cardinlity
    (C) ERD
    (D) Greater Entity Count (GEC)
26. In a one-to-many relationship, the entity that is on the one side of the relationship is called a(n) ..... entity.
    (A) Parent (B) child
    (C) instance (D) subtype
27. A recursive relationship is a relationship between an entity and ..... .
    (A) Itself
    (B) a subtype entity
    (C) an archetype entity
    (D) an instance entity
28. Which type of entity cannot exist in the database unless another type of entity also exists in the database, but does not require that the identifier of that other entity be included as part of its own identifier ?
    (A) Weak entity
    (B) Strong entity
    (C) ID-dependent entity
    (D) ID-independent entity
29. Which of the following indicates the minimum number of entities that must be involved in a relationship ?
    (A) Minimum cardinality
    (B) Maximum cardinality
    (C) ERD
    (D) Greater Entity Count (GEC)

30. Which of the following refers to something that can be identified in the users' work environment, something that the users want to track ?
    (A) Entity (B) Attribute
    (C) Identifier (D) Relationship

31. In which of the following is a single-entity instance of one type related to many entity instances of another type ?
    (A) One-to-One Relationship
    (B) One-to-Many Relationship
    (C) Many-to-Many Relationship
    (D) Composite Relationship

32. Which type of entity is related to two or more associated entities that each contain specialized attributes that apply to some but not all of the instances of the entity ?
    (A) Supertype entity
    (B) Subtype entity
    (C) Archetype entity
    (D) Instance entity

33. An attribute that names or identifies entity instances is a(n)—
    (A) Entity (B) Attribute
    (C) Identifier (D) Relationship

34. Entities of a given type are grouped into a(n)—
    (A) Database (B) Entity class
    (C) Attribute (D) ERD

35. Properties that describe the characteristics of entities are called—
    (A) Entities (B) Attributes
    (C) Identifiers (D) Relationships

36. The active data warehouse architecture includes which of the following ?
    (A) At least one data mart
    (B) Data that can extracted from numerous internal and external sources
    (C) Near real-time updates
    (D) All of the above

37. A goal of data mining includes which of the following ?
    (A) To explain some observed event or condition
    (B) To confirm that data exists
    (C) To analyze data for expected relationships
    (D) To create a new data warehouse

38. A data warehouse is which of the following ?
    (A) Can be updated by end users
    (B) Contains numerous naming conventions and formats
    (C) Organized around important subject areas
    (D) Contains only current data

39. A snowflake schema is which of the following types of tables ?
    (A) Fact (B) Dimension
    (C) Helper (D) All of these

40. The generic two-level data warehouse architecture includes which of the following ?
    (A) At least one data mart
    (B) Data that can extracted from numerous internal and external sources
    (C) Near real-time updates
    (D) All of the above

41. Fact tables are which of the following ?
    (A) Completely denormalized
    (B) Partially denoralized
    (C) Completely normalized
    (D) Partially normalized

42. Reconciled data is which of the following ?
    (A) Data stored in the various operational systems throughout the organization
    (B) Current data intended to be the single source for all decision support systems
    (C) Data stored in one operational system in the organization
    (D) Data that has been selected and formatted for end-user support applications

43. A star schema has what type of relationship between a dimension and fact table ?
    (A) Many-to-many (B) One-to-one
    (C) One-to-many (D) All of these

44. A distributed database has which of the following advantages over a centralized database ?
    (A) Software cost
    (B) Software complexity
    (C) Slow Response
    (D) Modular growth

45. Location transparency allows for which of the following ?
    (A) Users to treat the data as if it is at one location

(B) Programmers to treat the data as if it is at one location
(C) Managers to treat the data as if it is at one location
(D) All of the above

46. A heterogeneous distributed database is which of the following ?
(A) The same DBMS is used at each location and data are not distributed across all nodes
(B) The same DBMS is used at each location and data are distributed across all nodes
(C) A different DBMS is used at each location and data are not distributed across all nodes
(D) A different DBMS is used at each location and data are distributed across all nodes

47. Which of the following is true concerning a global transaction ?
(A) The required data are at one local site and the distributed DBMS routes requests as necessary
(B) The required data are located in at least one nonlocal site and the distributed DBMS routes requests as necessary
(C) The required data are at one local site and the distributed DBMS passes the request to only the local DBMS
(D) The required data are located in at least one nonlocal site and the distributed DBMS passes the request to only the local DBMS

48. A distributed database is which of the following ?
(A) A single logical database that is spread to multiple locations and is interconnected by a network
(B) A loose collection of file that is spread to multiple locations and is interconnected by a network
(C) A single logical database that is limited to one location
(D) A loose collection of file that is limited to one location

49. A distributed database can use which of the following strategies ?
(A) Totally centralized at one location and accessed by many sites
(B) Partially or totally replicated across sites
(C) Partitioned into segments at different sites
(D) All of the above

50. A semi join is which of the following ?
(A) Only the joining attributes are sent from one site to another and then all of the rows are returned
(B) All of the attributes are sent from one site to another and then only the required rows are returned
(C) Only the joining attributes are sent from one site to another and then only the required rows are returned
(D) All of the attributes are sent from one site to another and then only the required rows are returned

51. The ascending order of a data hierarchy is—
(A) bit, byte, record, field, file, database
(B) byte, bit, field, record, file, database
(C) bit, byte, field, record, file, database
(D) bit, byte, file, record, field, database

52. Which of the following is true of a network structure ?
(A) It is a physical representation of the data
(B) It allows a many-to-many relationship
(C) It is conceptually simple
(D) It will be dominant data base of the future

53. Which of the following is a problem of file management system ?
(A) Difficult to update
(B) Lack of data independence
(C) Data redundancy
(D) All of the above

54. One data dictionery software package is called—
(A) DB/DC dictionary
(B) TOTAL
(C) ACCESS
(D) Datapac
(E) Data Manager

55. The function of a database is—
(A) To check all input data
(B) To check all spelling
(C) To collect and organize input data
(D) To output data

56. What is the language used by most of the DBMSs for helping their users to access data?
    (A) High level language
    (B) SQL
    (C) Query Language
    (D) 4GL

57. The model for a record management system might be—
    (A) Handwritten list
    (B) A Rolodex card file
    (C) A business form
    (D) All of the above

58. Primitive operations common to all record management system include—
    (A) Print (B) Sort
    (C) Look-up (D) All of the above

59. In a large DBMS—
    (A) Each user can 'see' only a small part of the entire database
    (B) Each subschema contains every field in the logical schema
    (C) Each user can access every subschema

60. Information can be transferred between the DBMS and a—
    (A) Spreadsheet program
    (B) Word processor program
    (C) Graphics program
    (D) All of the above

61. Which of the following fields in a student file can be used as a primary key ?
    (A) Class
    (B) Social Security Number
    (C) GPA
    (D) Major

62. Which of the following is not an advantage of the database approach—
    (A) Elimination of data redundancy
    (B) Ability of associate deleted data
    (C) Increased security
    (D) All of the above

63. Which of the following contains a complete record of all activity that affected the contents of a database during a certain period of time ?
    (A) Report writer
    (B) Query language
    (C) Data manipulation language
    (D) Transaction log

64. In the DBMS approach, application programs perform the—
    (A) Storage function
    (B) Processing functions
    (C) Access control
    (D) All of the above

65. A set of programs that handle a firm's database responsibilities is called—
    (A) Database Management System (DBMS)
    (B) Database Processing System (DBPS)
    (C) Data Management System (DMS)
    (D) All of the above

66. Which is the make given to the database management system which is able to handle full text data, image data, audio and video ?
    (A) Full media (B) Graphics media
    (C) Multimedia (D) Hypertext

67. A record management system—
    (A) Can handle many files of information at a time
    (B) Can be used to extract information stored in a computer file
    (C) Always uses a list as its model
    (D) Both (A) and (B)

68. A command that lets you change one or more fields in a record is—
    (A) Insert (B) Modify
    (C) Lookup (D) None of these

69. A transparent DBMS—
    (A) Can not hide sensitive information from users
    (B) Keeps its logical structure hidden from users
    (C) Keeps its physical structure hidden from users
    (D) Both (B) and (C)

70. A file produced by a spreadsheet—
    (A) Is generally stored on disk in an ASCII text fromat
    (B) Can be used as is by the DBMS
    (C) Both (A) and (B)
    (D) None of the above

71. Which of the following is not true of the traditional approach to information processing—
    (A) There is common sharing of data among the various applications
    (B) It is file oriented
    (C) Programs are dependent on the file
    (D) It is inflexible

72. Which of the following hardware component is the most important to the operation of database management system ?
    (A) High resolution video display
    (B) Printer
    (C) High speed, large capacity disk
    (D) Plotter

73. Generalized database management system do not retrieve data to meet routine request—
    (A) True
    (B) False

74. Batch processing is appropriate if—
    (A) Large computer system is available
    (B) Only a small computer system is avilbale
    (C) Only a few transactions are involved
    (D) None of the above

75. Large collection of files are called—
    (A) Fields (B) Records
    (C) Database (D) Sectors

## Answers

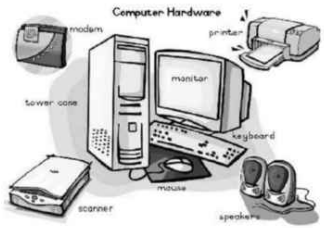
| | | | | |
|---|---|---|---|---|
| 1. (B) | 2. (D) | 3. (A) | 4. (A) | 5. (B) |
| 6. (B) | 7. (B) | 8. (A) | 9. (A) | 10. (C) |
| 11. (A) | 12. (C) | 13. (A) | 14. (C) | 15. (D) |
| 16. (C) | 17. (B) | 18. (A) | 19. (C) | 20. (C) |
| 21. (C) | 22. (D) | 23. (C) | 24. (A) | 25. (B) |
| 26. (A) | 27. (A) | 28. (A) | 29. (A) | 30. (A) |
| 31. (B) | 32. (A) | 33. (C) | 34. (B) | 35. (B) |
| 36. (D) | 37. (A) | 38. (C) | 39. (D) | 40. (B) |
| 41. (C) | 42. (B) | 43. (C) | 44. (D) | 45. (D) |
| 46. (D) | 47. (B) | 48. (A) | 49. (D) | 50. (C) |
| 51. (C) | 52. (B) | 53. (E) | 54. (A) | 55. (C) |
| 56. (C) | 57. (D) | 58. (C) | 59. (A) | 60. (D) |
| 61. (B) | 62. (D) | 63. (D) | 64. (B) | 65. (D) |
| 66. (C) | 67. (B) | 68. (B) | 69. (C) | 70. (A) |
| 71. (A) | 72. (C) | 73. (B) | 74. (D) | 75. (C) |

❑❑

# 12 Computer Hardware

## Hardware

The hardware are the parts of the computer itself including the Central Processing Unit (CPU) and related microchips and micro-circuitry, keyboards, monitors, case and drives (hard, CD, DVD, floppy, optical, tape, etc...). Other extra parts called peripheral components or devices include mouse, printers, modems, scanners, digital cameras and cards (sound, colour, video) etc... Together they are often referred to as a personal computer.




## Keyboard

The keyboard is used to type information into the computer or **input** information. There are many different keyboard layouts and sizes with the most common for Latin based languages being the QWERTY layout (named for the first 6 keys). The standard keyboard has 101 keys. Notebooks have embedded keys accessible by **special** keys or by pressing key combinations (CTRL or Command and P for example). **Ergonomically** designed keyboards are designed to make typing easier. Hand held devices have various and different keyboard configurations and **touch screens**.

Some of the keys have a special use. They are referred to as **command keys**. The 3 most common are the Control (CTRL), Alternate (Alt) and the Shift keys though there can be more (the Windows key for example or the Command key). Each key on a standard keyboard has one or two **characters**. Press the key to get the lower character and hold Shift to get the upper.

## Removable Storage and/or Disk Drives

All **disks** need a **drive** to get information off - or **read** - and put information on the disk - or **write**. Each drive is designed for a specific type of disk whether it is a CD, DVD, hard disk or floppy. Often the term 'disk' and 'drive' are used to describe the same thing but it helps to understand that the disk is the **storage device** which contains computer files - or **software** - and the drive is the mechanism that runs the disk.

**Digital flash drives** work slightly differently as they use **memory cards** to store information so there are no moving parts. Digital cameras also use Flash memory cards to store information, in this case photographs. **Hand held devices** use digital drives and many also use removable or built in memory cards.

## Mouse

Most modern computers today are run using a mouse controlled pointer. Generally if the mouse has two buttons the left one is used to **select** objects and text and the right one is used to **access menus**. If the mouse has one button (Mac for instance) it controls all the activity and a mouse with a third button can be used by specific software programs.

One type of mouse has a round ball under the bottom of the mouse that rolls and turns two wheels which control the direction of the pointer on the screen. Another type of mouse uses an optical system to track the movement of the mouse. **Laptop** computers use touch pads, buttons and other devices to control the pointer. Hand helds use a combination of devices to control the pointer, including touch screens.

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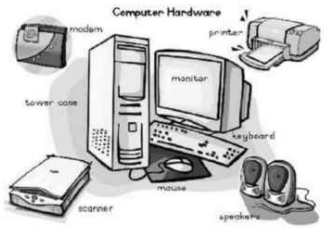


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## Monitors

The monitor shows information on the screen when you type. This is called **outputting** information. When the computer needs more information it will display a message on the screen, usually through a **dialog box**. Monitors come in many types and sizes. The resolution of the monitor determines the sharpness of the screen. The resolution can be adjusted to control the screen's display.

Most desktop computers use a monitor with a **cathode tube** or **liquid crystal display**. Most notebooks use a liquid crystal display monitor.

## Printers

The printer takes the information on your screen and transfers it to paper or a **hard copy**. There are many different types of printers with various levels of quality. The three basic types of printer are; **dot matrix**, **inkjet**, and **laser**.

- Dot matrix printers work like a typewriter transferring ink from a ribbon to paper with a series or 'matrix' of tiny pins.
- Ink jet printers work like dot matrix printers but fire a stream of ink from a cartridge directly onto the paper.
- Laser printers use the same technology as a photocopier using heat to transfer toner onto paper.

## Modem

A modem is used to translate information transferred through telephone lines, cable, satellite or line-of-sight wireless.

The term stands for **modulate and demodulate** which changes the signal from **digital**, which computers use, to **analog**, which telephones use and then back again. **Digital modems** transfer digital information directly without changing to analog.

Modems are measured by the speed that the information is transferred. The measuring tool is called the **baud rate**. Originally modems worked at speeds below 2400 baud but today analog speeds of 56,000 are standard. Cable, wireless or digital subscriber lines can transfer information much faster with rates of 300,000 baud and up.

## Scanners

Scanners allow you to transfer pictures and photographs to your computer. A scanner 'scans' the image from the top to the bottom, one line at a time and transfers it to the computer as a series of **bits** or a **bitmap**. You can then take that image and use it in a paint program, send it out as a fax or print it. With optional **Optical Character Recognition** (OCR) software you can convert printed documents such as newspaper articles to text that can be used in your word processor. Most scanners use **TWAIN** software that makes the scanner accessable by other software applications.

**Digital cameras** allow you to take digital photographs. The images are stored on a memory chip or disk that can be transferred to your computer. Some cameras can also capture sound and video.

## Case

The case houses the microchips and circuitry that run the computer. Desktop models usually sit under the monitor and tower models beside. They come in many sizes, including desktop, mini, midi, and full tower. There is usually room inside to expand or add components at a later time. By removing the cover off the case you may find plate covered, empty slots that allow you to add cards. There are various types of slots including IDE, ASI, USB, PCI and Firewire slots.

## Cards

Cards are components added to computers to increase their capability. When adding a peripheral device make sure that your computer has a slot of the type needed by the device.

**Sound Cards** allow computers to produce sound like music and voice. The older sound cards were 8 bit then 16 bit then 32 bit. Though the human ear can't distinguish the fine difference between sounds produced by the more powerful sound card they allow for more complex music and music production.

**Colour Cards** allow computers to produce colour (with a colour monitor of course). The first colour cards were 2 bit which produced 4 colours [CGA]. It was amazing what could be done with those 4 colours. Next came 4 bit allowing for 16 [EGA and VGA ] colours. Then came 16 bit allowing for 1064 colours and then 24 bit which allows for almost 17 million colours and now 32 bit and higher allow monitors to display almost a billion separate colours.

**Video Cards** allow computers to display video and animation. Some video cards allow computers to display television as well as *capture* frames from video. A video card with a digital video camera allows computers users to produce live video. A high speed connection is required for effective video transmission.

**Network cards** allow computers to connect together to communicate with each other. Network cards have connections for cable, thin wire or wireless networks. For more information.

**Cables** connect internal components to the **Motherboard**, which is a board with series of electronic path ways and connections allowing the CPU to communicate with the other components of the computer.

## Memory

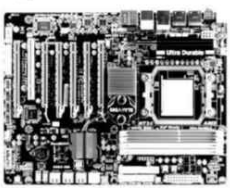
Memory can be very confusing but is usually one of the easiest pieces of hardware to add to your computer. It is common to confuse **chip memory** with **disk storage**. An example of the difference between memory and storage would be the difference between a table where the actual work is done (memory) and a filing cabinet where the finished product is stored (disk). To add a bit more confusion, the computer's hard disk can be used as **temporary memory** when the program needs more than the chips can provide.

**Random Access Memory** or **RAM** is the memory that the computer uses to temporarily store the information as it is being processed. The more information being processed the more RAM the computer needs.

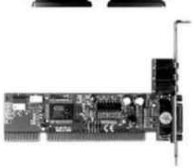
One of the first home computers used 64 **kilobytes** of RAM memory (Commodore 64). Today's modern computers need a minimum of 64 Mb (recommended 128 Mb or more) to run Windows or OS 10 with modern software. RAM memory chips come in many different sizes and speeds and can usually be **expanded**. Older computers came with 512 Kb of memory which could be expanded to a maximum of 640 Kb. In most modern computers the memory can be expanded by adding or replacing the memory chips depending on the processor you have and the type of memory your computer uses. Memory chips range in size from 1 Mb to 4 Gb. As computer technology changes the type of memory changes as well making old memory chips obsolete.

**Different Types of Computer Hardware's**

| Serial No. | Hardware Name | Figure |
|---|---|---|
| 1. | Microprocessor |   |
| 2. | Hard Disk |  |

| | | |
|---|---|---|
| 3. | OMR Reader |  |
| 4. | Network Interface Card (NIC) |  |
| 5. | Mother Board |  |
| 6. | Modem |  |
| 7. | Light Pen |  |

| | | |
|---|---|---|
| 8. | Graphics Card |  |
| 9. | Joy Stick |  |
| 10. | Finger Print Scanner |  |
| 11. | Card Reader |  |
| 12. | Bar Code Reader |  |
| 13. | Pen Drive |  |

| | | |
|---|---|---|
| 14. | Track Ball Mouse |  |
| 15. | Touch Screen |  |
| 16. | Super Computer |  |
| 17. | Sound |  |
| 18. | Sound Card |  |

| | | |
|---|---|---|
| 19. | Routers |  |
| 20. | Router & Switches |  |
| 21. | ROM Chip |  |
| 22. | RAM Chip |  |
| 23. | Plotter |  |
| 24. | Scanner |  |

# Computer Hardware Terminology

**3-D RAM**

Video RAM designed to improve 3-D graphics.

**Adapter Card**

Circuit board used in expansion slots. Also known as expansion cards.

**Address Bus**

It is used by the CPU to communicate memory and I/O address to memory controller and I/O devices.

**Asynchronous SRAM**

Static RAM that doesn't work in step with CPU clock rate.

**Backplane System**

Form factor which has no true motherboard.

**Bank**

Location on motherboard that contains slots for modules of memory.

**BNC Connector**

Used with thin coaxial cable.

**Brouter**

Functions as both a bridge and a router.

**Bus**

Paths or lines on a motherboard that carries data, instructions and electrical power.

**Cable Modem**

Used with cable internet service. The cable modem connects to the NIC in a PC.

**CD-R**

Drive that can write data to a CD.

**CD-RW**

Drive that can write data to a CD. The data can then be erased and rewritten.

**CPU (Central Processing Unit)**

The CPU receives data input by the user, processes information and executes commands. In a PC, the CPU is housed in a single chip called a microprocessor.

**Clock Speed**

Speed or frequency of a processor.

**Coaxial Cable**

Networking cable used with ThinNet or ThickNet.

**Data Bus**

Lines or paths on the system bus that the CPU uses to send and receive data.

**Data Cartridge**

Tape medium used for backups.

**Device Driver**

Program that tells the PC how to communicate with and I/O device.

**DIMM**

Circuit board used to hold memory.

**Diode**

Electronic device that allows electricity to flow in one direction.

**DMA Channel**

Channel in which a device can pass data to memory without involving the CPU.

**DMA Transfer Mode**

Used by devices, such as hard drives, to transfer data to memory without involving CPU.

**DDR SDRAM**

Memory technology used on DIMMs that runs at twice the speed of the system clock.

**DRAM**

Memory that requires refreshing every few milliseconds.

**EEPROM**

Chip in which a high voltage can be applied to one of the pins to erase data before new data is written.

**EISA Bus**

A 32-bit bus that can transfer 4 byts at a time at a speed of about 20 MHz.

**EPROM**

Chip that allows data to be erased with a special ultraviolet light so the chip can be reprogrammed.

**Expansion Bus**

Bus that does not run in sync with the system clock.

**Expansion Card**

Circuit board that is added to the motherboard to increase capabilities.

**Expansion Slot**

Slot on the motherboard where an expansion card can be added.

**Flash Memory**

RAM that can hold data when powered off.

**Flash ROM**

ROM that can be reprogrammed or changed without replacing chips.

**Flat Panel Monitor**

Monitor that uses and LCD panel.

**Hard Copy**

Output from printer to printed page.

**Hard Drive**

Main secondary storage device of a PC.

**Hardware Interrupt**

Caused by device signaling that it requires service.

**HD-DVD**

DVD standard that supports high def video encoding.

**Head**

Top or bottom surface of a platter in a hard drive.

**Heat Sink**

Piece of metal that can be mounted to chips to dissipate heat.

**Hertz (Hz)**

Unit of measurement for frequency.

**Hub**

Network component that provides a central location to connect cables.

**Hyper-Threading**

Technology trademarked by Intel that enables a processor to appear as two logical processor. Each logical processor can execute a thread of a multi-threaded program which can improve performance in certain conditions.

**Internal Bus**

Bus located in CPU used for communication between CPU and components.

**Internal Cache**

Memory cache contained inside the CPU. Faster than external cache.

**ISA**

Older interface which can only support an 8 or 16-bit data path.

**Jumper**

Two wired located on the motherboard that hold configuration data.

**Keyboard**

Input device through which data can be input the PC.

**LAN (Local Area Network)**

Network that covers a small area.

**LCD (Liquid Crystal Display)**

Flat panel display used in PC monitors and various other electronic devices.

**Local Bus**

Bus that works ata s speed synched with the CPU frequency.

**Local I/O Bus**

Bus that provides I/O devices with access to the CPU.

**MAC Address**

Hexadecimal address unique to each NIC.

**Master Boot Record**

First sector on hard drive. Contains program for booting and the partition table.

**MDRAM**

Type of RAM used on video cards.

**MHz (Megahertz)**

One million cycles per second.

**Memory**

Microchips that can hold data and programs.

**Modem**

Modulates **digital** data to an analog format that can be trnsported over telephone lines and demodulated back to digital. **Modulate** and **Demoduate**.

**Monitor**

Used to display text and graphics output from PC.

**Motherboard**

The main board of a PC. Also called system board.

**Mouse**

Input device that allows a user to move a cursor on screen and select items.

**MP3**

Compression method used on audio files.

**Multiplier**

The bus speed multiplied by the multiplier gives the CPU clock speed.

**NIC (Network Interface Card)**

Expansion card used to give a PC networking capabilities.

**NLX**

Form factor similar to LPX but with more support for current processor technology.

**Non-volatile**

Type of RAM that can hold data as long as it is powered.

**Patch Cable**

Network cable used to connect a PC to a hub.

**PC Card**

Adapter card for notebooks used for connecting modems, networks, and CD-ROM drives.

**PCI Bus**

Bus that runs at speed up to 33 MHz or 66 MHz with a 32 or 64-bit data path.

**PDA (Personal Digital Assistant)**

Handheld PC with its own OS and applications.

**Peripheral**

A peripheral is a device that communicates with the CPU that is not located on the motherboard.

**Pits**

Areas on the surface of DVDs or CDs used to represent data.

**Pixel**

Small dot on a scan line. Images on the monitor are made up of pixels.

**PnP (Plug and Play)**

Automatically configures devices during installation.

**Polling**

When the CPU checks a device to determine if they are ready to send and receive data.

**Port**

A Physical connector, Another name for an I/O address.

**Power Conditioner**

Regulates power and provides continuous voltage.

**Power Supply (PSU)**

Supplies power to all devices in a PC.

**Printer**

Produces printed output to paper.

**Protocol**

Set of rules and standards.

**PS/2 Mouse**

Mouse that plugs into the PS/2 port on the motherboard.

**RAID (Redundant Array of Inexpensive Disks)**

Method used to configure multiple hard drives for better performance and fault tolerance.

**RAMDAC**

Short for Random Access Memory Digital-to-Analog Converter. The RAMDAC is a single chip located on a video card. The RAMDAC's role is to convert digitally encoded images into analog signals that can be displayed by a monitor.

**RAM drive**

Memory that works as a hard drive. Much faster than a standard platter hard drive.

**RAM (Random Access Memory)**

Memory modules installed in the motherboard used for temporary data storage.

**Read/write head**

Device that reads or writes data to a disk.

**Rectifier**

Converts AC current to DC current.

**Refresh rate**

Number of times in a second an electronic beam can fill a monitor screen from top to bottom.

**Repeater**

Device that amplifies a signal so it may be sent for longer distances.

**Resistor**

Device that opposes the flow of electrical power.

**RIMM**

Memory module developed by Rambus.

**RJ-11**

Phone line connection found on devices such as modems.

**RJ-45**

Connection type used with a twisted pair cable on a network.

**ROM (Read-Only Memory)**

Chip that contains a program that can not be deleted.

**Router**

Device used to connect networks.

**SCSI (Small Computer System Interface)**

Interface between a host adapter and the CPU that can contain as many as 15 devices on a single bus.

**SCSI ID**

Number assigned to a SCSI device.

**Secondary Storage**

Device that permanently holds data such as hard drives.

**Sector**

A segment of a track on a hard drive disk that has a capacity of 512 bytes.

**SATA (Serial ATA)**

Cabling method that uses a smaller cable than a 80-pin PATA cable. Is more reliable and faster than PATA.

**Serial Port**

Used for transferring data one bit at a time.

**Shielded Twisted-Pair Cable**

Cable that has one or more twisted pairs of wires surrounded by a metal casing.

**Static RAM**

RAM module that holds data with the need for refreshing as long as the PC is powered up.

**Surge protector**

Device used to protect electrical components from power spikes and surges.

**Switch**

A network hardware device used to segment a network.

**Synchrnous DRAM (SDRAM)**

Type of RAM that runs in sync with the system clock.

**Synchrnous SRAM**

Type of SRAM. Is faster than asynchrnous SRAM.

**System Bus**

Bus between the memory and CPU. Also known as the memory bus, external bus, host bus or front side bus.

**System Clock**

Provides a continuous pulse that PC devices used to time themselves.

**Thermal Printer**

A line printer that uses a wax based ink.

**Trace**

Wire on a printed circuit board that provides a connection.

**Tracks**

Circles on a medium used to divide a disk.

**Transformer**

Used to change the ratio of current to voltage.

**Transistor**

Device used to control the flow of electricity.

**UART Chip**

Chip that controls serial ports.

**UDF**

File system used for optical mediums.

**UPS (Uninterruptible Power Supply)**

Provides a backup power source during power failures.

**Video Card**

Expansion card installed in a PC to provide video capabilities.

**ZIF (Zero Insertion Force) Socket**

Smaller lever used to secure the processor into the socket.

## Multiple Choice Questions

1. A hard disk is divided into tracks which are further subdivided into—
   (A) Clusters
   (B) Sectors
   (C) Vectors
   (D) Heads
   (E) None of the above
2. Which standard govern parallel communications ?
   (A) RS232
   (B) RS-232a
   (C) CAT 5
   (D) IEEE 1284
   (E) None of the above
3. What product is used to clean smudged keys on a keyboard ?
   (A) TMC solvent
   (B) Silicone spray
   (C) Denatured alcohol
   (D) All-purpose cleaner
   (E) None of the above
4. The terms 'red book', 'yellow book', and 'orange book' refer to—
   (A) SCSI
   (B) ide
   (C) floppy drive technology
   (D) CD-ROM standards
   (E) All of the above
5. Pick the correct choice for the 80386SXCPU—
   (A) 16 bit word size, 16 bit data path
   (B) 32 bit word size, 16 bit data path
   (C) 8 bit word size, 32 bit data path
   (D) 32 bit word size, 8 bit data path
   (E) 32 bit word size, 32 bit data path
6. You were installing an application in Windows 95, and the computer crashes, what do you do ?
   (A) Press alt + Ctrl + delete, twice
   (B) Press alt + Ctrl + delete, and end task
   (C) Press the reset button on the computer
   (D) Turn off computer and boot from a floppy disk
   (E) None of the above
7. RS-232 is a standard that applies to—
   (A) Serial ports (B) Parallel ports
   (C) Game ports (D) Networks
   (E) Digital frequencies

**System Bus**

Bus between the memory and CPU. Also known as the memory bus, external bus, host bus or front side bus.

**System Clock**

Provides a continuous pulse that PC devices used to time themselves.

**Thermal Printer**

A line printer that uses a wax based ink.

**Trace**

Wire on a printed circuit board that provides a connection.

**Tracks**

Circles on a medium used to divide a disk.

**Transformer**

Used to change the ratio of current to voltage.

**Transistor**

Device used to control the flow of electricity.

**UART Chip**

Chip that controls serial ports.

**UDF**

File system used for optical mediums.

**UPS (Uninterruptible Power Supply)**

Provides a backup power source during power failures.

**Video Card**

Expansion card installed in a PC to provide video capabilities.

**ZIF (Zero Insertion Force) Socket**

Smaller lever used to secure the processor into the socket.

## Multiple Choice Questions

1. A hard disk is divided into tracks which are further subdivided into—
   (A) Clusters
   (B) Sectors
   (C) Vectors
   (D) Heads
   (E) None of the above
2. Which standard govern parallel communications ?
   (A) RS232
   (B) RS-232a
   (C) CAT 5
   (D) IEEE 1284
   (E) None of the above
3. What product is used to clean smudged keys on a keyboard ?
   (A) TMC solvent
   (B) Silicone spray
   (C) Denatured alcohol
   (D) All-purpose cleaner
   (E) None of the above
4. The terms 'red book', 'yellow book', and 'orange book' refer to—
   (A) SCSI
   (B) ide
   (C) floppy drive technology
   (D) CD-ROM standards
   (E) All of the above
5. Pick the correct choice for the 80386SXCPU—
   (A) 16 bit word size, 16 bit data path
   (B) 32 bit word size, 16 bit data path
   (C) 8 bit word size, 32 bit data path
   (D) 32 bit word size, 8 bit data path
   (E) 32 bit word size, 32 bit data path
6. You were installing an application in Windows 95, and the computer crashes, what do you do ?
   (A) Press alt + Ctrl + delete, twice
   (B) Press alt + Ctrl + delete, and end task
   (C) Press the reset button on the computer
   (D) Turn off computer and boot from a floppy disk
   (E) None of the above
7. RS-232 is a standard that applies to—
   (A) Serial ports (B) Parallel ports
   (C) Game ports (D) Networks
   (E) Digital frequencies

8. Laser Jet printer speeds are measured in pages per minute (ppm) what do we use to measure dot-matrix printers ?
   (A) Lines per inch
   (B) Lines per sheet
   (C) Characters per inch
   (D) Characters per second
   (E) None of the above
9. Which device uses a DMA channel ?
   (A) Modem
   (B) Network Card
   (C) Sound Card
   (D) All of the above
   (E) None of the above
10. What do you need to check serial and parallel port ?
   (A) Port adapter
   (B) Logic probe
   (C) Loopback plug
   (D) All of the above
   (E) None of the above
11. RAM in its commercial forms are available as—
   (A) SIMM
   (B) DIMM
   (C) Both (A) and (B)
   (D) CPSB
   (E) None of the above
12. Refresh Rate of monitor is measured in—
   (A) Hz (B) Meter
   (C) Volts (D) Amp.
   (E) None of these
13. Which of the following meaning is used between CPU & RAM to speed up the processing power of a CPU ?
   (A) Virtual Memory
   (B) DRAM
   (C) Flash Memory
   (D) Cache Memory
   (E) None of the above
14. Which of the following is lowest in memory hierarchy ?
   (A) Cache memory
   (B) Secondary memory
   (C) Registers
   (D) RAM
   (E) None of the above
15. Which of the following is an input device ?
   (A) Keyboard
   (B) VDU
   (C) Both (A) and (B)
   (D) Dvu
   (E) None of the above
16. CRT stands for—
   (A) Character Ray Tube
   (B) Cathode Ray Tube
   (C) Colour Ray Tube
   (D) All of the above
   (E) None of above
17. Which of the following is a GUI device—
   (A) Keyboard (B) Mouse
   (C) OMR (D) All of these
   (E) None of these
18. LCD stands for—
   (A) Liquid Crystal Display
   (B) Laser Crystal Display
   (C) Light Crystal Display
   (D) All of the above
   (E) None of the above
19. Such types of printers, in which the printing head contacts with the paper in printing process, are called as—
   (A) Impact Printer
   (B) Non-Impact Printer
   (C) Laser Printer
   (D) All of the above
   (E) None of the above
20. Which of the following is a type of optical media ?
   (A) FDD
   (B) HDD
   (C) CD
   (D) Magnetic Tape
   (E) None of the above
21. DVD stands for—
   (A) Digital Video Disk
   (B) Digital Versatile Disk

(C) Both (A) and (B)
(D) All of the above
(E) None of the above

22. Which of the following is an input device ?
(A) VDU
(B) Printer
(C) Plotter
(D) MICR
(E) None of the above

23. Identify the odd one—
(A) Storage tape memory
(B) Magnetic disc memory
(C) Optical disc memory
(D) Read only memory
(E) None of the above

24. Nibble describes a bits combination of—
(A) 5 bits (B) 6 bits
(C) 7 bits (D) 4 bits
(E) None of these

25. A Byte constitutes of—
(A) 9 bits (B) 8 bits
(C) 7 bits (D) 4 bits
(E) None of these

26. Memory in a PC is addressable through—
(A) Bits
(B) Byte
(C) Nibble
(D) All of the above
(E) None of the above

27. One Kilo Byte represents—
(A) 1024 bytes
(B) 1000 bytes
(C) 100 bytes
(D) 1064 bytes
(E) None of the above

28. Basic building block for a digital circuit is—
(A) Word (B) Logic Gate
(C) Processor (D) BUS
(E) None of these

29. Which of the following is a logic gate ?
(A) AND (B) OR
(C) CPU (D) Both (A) and (B)
(E) None of these

30. The base of binary number is—
(A) 2 (B) 16
(C) 8 (D) 10
(E) None of these

31. ASCII stands for—
(A) American Standard Code for Institute Interchange
(B) American Standard Code for Information Interchange
(C) American Standard Code for Information Institute
(D) All of the above
(E) None of the above

32. Who is called as 'Father of Computers' ?
(A) Charles Babagez
(B) Blaise Pascal
(C) Hollirth
(D) All of the above
(E) None of the above

33. The first Digital Computer introduced, was named as—
(A) UNIVAC
(B) Mark-I
(C) ENIAC
(D) All of the above
(E) None of the above

34. How many generations, computer can be classified ?
(A) 4 (B) 5
(C) 3 (D) 6
(E) None of these

35. First Generation Computers contain—
(A) Transistors
(B) Vacume Tubes
(C) LSI
(D) VLSI
(E) None of the above

36. II Generation Computers are made of—
(A) Vaccume Tubes
(B) Transistors
(C) LSI
(D) VLSI
(E) None of the above

37. IV Generation Computers contain—
    (A) VLSI
    (B) Vaccume Tubes
    (C) All Technology
    (D) Transistors
    (E) None of the above
38. Vth Generation Computers are based on—
    (A) Artificial Intelligence
    (B) Programming Intelligence
    (C) System Knowledge
    (D) All of the above
    (E) None of the above
39. Computers, combine both measuring and counting, are called—
    (A) Analog (B) Digital
    (C) Hybrid (D) All of these
    (E) None of these
40. In world today, most of the computers are—
    (A) Digital (B) Hybrid
    (C) Analog (D) Complex
    (E) None of these
41. Internal memory in a CPU is nothing but—
    (A) A set of registers
    (B) A set of ALU
    (C) Microprocessor
    (D) BUS
    (E) None of the above
42. Physical structure of computer is called—
    (A) Software
    (B) Hardware
    (C) Humanware
    (D) All of these
    (E) None of the above
43. A computer can perform, which of the following tasks ?
    (A) Computation
    (B) Communication
    (C) Processing
    (D) All of the above
    (E) None of the above
44. CPU stands for—
    (A) Computer Processing Unit
    (B) Central Processing Unit
    (C) Both (A) and (B)
    (D) Communication Processing Unit
    (E) None of the above
45. In which type of computer, data are represented as discrete signals ?
    (A) Analog computer
    (B) Digital computer
    (C) Both (A) and (B)
    (D) Digilog Computer
    (E) None of the above
46. Which of the following is permanent memory ?
    (A) SRAM (B) DRAM
    (C) ROM (D) All of these
    (E) None of these
47. PARAM is an example of—
    (A) Super computer
    (B) PC
    (C) Laptop
    (D) PDA
    (E) None of the above
48. Who developed the 'analytical engine' ?
    (A) Jacquard loom
    (B) Charles Babbage
    (C) Shannon
    (D) IBM
    (E) None of the above
49 GUI stands for—
    (A) Graphical User Interface
    (B) Graph Use Interface
    (C) Graphical Universal Interface
    (D) None of the above
50. First Generation of computer was based on which technology ?
    (A) Transistor (B) Vacuum Tube
    (C) LSI (D) VLSI
    (E) None of these
51. Which of the following items are examples of storage devices ?
    (A) Floppy / hard disks
    (B) CD-ROMs
    (C) Tape devices
    (D) All of the above

52. The Width of a processor's data path is measured in bits. Which of the following are common data paths ?
(A) 8 bits (B) 12 bits
(C) 16 bits (D) 32 bits

53. Which is the type of memory for information that does not change on your computer ?
(A) RAM (B) ROM
(C) ERAM (D) RW / RAM

54. What type of memory is not directly addressable by the CPU and requires special software called EMS (expanded memory specification) ?
(A) Extended
(B) Expanded
(C) Base
(D) Conventional

55. Before a disk can be used to store data. It must be—
(A) Formatted
(B) Reformatted
(C) Addressed
(D) None of the above

56. What type of device is computer keyboard ?
(A) Memory (B) Output
(C) Storage (D) Input

57. The original ASCII code used ..... bits of each byte, reserving that last bit for error checking.
(A) 5 (B) 6
(C) 7 (D) 8

58. Which company is the biggest player in the microprocessor industry ?
(A) Motorola (B) IBM
(C) Intel (D) AMD

59. What is required when more than one person uses a central computer at the same time ?
(A) Light pen (B) Mouse
(C) Digitizer (D) Terminal

60. A hard copy would be prepared on a—
(A) Line printer
(B) Dot matrix Printer
(C) Typewriter terminal
(D) All of the above

61. A typical personal computer used for business purposes would have ..... of RAM.
(A) 4 KB (B) 16 K
(C) 64 K (D) 256 K

62. A high quality CAD system uses the following for printing drawing and graphs—
(A) Dot matrix printer
(B) Digital plotter
(C) Line printer
(D) All of the above

63. Symbolic logic was discovered by—
(A) George Boole (B) Herman Hollerith
(C) Van Neumann (D) Basic Pascal

64. What was the nick name of the computer used by the Americans in 1952 for their H-bomb project ?
(A) ENIAC (B) EDSAC
(C) MANIAC (D) UNIVAC

65. The word length of a computer is measured in—
(A) Bytes (B) Millimeters
(C) Meters (D) Bits

66. Multi user systems provided cost savings for small business because they use a single processing unit to link several—
(A) Personal computers
(B) Workstations
(C) Dumb terminals
(D) Mainframes

67. What are the three decisions making operations performed by the ALU of a computer ?
(A) Grater than
(B) Less than
(C) Equal to
(D) All of the above

68. Which part of the computer is used for calculating and comparing ?
(A) Disk unit
(B) Control unit
(C) ALU
(D) Modem

69. Can you tell what passes into and out from the computer via its ports ?
(A) Data (B) Bytes
(C) Graphics (D) Pictures

70. Which type of computers uses the 8-bit code called EBCDIC ?
    (A) Minicomputers
    (B) Microcomputers
    (C) Mainframe computers
    (D) Super computer

71. The first electronic computer in the world was—
    (A) UNIVAC (B) EDVAC
    (C) ENIAC (D) All of the above

72. The most commonly used standard data code to represent alphabetical, numerical and punctuation characters used in electronic data processing system is called—
    (A) ASCII (B) EBCDIC
    (C) BCD (D) All of the above

73. Which was the computer conceived by Babbage ?
    (A) Analytical engine
    (B) Arithmetic machine
    (C) Donald Knuth
    (D) All of the above

74. Offline device is—
    (A) A device which is not connected to CPU
    (B) A device which is connected to CPU
    (C) A direct access storage device
    (D) An I/O device

## Answers

| | | | | |
|---|---|---|---|---|
| 1. (B) | 2. (D) | 3. (D) | 4. (D) | 5. (B) |
| 6. (D) | 7. (A) | 8. (D) | 9. (C) | 10. (C) |
| 11. (B) | 12. (A) | 13. (A) | 14. (C) | 15. (A) |
| 16. (B) | 17. (D) | 18. (A) | 19. (A) | 20. (C) |
| 21. (B) | 22. (D) | 23. (A) | 24. (D) | 25. (B) |
| 26. (D) | 27. (A) | 28. (B) | 29. (D) | 30. (A) |
| 31. (B) | 32. (A) | 33. (C) | 34. (B) | 35. (B) |
| 36. (B) | 37. (A) | 38. (A) | 39. (D) | 40. (A) |
| 41. (A) | 42. (B) | 43. (D) | 44. (B) | 45. (B) |
| 46. (C) | 47. (A) | 48. (B) | 49. (A) | 50. (B) |
| 51. (D) | 52. (A) | 53. (B) | 54. (B) | 55. (A) |
| 56. (D) | 57. (C) | 58. (C) | 59. (D) | 60. (D) |
| 61. (D) | 62. (B) | 63. (A) | 64. (C) | 65. (D) |
| 66. (C) | 67. (D) | 68. (C) | 69. (A) | 70. (C) |
| 71. (C) | 72. (A) | 73. (A) | 74. (A) | |

❑❑

# 13 Operating System

## Operating System

An operating system is "the software that controls the hardware "and provide the interaction between user and hardware. An operating system as the programs that make the hardware useable. In brief, an operating system is the set of programs that controls a computer. Some examples of operating systems are UNIX, Mach, MS-DOS, MS-Windows, Windows/NT, Chicago, OS/2, MacOS, VMS, MVS, and VM.


**Logo of Different Operating System**

Controlling the computer involves software at several levels. We will differentiate kernel services, library services, and application-level services, all of which are part of the operating system. Processes run Applications, which are linked together with libraries that perform standard services. The kernel supports the processes by providing a path to the peripheral devices. The kernel responds to service calls from the processes and interrupts from the devices. The core of the operating system is the kernel, a control program that functions in **privileged state** (an execution context that allows all hardware instructions to be executed), reacting to interrupts from external devices and to service requests and traps from processes. Generally, the kernel is a permanent resident of the computer. It creates and terminates processes and responds to their request for service.

Operating Systems are resource managers. The main resource is computer hardware in the form of processors, storage, input/output devices, communication devices, and data. Some of the operating system functions are: implementing the user interface, sharing hardware among users, allowing users to share data among themselves, preventing users from interfering with one another, scheduling resources among users, facilitating input/output, recovering from errors, accounting for resource usage, facilitating parallel operations, organizing data for secure and rapid access, and handling network communications.

## Objectives of Operating Systems

Modern Operating systems generally have following three major goals. Operating systems generally accomplish these goals by running processes in low privilege and providing service calls that invoke the operating system kernel in high-privilege state.

- **To hide details of hardware by creating abstraction**

  An abstraction is software that hides lower level details and provides a set of higher-level functions. An operating system transforms the physical world of devices, instructions, memory, and time into virtual world that is the result of abstractions built by the operating system. There are several reasons for abstraction.

  *First*, the code needed to control peripheral devices is not standardized. Operating systems provide subroutines called device drivers that perform operations on behalf of programs for example, input/output operations. *Second*, the operating system introduces new functions as it abstracts the hardware. For instance, operating system introduces the file ab-

straction so that programs do not have to deal with disks.

*Third*, the operating system transforms the computer hardware into multiple virtual computers, each belonging to a different program. Each program that is running is called a process. Each process views the hardware through the lens of abstraction. *Fourth*, the operating system can enforce security through abstraction.

- **To allocate resources to processes (Manage resources)**
  An operating system controls how **processes** (the active agents) may access **resources** (passive entities).
- **Provide a pleasant and effective user interface**

  The user interacts with the operating systems through the user interface and usually interested in the "look and feel" of the operating system. The most important components of the user interface are the command interpreter, the file system, on-line help, and application integration. The recent trend has been toward increasingly integrated graphical user interfaces that encompass the activities of multiple processes on networks of computers.

One can view Operating Systems from two points of views: **Resource manager** and **Extended machines**. Form Resource manager point of view Operating Systems manage the different parts of the system efficiently and from extended machines point of view Operating Systems provide a virtual machine to users that is more convenient to use. The structurally Operating Systems can be design as a monolithic system, a hierarchy of layers, a virtual machine system, an exokernel, or using the client-server model. The basic concepts of Operating Systems are processes, memory management, I/O management, the file systems, and security.

## Types of Operating System

### Real-time

A real-time operating system is a multitasking operating system that aims at executing real-time applications. Real-time operating systems often use specialized scheduling algorithms so that they can achieve a deterministic nature of behavior. The main objective of real-time operating systems is their quick and predictable response to events. They have an event-driven or time-sharing design and often aspects of both. An event-driven system switches between tasks based on their priorities or external events while time-sharing operating systems switch tasks based on clock interrupts.

### Multi-user

A multi-user operating system allows multiple users to access a computer system concurrently. Time-sharing system can be classified as multi-user systems as they enable a multiple user access to a computer through the sharing of time. Single-user operating systems, as opposed to a multi-user operating system, are usable by a single user at a time. Being able to use multiple accounts on a Windows operating system does not make it a multi-user system. Rather, only the network administrator is the real user. But for a Unix-like operating system, it is possible for two users to login at a time and this capability of the OS makes it a multi-user operating system.

### Multi-tasking *Vs.* Single-tasking

When only a single program is allowed to run at a time, the system is grouped under a single-tasking system. However, when the operating system allows the execution of multiple tasks at one time, it is classified as a multi-tasking operating system. Multi-tasking can be of two types: *pre-emptive* or *co-operative*. In pre-emptive multitasking, the operating system slices the CPU time and dedicates one slot to each of the programs. Unix-like operating systems such as Solaris and Linux support pre-emptive multitasking, as does AmigaOS. Cooperative multitasking is achieved by relying on each process to give time to the other processes in a defined manner. 16-bit versions of Microsoft Windows used cooperative multi-tasking. 32-bit versions, both Windows NT and Win9x, used pre-emptive multi-tasking. Mac OS prior to OS X used to support cooperative multitasking.

### Distributed

A distributed operating system manages a group of independent computers and makes them appear to be a single computer. The development of networked computers that could be linked and communicate with each other gave rise to distributed computing. Distributed computations are carried out on more than one machine. When computers in a group work in cooperation, they make a distributed system.

**Embedded**

Embedded operating systems are designed to be used in embedded computer systems. They are designed to operate on small machines like PDAs with less autonomy. They are able to operate with a limited number of resources. They are very compact and extremely efficient by design. Windows CE and Minix 3 are some examples of embedded operating systems.

### List of Operating system

**Darwin**

The new version of BSD that serves as the core for the Macintosh's OSX. There is also a GNU version of Darwin, GNU-Darwin, which is hosted by SourceForge.

**BSD**

The most popular of the BSD open source Unix distributions.

**DOS**

Aims to be a complete, free, fully MS-DOS compatible operating system.

**Linux**

A high performance, yet completely free, Unix-like computer operating system suitable for use on a wide range of platforms and compatible with 32 bit and 64 bit processors.

**NetBSD**

Features the ability to run on more than 50 platforms, ranging from acorn26 to x68k.

**OpenBSD**

Has a goal of becoming the most secure computer operating system.

**Microsoft Windows**

This ubiquitous family of proprietary operating systems probably needs no introduction.

**QNX**

A widely used commercial POSIX-compliant, Unix-like real-time operating system for mission- and life-critical applications. QNX also features a unique and very attractive GUI.

**Solaris**

Developed by Sun Microsystems for the SPARC platform and the most widely used proprietary flavor of Unix for web servers.

## Operating System Terminology

**Belady's Anomaly**

A counterintuitive effect in which increasing the number of page frames may increase the number of page faults.

**CPU bound**

A property of a process in which processor use is high, and I/O requests are low.

**Circular LOOK disk scheduling**

A disk scheduling strategy which satisfies the pending disk request which is physically closest to the current position of the access arm in the direction toward the inside of the disk, reversing direction and seeking to the outside when it reaches the cylinder of the innermost request, and repeating.

**Circular SCAN Disk Scheduling**

A disk scheduling strategy which satisfies the pending disk request which is physically closest to the current position of the access arm in the direction toward the inside of the disk, reversing direction and seeking to the outside when it reaches the innermost cylinder, and repeating.

**EBCDIC**

An 8 bit code for representing characters and device controls.

**FIFO Page Replacement**

A strategy which replaces the page which has been in memory for the longest time.

**FIFO Scheduling**

A scheduling policy which schedules tasks in the same order in which they enter the ready state.

**I/O Bound**

A property of a process in which processor use is low, and I/O requests are high.

**LFU Page Replacement**

A strategy which replaces the page which has been used least often.

**LOOK Disk Scheduling**

A disk scheduling strategy which satisfies the pending disk request which is physically closest to the current position of the access arm in the current direction of motion, reversing direction when there are no more requests in the current direction.

**LRU Page Replacement**

A strategy which replaces the page which has not been used for the longest time.

**Round Robin Scheduling**

A scheduling policy which scheduleses tasks in a fixed circular order.

**SCAN Disk Scheduling**

A disk scheduling strategy which satisfies the pending disk request which is physically closest to the current position of the access arm in the current direction of motion, reversing direction when the first and last cylinders are reached.

**Unicode**

A 16 bit code for representing characters.

**Absolute Path**

A path beginning at the root directory.

**Access Time**

The time from a data transfer request to the completion of the transfer of the data.

**Anticipatory Fetch Strategy**

A strategy which fetches items which may be requested soon.

**Anticipatory Paging**

A paging policy which reads a page into real memory when its future use is predicted.

**Assembly Language**

A symbolic language closely related to a machine language.

**Assembly Language**

A symbolic language closely related to a machine language.

**Asynchronous Signal**

Signal generated for reasons unrelated to the current instruction of the running thread.

**Atomic Operation**

An operation which cannot be interrupted.

**Backup**

The creation of redundant copies of data from files.

**Batch Process**

A process which executes without user interaction.

**Best Fit**

A placement strategy which selects the smallest space from the free list which is large enough.

**Binary Semaphore**

A semaphore that can only have the values 0 and 1.

**Blocked List**

An operating system data structure which contains all of the blocked processes in the system.

**Blocked State**

A process state entered by a task which is waiting for some event or action to occur.

**Born State**

The tread state in which a new thread begins life.

**Busy Wait**

A situation in which a process, while not blocked, continuously checks for a condition which will allow it to proceed.

**Byte**

The smallest addressable part of memory.

**Compiler**

A translator from a high level language to a low level language.

**Compiler Language**

A high level language which is to be processed by a compiler.

**Consumer**

A process or thread that removes data from a shared object and processes it.

**Context Switch**

Action performed by the operating system to remove a process from the run state and replace it with another.

**Contiguous Memory Allocation**

Allocation in which the address space is continuously connected without breaks.

**Counting Semaphore**

A semaphore that maintains a count between zero and some maximum value.

**Critical Section**

A section of code which performs operations on a shared resources.

**Cylinder**

The set of tracks of a disk drive which can be accessed without changing the position of the access arm.

**Data Compression**

The encoding of data in such a way as to reduce its size.

**Dead State**

The state of a thread after it has been terminated.

**Deadline Scheduling**

A scheduling policy which schedules tasks based on the timing needs of the tasks.

**Deadlock**

A situation in which two or more processes are prevented from continuing while each waits for resources to be freed by the continuation of the other.

**Deadlock**

A situation in which two or more processes are prevented from continuing while each waits for resources to be freed by the continuation of the other.

Deadlock Avoidance

Deadlock Detection

Deadlock Prevention

Demand Fetch Strategy

A strategy which fetches items only when requested.

**Demand Paging**

A paging policy which reads in a page only when it is referenced.

**Device Independence**

An operating system characteristic in which devices are handled as virtual files by processes.

**Directory**

A data structure in a file system which maps to names to file system objects such as files or other directories.

**Dispatcher**

The operating system component which transitions a process to the running state.

**Dynamic Address Translation**

The real time conversion of virtual addresses to real addresses during execution.

**Dynamic Priority**

A priority which is adjusted automatically by the system according to task behavior and system loading.

**Earliest Deadline First Scheduling**

A deadline sheduling policy which dispatches the task with the earliest completion deadline.

**Extent**

A section of a file occupying logically contiguous clusters.

**Fair Share Scheduling**

A scheduling policy which assigns tasks to groups, and allocates a percentage of CPU time to each group.

**Fetch Strategy**

The method used to determine which block is to be obtained next.

**Field**

A single attribute of the entity which the record describes.

**File**

A data structure on secondary storage which acts as a non-volatile container for data.

**File Allocation Table**

A table on a disk volume containing chained lists of the physical locations of all files on the volume.

**Firmware**

Software stored in nonvolatile memory such as ROM.

**First Fit**

A placement strategy which selects the first space on the free list which is large enough.

**First-Come-First-Served Disk Scheduling**

A disk scheduling strategy which satisfies disk requests in the same order in which they are received.

**Flat Directory Structure**

A directory structure having a single directory.

**Fork**

A system call which creates a second (child) process identical to the calling (parent) process

**Hard link**

A directory entry which is the location of a file.

**Hard Real Time Scheduling**

A scheduling policy which ensures that deadlines are met.

**Hierarchical File System**

A file system in which a directory can logically contain other directories.

**High Level Language**

A language that conceptually closer the problems to be solved than to the hardware on which it runs.

**Hold and Wait**

**Indefinite Postponement**

A situation in which a process or thread is waiting for an event which may never occur.

**Information Hiding**

A program style which which masks implementation details of a module from the rest of the code.

**Interactive Process**

A process which requires user interaction while executing.

**Interpreter**

A program expressed in one language which executes programs expressed in another language.

**Interrupt**

An asynchronous service request from hardware or software to the CPU.

**Interrupt Handler**

A software routine which processes interrupts.

**Join**

Thread operation in which the calling thread is blocked until the thread it joins terminates.

**Kernel-level Thread**

A thread created by an operating system.

**Laxity**

The difference between the time until a tasks completion deadline and its remaining processing time requirement.

**Limit Register**

A register indicating the highest accessible memory address.

**Linker**

A program which combines two or more object modules into a single object module or into an executable file.

**Loader**

A program which loads a program into main memory in executable form.

**Logical Record**

A set of data which is treated as a unit by a program.

**Long Term Scheduler**

The part of an operating system which places new tasks into the ready state.

**Low Level Language**

A machine language or assembly language

**Machine Language**

A programming language which can be directly executed by a machine.

**Memory Management Unit (MMU)**

The hardware of a computer which performs dynamic address translation.

**Message**

A unit of data sent by one task or thread that is guaranteed to be delivered atomically to another task or thread.

**Metadata**

Data which describes the data in a file or table.

**Microcode**

Computer code which implements the machine language of a computer.

**Middleware**

Software that sits between two or more types of software and translates information between them.

**Minimum Laxity First Scheduling**

A deadline scheduling policy which dispatches the task with the least laxity.

**Modified Bit**

A bit in a page table entry or a segment descriptor which is set when a memory address in the page or segment is written.

The incorporation of multiple threads of execution within a process.

**Mutual Exclusion**

A situation in which at most one process can be engaged in a specified activity at a time.

**Mutual Exclusion Primitive**

A fundamental operation which is needed to implement mutual exclusion.

**Noncontiguous Memory Allocation**

Allocation in which the address space is separated into nonadjacent regions.

**Nonpreemptive**

Not having the capability of preempting running tasks.

**Object Module**

A file containing machine language code and data in a form that the linker can use to create an executable program or shared library.

**Object-Oriented Programming**

A style of programming that defines data as objects with attributes and methods that are applied to those objects, and which can be inherited by other objects.

**Operating System**

Software that manages system resources to provide services that allow applications to execute properly.

**Optimal Page Replacement**

A strategy which replaces the page which will not be used for the longest time.

**Page**

A fixed size block of contiguous memory addresses in a virtual address space which is managed as a unit.

**Page Fault**

An interrupt generated when a program references a page that is not currently resident.

**Page Fetch Policy**

The policy which determines when a memory page should be brought into real memory.

**Page Frame**

A fixed size block of contiguous memory addresses in a real address space which is managed as a unit.

**Page Replacement Policy**

The policy which determines which memory page is to be removed from real memory.

**Paging**

Virtual memory based on fixed size blocks.

**Parity**

A property of a data word or character which is even if the number of 1s in the data is even, and odd if the number of 1s in the data is odd.

**Path**

A series of directories and a filename which uniquely identify a file in a hierarchical file system.

**Pending Signal**

A signal which has not yet been delivered.

**Placement Strategy**

The method used to determine where to put a new block.

**Polling**

A technique which examines external device interfaces to determine if the device needs attention.

**Preemption**

The operating system act of interrupting a running task, removing it from the run state, and placing it in the ready state.

**Preemptive**

Having the capability of preempting running tasks.

**Priority**

An ordinal number which represents the relative importance of a task.

**Priority Aging**

A process which dynamically raises the priority of a task according to the time it has been waiting in the ready queue.

**Priority Scheduling**

A scheduling policy which schedules tasks in descending order of priority.

**Process**

The operating system concept of a (dynamic) instance of a program in execution.

**Process Control Block**

An operating system data structure that characterizes a process.

**Process State**

The status of a process as running, ready, blocked, etc.

**Process Table**

An operating system data structure which pointers to all of the processes in the system.

**Producer**

A process or thread that creates data and places it into a shared object.

**Program**

A (static) set of instructions which can be used as the basis for a process.

**Quantum**

The maximum amount of time that a task is allowed to run before being preempted.

**Race Condition**

A situation where the (uncontrolled) ordering of events can affect the outcome of the situation.

**Ready List**

An operating system data structure which contains all of the ready processes in the system.

**Ready State**

A process state in which all resources except the processor are available.

**Real Address**

An address used by the hardware of a computer system.

**Real Address Space**

The set of possible real addresses.

**Real Time System**

A system which must respond in real time to changing conditions.

**Record**

A subdivision of a file, containing data related to a single entity.

**Recovery**

The restoration of file data after its loss.

**Redundancy**

The portion of the total representation of a message that can be eliminated without loss of information.

**Redundant Array of Inexpensive Disks**

An array of multiple disk drives which appears as a single drive to the system.

**Referenced Bit**

A bit in a page table entry or a segment descriptor which is set when a memory address in the page or segment is read or written.

**Register**

A fast memory-like data storage element which is part of the CPU or other control unit.

**Relative Path**

A path beginning at the current directory.

**Replacement Strategy**

The method used to determine which resident block is to be displaced.

**Restore**

The copying of data from redundant copies back to the files from which they were created.

**Rotational Delay**

The time taken for a disk to move the correct sector to the read/write heads.

**Scheduler**

The part of an operating system which assigns resources to processes, tasks, or threads.

**Secondary Storage**

Online peripheral data storage.

**Seek**

To move to a specified location in a file.

**Seek Time**

The time taken for a disk drive to move the access arm to the correct cylinder.

**Segment**

A variable size block of contiguous memory addresses in a virtual address space which is managed as a unit.

**Semaphore**

A synchronization variable accessable only through wait and signal procedures.

**Serialize**

To control access to a variable so that only one thread can access the variable at a time.

**Serially Reusable Shared Resource**

A resource which can be used by at most one thread or process at a time.

**Shortest Process First Scheduling**

A scheduling policy which schedules tasks in ascending order of estimated processing time.

**Shortest Remaining Time Scheduling**

A scheduling policy which schedules tasks in ascending order of estimated remaining processing time.

**Shortest-Seek-Time-First Disk Scheduling**

A disk scheduling strategy which satisfies the pending disk request which is physically closest to the current position of the access arm.

**Signal**

A mechanism by which a process may be notified by the kernel of an event occurring in the system.

**Signal Handler**

Code that is executed in response to a particular signal type.

**Signal Mask**

A data structure which blocks specified signals from being delivered to a thread.

**Sleeping State**

A blocked thread state which can be transitioned to ready when notified of a timeout event.

**Soft Link**

A directory entry which is a pathname to a file.

**Soft Real Time Scheduling**

A scheduling policy which attempts to meet deadlines.

**Source Module**

A file containing source code for a part of a program.

**Spatial Locality**

A condition in which references to addresses in a given period are close together.

**Spatial Locality**

A condition in which references to addresses in a given period are close together.

**Spindle**

The axle on which a disk turns.

**Static Priority**

A priority which is not automatically adjusted by the system.

**Structured Programming**

A style programming in which a hierarchy of structures is used, each having a single entry and a single exit point.

**Swapping**

The process of copying a memory image to secondary storage and making the memory space available for other usage.

**Synchronous Signal**

Signal generated due to execution of the currently running thread's execution.

**Temporal Locality**

A condition in which reference to a single address are close together in time.

**Thrashing**

A condition in which the system is spending almost all of its time writing out virtual memory pages and reading them back in.

**Thread**

An independently executable stream of program instructions.

**Track**

The (circular) area on a disk platter which can be accessed by a single head without moving the access arm of the drive.

**Transfer Time**

The time required to transfer the data from a sector, once the transfer has begun.

**User-Level Thread**

A thread which has the same operating system execution context as its parent.

**Virtual Address**

The address seen by a process in a virtual memory system.

**Virtual Address Space**

The set of possible virtual addresses.

**Virtual Memory**

Memory simulated in software by swapping with a disk file.

**Volatile**

Depending on the maintenance of power for the retention of information.

**Waiting State**

A blocked thread state which can be transitioned to ready when notified of an event.

**Word**

A set of bits on which a computer can perform arithmetic operations with a single instruction.

**Working Set**

The set of pages, at any time, required in real memory for a program to make reasonable progress without thrashing.

**Worst Fit**

A placement strategy which selects the largest space from the free list (if it is large enough.)

## Multiple Choice Questions

1. A system program that combines the separately compiled modules of a program into a form suitable for execution—
   (A) Assembler
   (B) Linking loader
   (C) Cross compiler
   (D) Load and go
   (E) None of the above
2. Process is ?
   (A) Program in High level language kept on disk
   (B) Contents of main memory
   (C) A program in execution
   (D) A job in secondary memory
   (E) None of the above
3. Which of the following refers to the associative memory ?
   (A) The address of the data is generated by the CPU
   (B) The address of the data is supplied by the users
   (C) There is no need for an address *i.e.* the data is used as an address
   (D) The data are accessed sequentially
   (E) None of the above
4. Addressing structure—
   (A) Defines the fundamental method of determining effective operand addresses
   (B) Are variations in the use of fundamental addressing structures, or some associated actions which are related to addressing.
   (C) Performs indicated operations on two fast registers of the machine and leave the result in one of the registers.
   (D) All of the above
   (E) None of the above
5. The strategy of allowing processes that are logically runnable to be temporarily suspended is called—
   (A) Preemptive scheduling
   (B) Non preemptive scheduling

(C) Shortest job first
(D) First come first served
(E) None of the above

6. The LRU algorithm—
(A) Pages out pages that have been used recently
(B) Pages out pages that have not been used recently
(C) Pages out pages that have been least used recently
(D) Pages out the first page in a given area
(E) None of the above

7. Which of the following systems software does the job of merging the records from two files into one ?
(A) Security software
(B) Utility program
(C) Networking software
(D) Documentation system
(E) None of the above

8. Fork is—
(A) The dispatching of a task
(B) The creation of a new job
(C) The creation of a new process
(D) Increasing the priority of a task
(E) None of the above

9. Thrashing—
(A) Is a natural consequence of virtual memory systems
(B) Can always be avoided by swapping
(C) Always occurs on large computers
(D) Can be caused by poor paging algorithms
(E) None of the above

10. Supervisor state is—
(A) Never used
(B) Entered by programs when they enter the processor
(C) Required to perform any I/O
(D) Only allowed to the operating system
(E) None of the above

11. A computer cannot "boot" if it does not have the—
(A) Compiler
(B) Loader
(C) Operating system
(D) Assembler
(E) None of the above

12. Interprocess communication—
(A) Is required for all processes
(B) Is usually done via disk drives
(C) Is never necessary.
(D) Allows processes to synchronize activity

13. Which of the following addressing modes, facilitates access to an operand whose location is defined relative to the beginning of the data structure in which it appears ?
(A) Ascending (B) Sorting
(C) Index (D) Indirect
(E) None of the above

14. Which of the following rules out the use of GO TO ?
(A) Flowchart
(B) Hipo Diagrams
(C) Nassi-Shneiderman diagram
(D) All of the above
(E) None of the above

15. A system program that sets up an executable program in main memory ready for execution is—
(A) Assembler
(B) Linker
(C) Loader
(D) Compiler
(E) None of the above

16. Which of the following are loaded into main memory when the computer is booted ?
(A) Internal command instructions
(B) External command instructions
(C) Utility programs
(D) Word processing instructions
(E) None of the above

17. The principal of locality of reference justifies the use of—
(A) Reenterable
(B) Non reusable
(C) Virtual memory
(D) Cache memory
(E) None of the above

18. The register or main memory location which contains the effective address of the operand is known as—
    (A) Pointer
    (B) Indexed register
    (C) Special location
    (D) Scratch pad
    (E) None of the above

19. Assembly code data base is associated with—
    (A) Assembly language version of the program which is created by the code generation phase and is input to the assembly phase.
    (B) A permanent table of decision rules in the form of patterns for matching with the uniform symbol table to discover syntactic structure.
    (C) Consists of a full or partial list or the token's as they appear in the program. Created by Lexical analysis and used for syntax analysis and interpretation.
    (D) A permanent table which lists all key words and special symbols of the language in symbolic form.
    (E) None of the above

20. Thrashing can be avoided if—
    (A) The pages, belonging to the working set of the programs, are in main memory
    (B) The speed of CPU is increased
    (C) The speed of I/O processor is increased
    (D) All of the above
    (E) None of the above

21. Resolution of externally defined symbols is performed by—
    (A) Linker (B) Loader
    (C) Compiler (D) Assembler
    (E) None of the above

22. In virtual memory systems, Dynamic address translation—
    (A) Is the hardware necessary to implement paging
    (B) Stores pages at a specific location on disk
    (C) Is useless when swapping is used
    (D) Is part of the operating system paging algorithm
    (E) None of the above

23. Fragmentation of the file system—
    (A) Occurs only if the file system is used improperly
    (B) Can always be prevented
    (C) Can be temporarily removed by compaction
    (D) Is a characteristic of all file systems
    (E) None of the above

24. Which of the following are(is) Language Processor(s)—
    (A) Assembles (B) Compilers
    (C) Interpreters (D) All of these
    (E) None of the above

25. In which addressing mode the effective address of the operand is the contents of a register specified in the instruction and after accessing the operand, the contents of this register is incremented to point to the next item in the list ?
    (A) Index addressing
    (B) Indirect addressing
    (C) Auto increment
    (D) Auto decrement
    (E) None of the above

26. The memory allocation scheme subject to "external" fragmentation is—
    (A) Segmentation
    (B) Swapping
    (C) Pure demand paging
    (D) Multiple contiguous fixed partitions
    (E) None of the above

27. In which addressing mode the contents of a register specified in the instruction are first decremented, and then these contents are used as the effective address of the operands ?
    (A) Index addressing
    (B) Indirect addressing
    (C) Auto increment
    (D) Auto decrement
    (E) None of the above

28. Page stealing—
    (A) Is a sign of an efficient system
    (B) Is taking page frames from other working sets
    (C) Should be the tuning goal

(D) Is taking larger disk spaces for pages paged out
(E) None of the above

29. Bug means—
(A) A logical error in a program
(B) A difficult syntax error in a program
(C) Documenting programs using an efficient documentation tool
(D) All of the above
(E) None of the above

30. What is the name given to the values that are automatically provided by software to reduce keystrokes and improve a computer user's productivity ?
(A) Defined values
(B) Fixed values
(C) Default values
(D) Special values
(E) None of the above

31. The initial value of the semaphore that allows only one of the many processes to enter their critical sections, is—
(A) 8 (B) 1
(C) 16 (D) 0

32. A page fault—
(A) Is an error is a specific page
(B) Occurs when a program accesses a page of memory
(C) Is an access to a page not currently in memory
(D) Is a reference to a page belonging to another program
(E) None of the above

33. Which of the following statements is false ?
(A) A small page size causes large page tables
(B) Internal fragmentation is increased with small pages
(C) A large page size causes instructions and data that will not be referenced brought into primary storage
(D) I/O transfers are more efficient with large pages
(E) None of the above

34. Which, of the following is not true about the description of a decision table ?
(A) A decision table is easy to modify
(B) A decision table is directly understood by the computer
(C) A decision table is easy to understand
(D) All of the above
(E) None of the above

35. Seeks analysis—
(A) Is used for analyzing paging problems
(B) Is used for analyzing device busy problems
(C) Is used for analyzing control-unit busy problems
(D) Is only shown on real-time displays
(E) None of the above

36. What is the name of the technique in which the operating system of a computer executes several programs concurrently by switching back and forth between them ?
(A) Partitioning (B) Multitasking
(C) Windowing (D) Paging
(E) None of the above

37. Software that measures, monitors, analyzes, and controls real-world events is called—
(A) System software
(B) Real-time software
(C) Scientific software
(D) Business software
(E) None of the above

38. The dispatcher—
(A) Actually schedules the tasks into the processor
(B) Puts tasks in I/O wait
(C) Is always small and simple
(D) Never changes task priorities
(E) None of the above

39. Swapping—
(A) Works best with many small partitions
(B) Allows many programs to use memory simultaneously
(C) Allows each program in turn to use the memory
(D) Does not work with overlaying
(E) None of the above

40. A translator is best described as—
    (A) An application software
    (B) A system software
    (C) A hardware component
    (D) All of the above
    (E) None of the above

41. Multiprogramming—
    (A) Is a method of memory allocation by which the program is subdivided into equal portions, or pages and core is subdivided into equal portions or blocks.
    (B) Consists of those addresses that may be generated by a processor during execution of a computation.
    (C) Is a method of allocating processor time.
    (D) Allows multiple programs to reside in separate areas of core at the time.
    (E) None of the above

42. In which of the storage placement strategies a program is placed in the largest available hole in the main memory ?
    (A) Best fit (B) First fit
    (C) Worst fit (D) Buddy
    (E) None of the above

43. The problem of thrashing is affected significantly by—
    (A) Program structure
    (B) Program size
    (C) Primary-storage size
    (D) All of the above
    (E) None of the above

44. Which of the following is not true about the memory management ?
    (A) Virtual memory is used only in multi-user systems
    (B) Segmentation suffers from external fragmentation
    (C) Paging suffers from internal fragmentation
    (D) Segmented memory can be paged
    (E) None of the above

45. Job Control Language (JCL) statements are used to—
    (A) Read the input from the slow-speed card reader to the high-speed magnetic disk
    (B) Specify, to the operating system, the beginning and end of a job in a batch
    (C) Allocate the CPU to a job
    (D) All of the above
    (E) None of the above

46. Paging—
    (A) Is a method of memory allocation by which the program is subdivided into equal portions, or pages and core is subdivided into equal portions or blocks.
    (B) Consists of those addresses that may be generated by a processor during execution of a computation.
    (C) Is a method of allocating processor time.
    (D) Allows multiple programs to reside in separate areas of core at the time.
    (E) None of the above

47. Scheduling is—
    (A) Allowing jobs to use the processor
    (B) Unrelated to performance consideration
    (C) Not required in uniprocessor systems
    (D) The same regard-less of the purpose of the system
    (E) None of the above

48. What scheduling algorithm allows processes that are logical runnable to be temporarily suspended ?
    (A) Preemptive scheduling
    (B) Non-preemptive scheduling
    (C) FIFO
    (D) FCFS
    (E) None of the above

49. The computational technique used to compute the disk storage address of individual records is called—
    (A) Bubble memory
    (B) Key fielding
    (C) Dynamic reallocation
    (D) Hashing
    (E) None of the above

50. Semaphores—
    (A) Synchronize critical resources to prevent deadlock
    (B) Synchronize critical resources to prevent contention

(C) Are used to do I/O
(D) Are used for memory management
(E) None of the above

51. When a computer is first turned on or restarted, a special type of absolute loader called ..... is executed—
(A) Compile and Go loader
(B) Boot loader
(C) Bootstrap loader
(D) Relating loader

52. Which of the following Operating systems is better for implementing a Client-Server network—
(A) MS DOS
(B) Windows 95
(C) Windows 98
(D) Windows 2000

53. The operating system manages—
(A) Memory
(B) Processes
(C) Disks and I/O devices
(D) All of the above

54. Usually, in MS-DOS, the primary hard disk drives has the drive letter .....
(A) A (B) B
(C) C (D) D

55. What is the function of an operating system?
(A) Manages computer's resources very efficiently
(B) Takes care of scheduling jobs for execution
(C) Manages the flow of data and instructions
(D) All of the above

56. Which is not the function of the Operating System ?
(A) Memory management
(B) Disk management
(C) Application management
(D) Virus Protection

57. Which Operating System doesn't support networking between computers ?
(A) Windows 3.1 (B) Windows 95
(C) Windows 2000 (D) Windows NT

58. Which Operating System doesn't support long file names ?
(A) OS/2
(B) Windows 95
(C) MS-DOS
(D) Windows NT

59. Which file keeps commands to execute automatically when OS is started ?
(A) Command.com
(B) Any batch file
(C) Autoexec.bat
(D) Config.sys

60. What should be the extension to execute files ?
(A) EXE (B) BAT
(C) COM (D) All of these

61. Which one of the following is not the function of Operating System ?
(A) Resource Management
(B) File Management
(C) Networking
(D) Processor Management

62. The Banker's algorithm is used—
(A) To rectify deadlock
(B) To detect deadlock
(C) To prevent deadlock
(D) To slove deadlock

63. Which of the following concept is best to preventing page faults ?
(A) Paging
(B) The working set
(C) Hit ratios
(D) Address location resolution

64. Which of the following memory unit that processor can access more rapidly—
(A) Main Memory
(B) Virtual Memory
(C) Cache memory
(D) Read Only Memory

65. A page fault occurs when—
(A) The Deadlock happens
(B) The Segmentation starts
(C) The page is found in the memory
(D) The page is not found in the memory

66. Bringing a page into memory only when it is needed, this mechanism is called—
    (A) Deadlock
    (B) Page Fault
    (C) Dormant Paging
    (D) Demand Paging

67. First-in-First-Out (FIFO) scheduling is—
    (A) Non Preemptive Scheduling
    (B) Preemptive Scheduling
    (C) Fair Share Scheduling
    (D) Deadline Scheduling

68. Copying a process from memory to disk to allow space for other processes is Called—
    (A) Swapping
    (B) Deadlock
    (C) Demand Paging
    (D) Page Fault

69. The necessary conditions needed before deadlock can occur ?
    (A) No Mutual Exclusion, Hold and wait, Preemption, Circular Wait
    (B) Mutual Exclusion, No Hold and wait, Preemption, Circular Wait
    (C) Mutual Exclusion, Hold and wait, No Preemption, Circular Wait
    (D) Mutual Exclusion, Hold and wait, Preemption, No Circular Wait

70. A program in execution is called—
    (A) A Paging
    (B) A Process
    (C) A virtual memory
    (D) A Demand Page

## Answers

| | | | | |
|---|---|---|---|---|
| 1. (B) | 2. (C) | 3. (C) | 4. (A) | 5. (A) |
| 6. (C) | 7. (B) | 8. (C) | 9. (D) | 10. (D) |
| 11. (C) | 12. (D) | 13. (C) | 14. (C) | 15. (C) |
| 16. (A) | 17. (D) | 18. (A) | 19. (A) | 20. (A) |
| 21. (A) | 22. (A) | 23. (C) | 24. (D) | 25. (C) |
| 26. (A) | 27. (D) | 28. (B) | 29. (A) | 30. (C) |
| 31. (B) | 32. (C) | 33. (B) | 34. (B) | 35. (B) |
| 36. (B) | 37. (B) | 38. (A) | 39. (C) | 40. (B) |
| 41. (D) | 42. (C) | 43. (A) | 44. (A) | 45. (B) |
| 46. (A) | 47. (A) | 48. (A) | 49. (D) | 50. (A) |
| 51. (C) | 52. (D) | 53. (D) | 54. (C) | 55. (D) |
| 56. (D) | 57. (A) | 58. (C) | 59. (C) | 60. (D) |
| 61. (C) | 62. (C) | 63. (B) | 64. (C) | 65. (D) |
| 66. (D) | 67. (A) | 68. (A) | 69. (C) | 70. (B) |

❑❑

# 14 Computer Organization and Architecture

## Computer Organization

Computer organization is the study about the internal procession of the computer system; it helps optimize performance-based products. For example, software engineers need to know the processing ability of processors. They may need to optimize software in order to gain the most performance at the least expense. This can require quite detailed analysis of the computer organization. For example, in a multimedia decoder, the designers might need to arrange for most data to be processed in the fastest data path and the various components are assumed to be in place and task is to investigate the organizational structure to verify the computer parts operates.

Computer organization also helps plan the selection of a processor for a particular project. Multimedia projects may need very rapid data access, while supervisory software may need fast interrupts.

Sometimes certain tasks need additional components as well. For example, a computer capable of virtualization needs virtual memory hardware so that the memory of different simulated computers can be kept separated.

## Computer Architecture

Computer Architecture is study about those attributes visible to the programmer Instruction set, number of bits used for data representation, I/O mechanisms, addressing techniques.

## Computer Organization and Architecture Terminology

### Access Time

The of time required for a binary Word in the memory section of a computer to be read by the Central Processing Unit (CPU), or the time to read data from a peripheral data storage area.

### Accumulator

An interface Register (memory) in the Arithmetic Logic Unit (ALU), that stores interim arithmetic information for future processing. The accumulator is interface between the ALU and other sections of the computer.

### Adder

The digital logic circuits in the ALU section of a computer which implements the adding process (sum and carry) of two or more binary numbers.

### Address

The location of digital information in the Memory Unit of a computer, or a digital code that designates this location.

### American Standard Code For Information Interchange (ASCII)

A 7-bit binary code, providing 128 different binary combinations for standard American keyboards. ASCII is used to encode all 26 letters of the alphabet (upper and lower case), all ten decimal digits (0 to 9), punctuation marks, standard graphics, and special control codes into machine language. Although ASCII has 128 different codes, only 7 bits are needed for each different code. ASCII characters are generally stored inside 8-bit bytes, providing room for the 128 ASCII codes plus another 128 codes, totalling

256 characters. This 8-bit code is referred to as Extended ASCII.

### Arithmetic Logic Unit (ALU)

The section of a computer that contains a large amount of logic circuitry and performs the four basic arithmetic functions (addition, subtraction, multiplication, and division). Larger units contain circuitry for higher mathematical functions, such as: quadratic equations, etc.

### ASCII Data (ASCII File)

Data, or the file containing the data, that is constructed with letters of the alphabet, numerals, punctuation marks, and the standard ASCII formatting commands, such as: "carriage return" or "line feed". These terms refer to text information.

### Assembler

A software program that converts (translates) each symbolic instruction written in Assembly Language into the Machine Language (binary code) of a computer.

### Assembly Language

A programming language (source code) that consists of a group of coded letters or labels, called mnemonics. A mnemonic is a memory assist to help recall data. Each mnemonic represents a single instruction that is translated into the binary code of machine language. Mnemonics are easier to use than machine language instructions. For example, the mnemonic "MUL" tells the computer to "Multiply".

Asynchronous means not clocked; often controlled by handshaking

### Backplane

A part of a computer into which the system's PC boards are plugged to provide a common voltage supply, reference, and System Bus for all computer sections. A backplane is often called a Motherboard.

### BASIC

The acronym for Beginner's All-purpose Symbolic Instruction Code. BASIC is an easy to use programming language, originally intended for educational purposes; it is available for personal computers in varying degrees of complexity.

### Baud Rate

A measure of speed (up to 2400 bits per second) of transferring information between two or more sections of a computer system, or between two or more computers.

### Binary Coded Decimal (BCD)

A coding system in which each decimal system numeral (0 to 9) is represented by a 4-digit (4-bit) binary code.

### Binary System (BASE 2)

A numbering system consisting of only two digits (0 and 1), as contrasted with a Decimal System that uses ten digits (0 to 9). In electronics, "binary" and "two-state" are synonymous.

### Binary Digit (Bit)

The term "Bit" is the contraction of Binary Digit and is part of a binary WORD that consists of combinations of "0s" and/or "1s". There are only two numerals in binary arithmetic (base 2) and is the basis for binary code (Machine Language), the language of the computer. A "bit" has the same significance in binary arithmetic that a decimal digit has in the more familiar decimal (base 10) arithmetic system.

### Boolean Algebra

Named after George Boole, a 19th century English mathematician, who first formulated theorems that included a mathematical analysis of the laws of human logic. It uses algebraic-like notation to describe the interaction of variables having only two states - "true" and "false". In electronics, the states are often referred to as "1" and "0" or, "high" and "low". The terms "high" and "low" refer to the voltage levels of the input and output signals of a logic gate (logic circuit). Boolean algebra is used in the design of logic circuits in computers and similar digital systems. The logic gates called AND, OR, and NOT are the three basic logic gates in Boolean algebra. NAND, NOR, XOR and others are combinations of the three basic logic gate operations.

### Bootstrap (BOOT)

A software program for initiating the operation of a computer. The function of the program is to set up the input and output (I/O) devices and load the Operating System from a disk, cassette, or built-in Read Only Memory (ROM).

### Breakpoint

Location of a place in a program where program execution can be stopped to permit a visual test, printing, or other performance analyses.

### Bubble Memory

A high-density memory medium upon which a magnetic film is grown on a gadolinium-gallium garnet substrate. A small permanent magnet is mounted inside its package, perpendicular to the surface of the substrate. When an external magnetic field is created with an external coil, magnetic "bubble" domains are formed on the internal magnetic film which represent patterns of "1s". The absence of magnetic bubbles will represent patterns of "0s".

### Buffer

A buffer has different meanings like—

1. A digital logic circuit inserted between other digital circuits to reduce circuit interaction and/or to provide amplification of a digital signal.
2. An intermediate storage circuit used to compensate for a difference in baud rate or, to compensate for different times of occurrence of different events or instructions.
3. A circuit for converting input or output voltages for signal level compatibility when transmitting data from one device to another.

### Bus (BUSS)

A series of transmission lines connecting the various elements of a computer for distribution of data, control signals, addresses, and/or voltage supply(s) within a computer.

### Bus Controller

A circuit that generates commands and control signals for sequencing and timing of the data transmitted on a bus.

### Byte

A set (group) of consecutive binary digits (bits) that forms a unit (word) or sub-unit of digital information in a computer. Depending on the size of the computer, a digital word may contain one or more bytes. Through common usage, a byte is generally accepted as containing eight bits.

### Cache

A high-speed buffer memory that is similar to a Scratch Pad Memory, but has a larger capacity; it is located in the Central Processing Unit. It is filled from the main memory at low speed with instructions and programs and is operated at a higher speed. A cache can also serve as a storage section between the CPU and a hard disk to speed up access of data on the hard disk.

### Carry Look Ahead Adder

A carry-look ahead adder (CLA) is a type of adder used in digital logic. A carry-look ahead adder improves speed by reducing the amount of time required to determine carry bits.

### CISC (Complex Instruction Set Computer)

Refers to an *instruction set architecture* in which the operands of instructions may be in memory (as well as in *registers*), in which many addressing modes are available, and in which some instructions may perform highly specialized tasks. As a rule, implementing CISC architecture in hardware requires the use of microcode. CISC instructions may require 10 or more clock periods to execute.

### Clock

A digital pulse generator that controls the timing of a computer and, to a great extent, determines the speed (number of instructions per second) capability of the computer. Generally, it is located in the CPU.

### CMOS Logic

A CMOS technology monolithic IC "logic family" characterized by low power dissipation per gate, high chip density, and relatively high propagation delay per gate compared with bipolar IC logic families.

### Compiler

A software program that converts (translates) a complete software program written in high-level language Source Code (such as PASCAL or FORTRAN) into machine language. The entire source code is edited, compiled, and run at one time as compared to an Interpreter that is run one line at a time.

### Complement

Reversal of bit values: "1s" become "0s" and "0s" become "1s".

### Concurrency

The independent execution of two or more sequences of events that are either occurring, or appearing to occur simultaneously.

### Console

The term referring to a combination of a Display and Keyboard.

### Control Bus

A set of transmission lines whose function is to carry synchronization signals and control data as part of the System Bus.

### Control Unit (CU)

Part of the CPU containing the Clock, Program Counter and Instruction Register. The Control Unit also generates control signals and manages the Control Bus.

### Counter

A circuit whose output(s) change state in a specified sequence on receiving appropriate input signals. The circuit can provide a required output pulse after receiving a specified number of input pulses.

### Crash

The term that describes a situation when a part of, or the complete computer, stops working because of a hardware and/or software malfunction. A head-crash in a disk system refers to the accidental impact of the read/write head on the surface of the disk.

### Daisy-Wheel Printer

An impact printer that uses a print element shaped like a flat disk or large thimble to form the alphanumeric and punctuation marks that are part of its print element. Unlike dot-matrix, ink-jet, and laser printers, daisy-wheel printers can not print graphics.

### Debug

The process of detecting, locating, and correcting a problem in a software program or hardware.

### Decrement

The reduction of the numerical contents of a counter. A decrement of 1 is usually assumed, unless otherwise specified. It is the complementary operation of Increment.

### Diode-Transistor Logic (DTL)

One of the first bipolar monolithic IC families of logic gates. A diode in an IC logic gate performs the required logic with a transistor amplifying and inverting the output. The DTL family has been made obsolete by the Transistor-Transistor Logic (TTL) family.

### Direct Address

A memory accessing mode in which the contents of the accessed location is called the Operand.

### Direct Memory Access (DMA)

A method of transferring blocks of data directly between an external device and the computer system memory without the need for intervention by the CPU. This method significantly speeds up the data transfer rate, improving system efficiency.

### DISC or DISK (DISKETTE)

A thin, flexible, plastic, circular memory medium, coated on both sides with metal oxide and enclosed in a protective jacket. Data is stored magnetically in binary digital form on its surface(s).

### Disk Drive

The mechanical/electronic section that can accept and operate a compatible floppy or hard disk. It may include several motors (for disk rotation and reading/writing head positioning), position sensors, and control circuits.

### Disk Operating System (DOS)

A software program on a disk which coordinates the operation, transfer of data, supervision, and control of a computer. This software program must first be booted into the working memory of the computer from the disk before it can operate.

### Disk Storage

A method of storing software programs and data on a rotating circular disk (either a floppy or hard disk) coated with magnetic material, such as iron oxide. Data is written (stored) and read (retrieved) by movable read/write heads positioned over data tracks on the surface of the disk. Addressable portions of the disk can be selected for read or write operations.

**Documentation**

Information that explains how to use computer hardware or software. It is usually provided as a manual or stored on a disk.

**Dot-Matrix Printer**

An impact printer with a computer-driven, multi-pin print element (print-head). It create images by imprinting a series of tiny dots on a paper to print a wide variety of character styles and/or finely detailed graphics. Generally, these printers are extremely fast and are used for draft-quality documents and precise graphics.

**Dots Per Inch (DPI)**

The measurement of density on dot-matrix printers or other dot-matrix devices. As the DPI increases, image clarity increases.

**Download**

The transfer of files or data from a source of data to a remote computer.

**Down Time**

A period of time during which a computer is not functioning. It is inoperable because of temporary or permanent failure of hardware or software, or when routine hardware or software maintenance procedures are indicated.

**Dynamic Random Access Memory (DRAM)**

A type of semiconductor memory in which the presence or absence of a capacitive charge in each element of the memory represents the state of the bit (1 or 0). This charge must be periodically recharged (refreshed) to maintain the desired binary state of the element.

**Editor**

A program for preparing and/or modifying a Source Program or other file by addition, deletion, or change.

**Emulation**

The process of imitation (simulation) of one computer system by another. The imitating program, or device (emulator), accepts the same data, executes the same programs, and achieves the same results.

**EPROM (Erasable Programmable Read-Only Memory)**

A general term for a non-volatile, semiconductor memory that can be programmed, erased, and reprogrammed many times without damage to the device. More specific types of EPROMs include: EAPROM (Electrically Alterable PROM), EEPROM (Electrically Erasable Prom) And UV-EPROM (Ultraviolet Erasable PROM). Either memory is suitable for prototype and computer development, or to change memory data when new conditions dictate the change.

**Event**

An occurrence during the execution of a task, such as the completion of an input/output operation.

**Execute**

The command to run a specified instruction or software program.

**Extended Binary Coded Decimal Interchange Code (EBCDIC)**

An 8-bit code developed by IBM for their mainframe computers, providing 256 bit-pattern equivalents of standard keyboard symbols.

**Fan-In**

The maximum number of output terminals from other logic gates that can be connected to an input terminal of a specified logic gate.

**Fan-Out**

The maximum number of input terminals that can be connected to the output terminal of a specified logic gate.

**Fetch**

The command to obtain an instruction from a stored program.

**File**

A collection of related data treated as a single unit. In a computer, a file can exist on a disk, magnetic tape, or as an accumulation of information in memory.

**Firmware**

A combination of a software program in hardware, such as a Read-Only Memory (ROM), or a disk that has files or software programs written on its surface.

### First In, First Out (FIFO)

The term refers to the sequence of entering and then retrieving data from a data storage section of a computer. The first data entered is the first data retrieved.

### Flag

An indicator of a specific condition that informs a section of a program that this condition has already occurred and is identified by the presence or absence of the flag. A flag can be implemented in software and/or hardware.

### Flash Memory (Flexible Architecture For Shared Memory)

Non-volatile semiconductor memory with access time approximately that of EEPROM or EAPROM and density similar to that of an EPROM. FLASH memory is generally limited to about 100,000 erase cycles. Usually packaged in PCMCIA for plugging into a laptop computer card slot.

### Flip-Flop Circuit

A logic circuit having two stable output states. It has the ability to change from one state to the other when an input pulse is applied in a specified manner. It is also called a Bistable Multivibrator.

### Floating-Point Arithmetic

A method in which the decimal point location of a number in an arithmetic operation is determined by the number's exponent value in base 10. All exponents are equalized prior to the operation to set a decimal point in its proper location in the final computation. Floating-point arithmetic extends a computer's mathematical capability beyond the limit imposed by a fixed word length and contributes to easier programming.

### Gate Array

A group of standard logic gates that can be interconnected into a complete circuit or system. Also called Logic Array.

### General Purpose Interface Bus (GPIB)

A BUS specification standard (IEEE 488) for controlling peripheral devices.

### GIGO (Garbage In, Garbage Out)

The term describing the output of a computer whose operation or accuracy is faulty.

### Graphics

Schematic drawings, pictures, line drawings, and/or diagrams generated by data entered into a computer via a keyboard or a data base.

### Half-Duplex

A communications mode that allows transmission and reception of digital data between computers, but not simultaneously.

### Handshaking

A communications synchronizing technique carried out before and after any transfer of digital data. It consists of a sequence of signals for non-clocked (asynchronous) systems in which a reply is needed to complete a data transfer operation.

### Hard Copy

A printed copy of a file, message, or graphic of the visual display on the screen of a computer monitor.

### Hard-Disk Drive

A sealed unit containing high-density, high-speed, rigid metal disks, and recording heads to store digital data. It reads and writes data faster than floppy disks.

### Hardware

The physical equipment of a computer system consisting of mechanical and electrical/electronic components.

### Hexadecimal

The base 16 number system using 16 symbols (0 to 9 and A to F) to represent 16 decimal numerals (0 to 15).

### High-Level Language (HLL)

A programming language (source code) consisting of a unique group of symbols and command statements representing a series of machine operations. A Compiler or Interpreter translates (converts) a HLL into Machine Language. BASIC, FORTRAN, PASCAL, ALGOL, and ADA are some examples of high-level languages.

### Impact Printer

A computer-driven mechanical imprinting device where the characters are formed by the printer-head key striking a ribbon to imprint the character's image onto a paper.

### Increment

The increase in the numerical contents of a counter. An increment of one is usually assumed, unless otherwise specified.

### Ink-Jet Printer

A printer that forms characters by electrostatically aiming and depositing a tiny patterned drop of ink onto the paper to be printed.

### Input/Output (I/O) Section

The section that interfaces between the computer's System Bus and the peripherals feeding data into and taking data out of the computer. Depending on the number of peripherals in a system, the I/O sections can have a single Port or multiple ports.

### Instruction

A software statement that specifies a machine operation. Also called a Command.

### Instruction Set (Instruction Repertoire)

A description of the total operational capabilities of a computer provided by the computer or the CPU (MPU) manufacturer. It consists of a listing of binary words for each executable commands. It is sometimes called the computer's Microcode.

### Interpreter

A high-level language translator that converts individual high-level computer language program instructions (source code) into machine instructions. It translates and executes each statement line-by-line during the running of the program.

### Interrupt

The suspension of normal program execution to perform a higher priority service routine as requested by a peripheral device. After completion of the service routine operation, the interrupted program routine is resumed at the point where it was interrupted.

### Jump

An instruction that causes the computer to fetch the next instruction to be executed from a location other than the next sequential location in memory.

### Keyboard

A peripheral device consisting of alphanumeric, punctuation marks, and other special function keys that are mechanically arranged to allow the entry of data, commands, and other information into the system.

### Landscape

A printer feature, generally controlled by software, which rotates the output image by 90° to print across the length rather than the width of the paper.

### LASER (Light Amplification By Stimulated Emission Of Radiation)

A system that generates high-intensity, highly-focused light for many purposes, including printers, high-density memory media, and a light generator for fibre optic transmission systems.

### Printer

A computer-driven photocopier that creates an original image of the text or graphics from the output of the computer. A computer-controlled laser beam "paints" the desired image inside the photocopier and then prints the image on a sheet of paper.

### Last-In, First-Out (LIFO)

A method of storing and retrieving data in a stack, table, or list.

### Light Pen

A light-sensitive stylus for forming graphics by touching coordinates on a display screen, thereby seeming to draw directly on the screen.

### Library

A collection of standard software instructions, programs, routines, and subroutines in a computer's memory.

### Linkage

Instructions that connect one program to another, providing continuity of executions between the programs.

### Local Area Network (LAN)

A combined hardware/software technique for interconnecting company related multiple computers or computer terminals through a high-speed networking system.

### Logic Gate

A digital circuit resulting in an output whose state (0 or 1) depends on the specific combination of the states of input signals. Definitions of the more commonly used logic gates are listed below:

### AND

All inputs must be in a "1" state to produce a "1" state output.

### NAND (NOT AND)

All inputs must be in a "1" state to produce a "0" state output.

### OR (NOT OR)

Any one input, or more, in a "1" state will produce a "0" state output.

### NOT (Inverter)

logic gate having only one input and one output. If the input is in a "1" state, the output is in a "0" state and vice versa.

### OR

Any one input, or more, in a "1" state will produce a "1" state at the output.

### XOR (Exclusive OR)

If any of the inputs are in a "1" state, but not if two or more inputs are "1", the output is in a "1" state.

Latency the amount of time that passes from the moment a hardware data request is issued until the data has arrived at its destination. The term \latency" is applied to memory, hard disks, and networks.

### Look Ahead

1. A feature of a CPU which allows the masking of an interrupt request until the current sequential instruction has been completed. 2. A feature of an adder circuit in the ALU section which allows the circuit to look ahead to see that all the generated arithmetic carries are available for addition.

### Looping

The repetition of program instructions until a conditional exit situation is encountered.

### Machine Language

Sets of numeric binary code instructions in a computer which execute its operations. All other programming languages (Source Programs) must be translated into machine language (Object Program) before entering the CPU.

### Macro

A combination of commands, instructions, or keystrokes which may be stored in a computer's memory to be executed as a single command by a single keystroke or a simultaneous combination of keystrokes.

### Macro Assembler

An assembly language translator that converts macro expressions into several machine language instructions. Although macros simplify program coding and speed up execution of a program, a code for each macro must also be generated.

### Mainframe Computer

Second largest of the computer family, in capability and, generally, in size, having a Word-Width of 32 bits and higher. The largest computer is the Super Computer with a Word Width of 64 to 128 bits.

### Memory

A data storage structure in a computer that accepts binary information for storage in electrical, mechanical, or magnetic form, and retains the information for as long as needed. Selected data can be written, moved, displayed, copied, or erased. The variety of memory media includes: paper, magnetic, bubble, optical laser, and semiconductor memory. Each one has a different method of operation and a specific criterion for being selected.

### Microcomputer

A microprocessor-based computer, consisting of an MPU, internal semiconductor memory, input and output sections, and a system bus, all on one, or several monolithic IC chips inserted into one or several PC boards. The addition of a power supply and connecting cables, appropriate peripherals (keyboard, monitor, printer, disk drives, etc.), an

operating system and other software programs can provide a complete microcomputer system. The microcomputer is generally the smallest of the computer family, however, the improvement in performance capability of newer microcomputer systems can make the microcomputer as powerful as larger systems.

### Microprocessor Unit (MPU)

The Central Processor Unit (CPU) implemented in monolithic IC technology, usually, but not necessarily, on one VLSI chip. In many cases, the System Bus is also included on the MPU chip.

### Minicomputer

Considered to be more capable than a microcomputer but less powerful than a mainframe. Generally, the Word-Width of the minicomputer is between 12 to 32 bits.

### Mnemonic

A symbolic label or code reminder that assists the user in remembering a specific operation or command.

### MIPS

(1) Millions of Instructions Per Second. (2) A subsidiary of Silicon Graphics, Inc., that designs and manufactures the **MIPS Rx000** family of *RISC* microprocessors, where x = 2, 3, 4, 5, 8 or 10. SPIM simulates the R2000{R3000 architecture.

### Modem

An acronym for Modulator/Demodulator that refers to specific equipment that provides a means of communication between two computer systems over conventional telephone lines. Each remote computer requires its own modem and a compatible communications software program for proper interfacing.

### Monitor

The visual readout device of a computer system. A monitor can be in several forms:, a cathode ray tube (CRT), a liquid crystal display (LCD), or a flat-panel, full-colour display.

### Mouse

A manually operated input device for moving or entering positional information and other data or commands by accessing (pointing to) images on a monitor.

### Multitasking

The technique of using several applications programs (tasks) in a computer system or on several terminals in a network at the same time. Multitasking can simultaneously work with several programs or interrelated tasks that share memories, codes, buffers, and files.

### Multiuser

The term describing the capability of a computer system to be operated at more than one terminal at the same time.

### Negative Logic

This term refers to logic in which the negative voltage represents the "1" state and the zero voltage represents the "0" state.

### Nesting

Embedding commands or data in levels of other data so that specific routines or instructions can be executed or accessed continuously in loops, without returning to the main program.

### Nibble

A sequence of four adjacent bits, or a half-byte. A hexadecimal or BCD coded digit can be represented by a nibble.

### Node

The endpoint of a network branch or the junction of two or more branches.

### NonVolatile Memory

A memory where stored data remains undisturbed by the removal of electrical power.

### Object Code

Machine language code produced by a translator program, such as an assembler, interpreter, or compiler. Instructions in object code can be executed by a Central Processing Unit (CPU).

### Operation Code (OP-CODE)

Part of a computer instruction word that designates the function performed by a specific instruction. For example, op-codes for arithmetic instructions include: "ADD", "SUB", "MUL" and "DIV".

### Overflow

An error condition occurring in a computer when a mathematical operation produces a result

having a magnitude that exceeds the capacity of the computer's arithmetic register.

### Pascal

A high-level programming language that is structured to encourage efficient programming habits (documentation) and is used extensively in educational institutions and engineering environments.

### Parallel Operation

A method of data transmission in which all bits of a digital word are handled simultaneously with each bit on a separate line. Although faster and simpler to install and operate than Serial Operation, this method requires more transmission lines (real estate).

### Parity

A method of verifying the accuracy of binary data after it has been transferred to or from a storage area.

### PCMCIA (Personal Computer Memory Card International Association)

A package in a plastic card form containing semiconductor memory, particularly FLASH. These cards are plugged into the card slot in laptop computers.

### Peripheral

A term designating the various kinds of machines and devices that work in conjunction with a computer but are not necessarily part of the computer structure. Typically, peripherals refer to: printers, keyboards, monitors, scanners, CD ROM drives, and plotters. A hard drive, floppy disk drive, and a Modem are considered to be peripheral devices even though they may be physically located inside a computer.

### Plug-Compatible

A term that describes the ability of peripherals to be interchanged without modification.

### Polling

A process in which a number of peripheral devices, remote stations, or nodes in a computer network are interrogated, one at a time, to determine if service is required.

### POP

The instruction that removes a word from the top of a stack.

### Port

An input/output channel (either parallel or serial), terminated at a connector on the computer. It interconnects the computer's input and/or output terminals to an appropriate source and/or destination.

### Portrait

A term that designates the position of conventional printing across the width of a page.

### Positive Logic

This logic represents the reverse of Negative Logic. It is the more commonly used form of logic. A positive voltage represents a "1" state and a negative (or zero) voltage represents a "0" state.

### Print Spooler

A device for temporarily storing data to be printed when the printer is functioning. It provides uninterrupted data entry and editing while the printer is active and while other data awaits transmission to the printer.

Process an instance of a program in execution.

### Processor

A processor adds, subtracts, multiplies and divides numbers, tests inequalities, etc. The central processing unit **(CPU)** is the executive part of the computer, following the instructions of programs to the letter. In some computers one or more **peripheral processors** control routine tasks such as I/O in order to reduce the load on the CPU. A processor is usually classified as 4-, 8-, 16- or 32-bit, depending on the width of its data bus.

### Program

A complete sequence of computer software instructions necessary to provide an application, solve a specific problem, perform an action, or respond to external stimuli in a prescribed manner. As a verb, it means to develop a program.

### Program Counter (PC)

A special-purpose register in the CPU which contains the address of the next instruction to be fetched and executed.

**Programmable Logic Array (PLA)**

An unprogrammed, general-purpose logic structure in monolithic IC form consisting of an array of similar, and/or compatible logic gates. Also called Programmable Array Logic (PAL).

**Programmable Read-Only Memory (PROM)**

A blank read-only memory (ROM) that is programmed with external programming equipment after manufacture. Once programmed, it is not re-programmable and is considered to be a ROM.

**Propagation Delay**

The time required for the output of a logic gate to respond to a combination of input pulses.

**PUSH**

The instruction used to deposit a word on top of a stack.

**Push-Down Stack**

A dedicated temporary storage register in a computer, sometimes part of a system memory, structured so that data (words) in the stack are retrieved in reverse order of entry.

**Ram Disk (Disk Emulator)**

A portion of a hard drive configured to emulate a RAM. It accesses information quickly, but its data must be saved in a non-volatile memory for future use. Otherwise, the information is lost when power is removed.

**Random Access**

A technique of accessing (reading) a word of data from a memory structure by the CPU. Since a word in the memory can be accessed directly, the time required is independent of its location (address) in the memory structure. It is sometimes called a "direct access" method.

**Random Access Memory (RAM)**

A volatile, semiconductor storage structure that accesses temporary data with a random or direct accessing method. It is more accurately referred to as "erasable read/write" memory. Data in this memory can be read by the CPU, edited, altered, erased, or new information written over existing data by computer commands. Its data must be saved for future access by writing it into a non-volatile memory.

**Read-Only Memory (ROM)**

A semiconductor memory whose data cannot be erased, or overwritten; it can only be accessed (read) for use by the CPU. The data in a ROM is of a permanent nature and is programmed by the ROM manufacturer. In many cases, its programmed information identifies the dedicated function of a computer. A ROM can also be in the physical form of a module (tape or disk) that is plugged into a computer to change its operation from one program to another.

**Real-Time Data**

Time-dependent data processed by a computer whose output data is capable of controlling other time-related events, such as traffic control. Real time is the actual time it takes for an event to occur.

**Register**

A temporary storage unit for quick, direct accessibility of a small amount of data for processing. Most computers include a set of internal registers that can be accessed more quickly than the system's main memory.

**Resident Software**

The program(s) residing in the main memory of a computer system. For convenience of operation, several software programs can reside in RAM after the computer is turned on and booted, and they can be accessed quickly from within another program.

**RISC (Reduced Instruction Set Computer)**

A class of computer architectures featuring a small number of primitive instructions, a constant hardware instruction length (in bits), and no memory accesses except by \load" and \store" instructions. The objective of a RISC architecture is to reduce the number of clock periods per (integer) instruction to 1 for most executions, in order to maximize *performance*.

**RS-232-C**

Identifies an interconnection standard for serial operation. It specifies the configuration and type of connectors in the computer's serial I/O port(s) and peripheral serial port(s).

**Scratch Pad Memory**

A group of internal registers used for the temporary storage of data being collected and

sorted for immediate processing. It is analogous to a pad of paper for quickly jotting down notes.

**Sector**

A section of a recording track on a magnetic disk.

**Semiconductor Memory**

Data storage devices formed with semiconductor components (generally monolithic ICs).

**Serial Operation**

A method of data transmission where the data is handled in sequence, one bit at a time.

**Service Routine**

A set of instructions for performing a programmed operation, typically, in response to an interrupt command.

**Shift**

A computer operation consisting of moving a group of adjacent data bits either to the left or to the right by a prescribed number of positions. The move is done in a Shift Register for a carry-over operation.

**Simplex**

A data transmission mode that provides transmission in one direction only.

**Simulation**

The imitation of a logical operation of one computer by another to measure and evaluate the operation of the computer being designed. Simulation is primarily intended to provide an analysis of program logic, independent of hardware environment, and is extremely useful for debugging a new software program prior to committing it to ROM.

**Software**

Programs, languages, procedures, and documentation for a computer system. Software includes : operating systems (system software), language translators (assemblers, interpreters and compilers), subroutine libraries, application programs, and the information in instruction manuals.

**Source Code (Source Program)**

A set of computer instructions in hard-copy or stored form. When written in a language other than machine language, the source code requires translation by an assembler (or macro assembler), interpreter, or compiler into object code.

**Stack**

A dynamic, sequential data list usually contained in the computer system's main memory. It has special provisions to access data from either end. Storage and retrieval of data from the stack is performed automatically by the CPU.

**Static Memory**

A type of semiconductor read/write memory (RAM) that does not require periodic refresh cycles. As long as electrical power is ON, the data in a static memory is maintained.

**Storage**

This term is interchangeable with the term Memory.

**Subroutine**

A short program segment that performs a specific function and is available for general use by other programs and routines.

**Supercomputer**

The largest mainframe computer featuring exceptionally high speed operation while manipulating huge amounts of information.

**Support Chips**

Computer-related circuits other than the CPU. Examples are : main memory (RAM and ROM), I/O ports, and system bus.

**State**

The logic input or output condition of a binary digital circuit - the state is either a "0" or "1".

**Storage Capacity**

The amount of data that can be retained in a memory unit. It is expressed either by a number of bits or bytes (8-bit words).

**Streamer/Streaming Tapes**

A small tape recorder, usually in cassette form, is used to store data from a hard disk for the purpose of backing up this data.

**Synchronous Communication**

A method of transferring binary data, in serial form, between computers or between a computer and its peripherals. Transmission of data is at a

rate set by the computer's clock with synchronization bits located at the beginning of each message or block of data.

**Systems Software**

A general term for software that supervises, sequences, and coordinates programs. Systems software may include programs, such as: operating systems, assemblers, interpreters, compilers, software debugging programs, text editors, utilities and peripheral drivers.

**Third-Party Software**

Software developed by a software company rather than by a computer manufacturer or user.

**Throughput**

The number of instructions executed per second, measured in millions of instructions per second (MIPS) or billions of instructions per second (BIPS).

**Toggle**

To switch back and forth between two states or conditions of operation, as in a toggle switch.

**Top-Down Hierarchical Design**

A hardware and/or software design approach that starts at the most general level of a machine or software program. It proceeds, step-by-step, to lower levels, adding detail as the design progresses.

**Track**

A ring on the surface of a magnetic disk.

**Tractor-Feed**

A pin-fed device for advancing continuous form paper through a computer printer.

**Transistor-Transistor Logic (T2L)**

A logic gate family that provides higher-speed and higher-power than the obsolete DTL logic family. The first transistor in the circuit performs the required logic. Another transistor amplifies and inverts the output. Improved pin-compatible versions of this logic family are called TTL-Schottky (T2L-S) and Low Power TTL-S (LPT2L-S).

**Tri-State Logic**

The term that designates the possible conditions of a specific logic gate output: "0", "1" or "undefined".

**Truncate**

The dropping of digits or characters from one end of a data item causing loss of accuracy or information.

**Truth Table**

A tabulation of all possible combinations of states at the inputs of a logic gate which will result in a specific logic state at the output of the gate.

**Turnkey System**

A complete computer system ready to operate without any hardware or software modification or addition.

**Unformatted (Uninitialized) Disk**

A blank magnetic disk with no track/sector identification recorded on it that allows users to implement their own track/sector identifications.

**USART-Universal Synchronous/Asynchronous Receiver Transmitter**

A circuit that converts serial-to-parallel or parallel-to-serial operation for communication between two computers or between a computer and its peripherals.

**User-Friendly Program**

A software program that has been designed to easily direct the user through the operation or application of a program. A menu-driven program is considered to be "user-friendly".

**Utility**

A software program designed to perform a computer system's routine housekeeping functions, like copying, deleting files, and/or providing techniques to simplify the execution of a program.

**Virtual Memory**

Memory created by using the hard disk to simulate additional random-access memory; the addressable storage space available to the user of a computer system in which virtual addresses are mapped into real addresses.

**Vocabulary**

A list of operating codes or instructions available to the software programmer for writing a program in a specific language.

### Volatile Memory

A memory whose contents are irretrievably lost when power is removed. If data in RAM must be saved after power shut-down, back-up in non-volatile memory (magnetic disk, tape, or CD-R) is essential.

### Wait State

An internal condition of delay in processing time executed by the CPU when a synchronizing control signal is not present. Wait states synchronize the timing of a CPU with the relatively slower access time of the computer's main memory.

### Word Processing (WP)

The term refers to a program that allows creating, editing, formatting, displaying, printing, and storage of text with great flexibility and ease. Different WP programs provide different, and sometimes, more desirable capabilities than others.

### Word

The set of binary bits handled by a computer as a primary unit of data. The width (number of bits) of a computer word depends on the hardware design. Wider words imply higher levels of precision, higher speed, and more intricate instructions. Typically, each location in memory contains one word.

### WORM (Write-Once, Read-Many)

A high-density optical disk memory available in a variety of formats from 5.25" to 14". The WORM can be programmed once, permanently saving a user's data. It then becomes an optical disk read-only memory having essentially the same features as a CD-ROM. Also called CD-R (CD-Recordable).

### Workstation

The work area and/or equipment used for computer operations, including computer-aided design (CAD). The equipment generally consists of a monitor, keyboard, printer and/or plotter, and other output devices.

### Write

The process of storing data into a memory.

### X-Y Plotter

A computer-driven printing mechanism that draws coordinate points in graph form.

### Zero-Wait State

A condition that results when no delays are inserted into the system software to deliberately detain operation of the CPU. This can be done with high-speed memory and proper design of computer architecture. Zero-wait state is desirable for the high-speed operation of a computer.

### Zoom

The process of proportionately enlarging or reducing an image displayed on a computer monitor.

## Multiple Choice Questions

1. A collection of 8 bits is called—
   (A) byte
   (B) word
   (C) record
   (D) None of the above
2. The ascending order or a data Hierarchy is—
   (A) bit, bytes, fields, record, file, database
   (B) bit, bytes, record, field, file, database
   (C) bytes, bit, field, record, file, database
   (D) bytes, bit, record, field, file, database
3. How many address lines are needed to address each memory locations in a 2048 × 4 memory chip ?
   (A) 10 (B) 11
   (C) 8 (D) 12
4. A computer program that converts an entire program into machine language at one time is called a/an—
   (A) interpreter (B) simulator
   (C) compiler (D) commander
5. In immediate addressing the operand is placed—
   (A) in the CPU register
   (B) after OP code in the instruction
   (C) in memory
   (D) in stack

6. Microprocessor 8085 can address location upto—
   (A) 32K (B) 128K
   (C) 64K (D) 1M
7. The ALU and control unit of most of the microcomputers are combined and manufacture on a single silicon chip. What is it called ?
   (A) Monochip
   (B) Microprocessor
   (C) ALU
   (D) Control unit
8. When the RET instruction at the end of subroutine is executed—
   (A) the information where the stack is iniatialized is transferred to the stack pointer
   (B) the memory address of the RET instruction is transferred to the program counter
   (C) two data bytes stored in the top two locations of the stack are transferred to the program counter
   (D) two data bytes stored in the top two locations of the stack are transferred to the stack pointer
9. A microporgram is sequencer perform the operation —
   (A) read
   (B) write
   (C) execute
   (D) read and write
   (E) read and execute
10. Interrupts which are initiated by an I/O drive are—
    (A) internal
    (B) external
    (C) software
    (D) All of the above
11. Processors of all computers, whether micro, mini or mainframe must have—
    (A) ALU
    (B) Primary Storage
    (C) Control unit
    (D) All of the above
12. What is the control unit's function in the CPU ?
    (A) To transfer data to primary storage
    (B) To store program instruction
    (C) To perform logic operations
    (D) To decode program instruction
13. What is meant by a dedicated computer ?
    (A) Which is used by one person only
    (B) Which is assigned to one and only one task
    (C) Which does one kind of software
    (D) Which is meant for application software only
14. The most common addressing techniques employed by a CPU is—
    (A) immediate
    (B) direct
    (C) indirect
    (D) register
    (E) All of the above
15. Pipeline implement—
    (A) fetch instruction
    (B) decode instruction
    (C) fetch operand
    (D) calculate operand
    (E) execute instruction
    (F) All of the above
16. Which of the following code is used in present day computing was developed by IBM corporation ?
    (A) ASCII
    (B) Hollerith Code
    (C) Baudot code
    (D) EBCDIC code
17. When a subroutine is called, the address of the instruction following the CALL instructions stored in/on the—
    (A) stack pointer
    (B) accumulator
    (C) program counter
    (D) stack
18. A microprogram written as string of 0's and 1's is a—
    (A) Symbolic microinstruction

(B) Binary microinstruction
(C) Symbolic microprogram
(D) Binary microprogram

19. Interrupts which are initiated by an instruction are—
(A) Internal
(B) External
(C) Hardware
(D) Software

20. Memory access in RISC architecture is limited to instructions—
(A) CALL and RET
(B) PUSH and POP
(C) STA and LDA
(D) MOV and JMP

21. Where does a computer add and compare data ?
(A) Hard disk
(B) Floppy disk
(C) CPU chip
(D) Memory chip

22. Which of the following registers is used to keep track of address of the memory location where the next instruction is located ?
(A) Memory Address Register
(B) Memory Data Register
(C) Instruction Register
(D) Program Register

23. A complete microcomputer system consists of—
(A) microprocessor
(B) memory
(C) peripheral equipment
(D) All of the above

24. CPU does not perform the operation—
(A) data transfer
(B) logic operation
(C) arithmetic operation
(D) All of the above

25. Pipelining strategy is called implement—
(A) instruction execution
(B) instruction prefetch
(C) instruction decoding
(D) instruction manipulation

26. A stack is—
(A) An 8-bit register in the microprocessor
(B) A 16-bit register in the microprocessor
(C) A set of memory locations in R/WM reserved for storing information temporarily during the execution of computer
(D) A 16-bit memory address stored in the program counter

27. A stack pointer is—
(A) A 16-bit register in the microprocessor that indicate the beginning of the stack memory.
(B) A register that decodes and executes 16-bit arithmetic expression.
(C) The first memory location where a subroutine address is stored.
(D) A register in which flag bits are stored

28. The branch logic that provides decision making capabilities in the control unit is known as—
(A) controlled transfer
(B) conditional transfer
(C) unconditional transfer
(D) None of the above

29. Interrupts which are initiated by an instruction are—
(A) Internal
(B) External
(C) Hardware
(D) Software

30. A time sharing system imply—
(A) More than one processor in the system
(B) More than one program in memory
(C) More than one memory in the system
(D) None of the above

31. During the boot process, the ..... looks for the system files.
(A) CD (B) BIOS
(C) CPU (D) DVD

32. The unique signal, generated by a device, that tells the operating system that it is in need of immediate attention is called an—
(A) Action (B) Event
(C) Interrupt (D) Activity

33. The operating system controls access to the processor by assigning a(n) ..... to each task requiring the processor's attention.
    (A) CPU
    (B) Slice of time
    (C) Stack
    (D) Event
34. The blocks of code, included in the operating system, that software applications interact with are known as—
    (A) Application programming interfaces (APIs)
    (B) Complimentary metal-oxide conductors (CMOS)
    (C) Device drivers
    (D) Bootstrap loaders
35. An interrupt handler is a(n)—
    (A) Location in memory that keeps track of recently generated interrupts
    (B) Peripheral device
    (C) Utility program
    (D) Special numeric code that indicates the priority of a request
36. A spooler is a(n)—
    (A) Location in memory that maintains the contents of a document until it prints out
    (B) Print job
    (C) Program that coordinates the print jobs that are waiting to print
    (D) Message sent from the printer to the operating system when a print job is completed
37. The purpose of a swap (or page) file is to—
    (A) Maintain pages of documents that are being spooled to the printer
    (B) Hold a program's data or instructions in virtual memory when it can't fit in RAM
    (C) Prevent thrashing in a multitasking environment
    (D) Allow multiple print jobs to print their pages out simultaneously
38. The definition of thrashing is—
    (A) Swapping data between virtual memory and RAM too frequently
    (B) Insufficient hard disk space
    (C) Too many processors being managed by the operating system
    (D) Inaccurate information stored in the registry
39. All of the following are TRUE of Safe Mode EXCEPT—
    (A) Safe Mode is a special diagnostic mode
    (B) Safe Mode loads all nonessential icons
    (C) Safe Mode allows users to troubleshoot errors
    (D) Safe Mode loads only the most essential devices
40. Which of the following is the correct sequence of actions that takes place during the boot-up process ?
    (A) Load operating system, Activate BIOS, Perform POST, Check configuration settings
    (B) Activate BIOS, Perform POST, Load operating system, Check configuration settings
    (C) Perform POST, Load operating system, Activate BIOS, Check configuration settings
    (D) Activate BIOS, Check configuration settings, Perform POST, Load operating system
41. All of the following are steps involved in the boot process EXCEPT—
    (A) Load the operating system into RAM
    (B) The power-on self-test
    (C) Activate the basic input/output system (BIOS)
    (D) Load application programs.
42. The basic input/output system (BIOS) is stored in—
    (A) RAM (B) ROM
    (C) CPU (D) hard drive
43. Which of the following does NOT occur during the power-on self-test (POST) ?
    (A) The Scan Disk utility begins to run
    (B) The video card and video memory are tested
    (C) The BIOS identification process occurs
    (D) Memory chips are checked to ensure they are working properly

44. The operating system allows users to organize the computer's contents in a hierarchical structure of directories that include all of the following EXCEPT—
    (A) Files (B) Folders
    (D) Drives (D) Systems

45. Virtual memory is typically located—
    (A) On a floppy disk
    (B) In the CPU
    (C) In a flash card
    (D) On the hard drive

46. The horizontal and vertical lines on a worksheet are called—
    (A) Cells
    (B) Sheets
    (C) Block lines
    (D) Gridlines
    (E) None of the above

47. The following message generally means—
    (A) A nonsystem floppy has been left in the floppy disk drive
    (B) The CD drive is not functioning
    (C) The BIOS is corrupted
    (D) There is a problem loading a device

48. All of the following statements concerning files are true EXCEPT—
    (A) A file is a collection of related pieces of information stored together for easy reference
    (B) Files can be generated from an application
    (C) Files are stored in RAM
    (D) Files should be organized in folders

49. All of the following are TRUE regarding virtual memory EXCEPT—
    (A) Any amount of RAM can be allocated to virtual memory
    (B) The setting for the amount of hard drive space to allocate to virtual memory can be manually changed
    (C) This temporary storage is called the swap file (or page file)
    (D) Virtual memory is physical space on the hard drive

50. Using Windows Explorer, a plus (+) sign in front of a folder indicates—
    (A) An open folder
    (B) The folder contains subfolders
    (C) A text file
    (D) A graphics file

51. All of the following are examples of real security and privacy risks EXCEPT—
    (A) Hackers
    (B) Spam
    (C) Viruses
    (D) Identity theft

52. A process known as ..... is used by large retailers to study trends.
    (A) Data mining
    (B) Data selection
    (C) POS
    (D) Data conversion

53. ..... terminals (formerly known as cash registers) are often connected to complex inventory and sales computer systems.
    (A) Data
    (B) Point-of-sale (POS)
    (C) Sales
    (D) Query

54. A(n) ..... system is a small, wireless handheld computer that scans an item tag and pulls up the current price (and any special offers) as you shop.
    (A) PSS
    (B) POS
    (C) Inventory
    (D) Data mining

55. The ability to recover and read deleted or damaged files from a criminal act computer is an example of a law enforcement specialty called—
    (A) Robotics
    (B) Simulation
    (C) Computer forensics
    (D) Animation

56. Which of the following is NOT one of the four major data processing functions of a computer ?
    (A) Gathering data

(B) Processing data into information
(C) Analyzing the data or information
(D) Storing the data or information

57. ..... tags, when placed on an animal, can be used to record and track in a database all of the animal movements.
(A) POS (B) RFID
(C) PPS (D) GPS

58. Surgeons can perform delicate operations by manipulating devices through computers instead of manually. This technology is known as—
(A) Robotics
(B) Computer forensics
(C) Simulation
(D) Forecasting

59. Technology no longer protected by copyright, available to everyone, is considered to be—
(A) Proprietary
(B) Open
(C) Experimental
(D) In the public domain

60. ..... is the study of molecules and structures whose size ranges from 1 to 100 nanometers.
(A) Nanoscience
(B) Microelectrodes
(C) Computer forensics
(D) Artificial intelligence

61. ..... is the science that attempts to produce machines that display the same type of intelligence that humans do.
(A) Nanoscience
(B) Nanotechnology
(C) Simulation
(D) Artificial intelligence (AI)

62. ..... is data that has been organized or presented in a meaningful fashion.
(A) A process (B) Software
(C) Storage (D) Information

63. The name for the way that computers manipulate data into information is called—
(A) programming (B) processing
(C) storing (D) organizing

64. Computers gather data, which means that they allow users to ..... data.
(A) Present (B) Input
(C) Output (D) Store

65. After a picture has been taken with a digital camera and processed appropriately, the actual print of the picture is considered—
(A) Data
(B) Output
(C) Input
(D) The process

66. Computers use the ..... language to process data.
(A) Processing
(B) Kilobyte
(C) Binary
(D) Representational

67. Computers process data into information by working exclusively with—
(A) Multimedia
(B) Words
(C) Characters
(D) Numbers

68. In the binary language each letter of the alphabet, each number and each special character is made up of a unique combination of—
(A) Eight bytes
(B) Eight kilobytes
(C) Eight characters
(D) Eight bits

69. The term bit is short for—
(A) Megabyte
(B) Binary language
(C) Binary digit
(D) Binary number

70. A string of eight 0s and 1s is called a—
(A) Megabyte (B) Byte
(C) Kilobyte (D) Gigabyte

71. A ..... is approximately one billion bytes.
(A) Kilobyte (B) Bit
(C) Gigabyte (D) Megabyte

72. A ..... is approximately a million bytes.
(A) Gigabyte (B) Kilobyte
(C) Megabyte (D) Terabyte

73. ..... is any part of the computer that you can physically touch.
(A) Hardware (B) A device
(C) A peripheral (D) An application

74. The components that process data are located in the—
(A) Input devices
(B) Output devices
(C) System unit
(D) Storage component

75. All of the following are examples of input devices EXCEPT a—
(A) Scanner (B) Mouse
(C) Keyboard (D) Printer

## Answers

| | | | | |
|---|---|---|---|---|
| 1. (A) | 2. (A) | 3. (B) | 4. (C) | 5. (B) |
| 6. (C) | 7. (B) | 8. (C) | 9. (E) | 10. (B) |
| 11. (D) | 12. (D) | 13. (B) | 14. (E) | 15. (F) |
| 16. (D) | 17. (D) | 18. (D) | 19. (B) | 20. (C) |
| 21. (C) | 22. (D) | 23. (D) | 24. (D) | 25. (B) |
| 26. (C) | 27. (A) | 28. (A) | 29. (D) | 30. (B) |
| 31. (B) | 32. (C) | 33. (B) | 34. (A) | 35. (D) |
| 36. (C) | 37. (B) | 38. (A) | 39. (B) | 40. (B) |
| 41. (D) | 42. (B) | 43. (A) | 44. (D) | 45. (D) |
| 46. (D) | 47. (A) | 48. (C) | 49. (A) | 50. (B) |
| 51. (B) | 52. (A) | 53. (B) | 54. (A) | 55. (C) |
| 56. (C) | 57. (B) | 58. (A) | 59. (A) | 60. (A) |
| 61. (D) | 62. (D) | 63. (B) | 64. (B) | 65. (B) |
| 66. (C) | 67. (D) | 68. (D) | 69. (C) | 70. (B) |
| 71. (C) | 72. (C) | 73. (A) | 74. (C) | 75. (D) |

❑❑

# Abbreviation

| | |
|---|---|
| **API** | Application Programming Interface |
| **ASCII** | American Standard Code for Information Interchange |
| **ASP** | Active Server Pages |
| **ATM** | Automatic Teller Machine |
| **ADO** | ActiveX Data Object |
| **ALGOL** | Algorithmic Language |
| **ARPANET** | Advanced Research Projects Agency Network |
| **ARP** | Address Resolution Protocol |
| **BDA** | BIOS Data Area |
| **BIOS** | Basic Input Output System |
| **BP** | Base Pointer |
| **BPB** | BIOS Parameter Block |
| **CCP** | Configuration Control Register |
| **CHS** | Cylinder Head Sector |
| **DIR** | Digital Input Register |
| **DMA** | Direct Memory Access |
| **DSO** | Downloadable Sub Osliteration |
| **EOF** | End Of File |
| **EXT** | Extended File System |
| **FAT** | File Allocation Table |
| **FCB** | File Control Block |
| **FDC** | Floppy Drive Controller |
| **FDD** | Floppy Disk Drive |
| **FLIH** | First Level Interrupt Handler |
| **FTP** | File Transfer Protocol |
| **GDT** | Global Descriptor Table |
| **HAL** | Hardware Abstraction Table |
| **HDC** | Hard Disk Controller |
| **HDD** | Hard Disk Drives |
| **HPFS** | High Performance File System |
| **HTTP** | Hyper Text Transfer Protocol |
| **IDT** | Interrupt Descriptor Table |
| **IF** | Interrupt Flag |
| **IP** | Internet Protocol |
| **IPC** | Inter Process Communication |
| **ISA** | Industry Standard Architecture |
| **ISR** | Internet Service Routine |
| **IVT** | Interrupt Vector Table |
| **LBA** | Logical Block Addressing |
| **LDT** | Local Descriptor Table |
| **LPC** | Low Pin Count |
| **LUT** | Look up Table |
| **LVM** | Logical Volume Manager |
| **MBR** | Master Boot Record |
| **MBR** | Memory Buffer Register |
| **MMU** | Memory Manage Unit |
| **MSR** | Main Status Register |
| **NTFS** | New Table File System |
| **NTFS** | New Technology File System |
| **NTLDR** | New Technology Loader |
| **OCW** | Operation Command Word |
| **OTP** | One Time Programmable |
| **PAE** | Physical Address Expansion |
| **PAS** | Physical Address Space |
| **PC** | Program Counter |
| **PCB** | Process Control Block |
| **PCB** | Printed Circuit Board |
| **PDBR** | Page Directory Base Register |
| **PDT** | Page Directory Table |
| **PIC** | Programmable Interrupt Controller (IC 8259A) |
| **PIT** | Programmable Interrupt Timer (IC 8254) |
| **PMM** | Physical Memory Manager |
| **POST** | Power on Self Test |
| **PPI** | Programmable Peripheral Interface |
| **PSE** | Page Size Extension |

| | | | |
|---|---|---|---|
| **PSFS** | Polyserve File System | **TDR** | Tape Drive Register |
| **PTE** | Page Table Entries | **TLB** | Translation Lookaside Buffer |
| **SC** | Stack Counter | **TSR** | Terminate and Stay Resident |
| **SDL** | Shielded Data Link | **UDP** | User Datagram Protocol |
| **SJF** | Shortest Job First | **UFS** | Unix File System |
| **SLIH** | Second Level Interrupt Handler | **USB** | Universal Serial Bus |
| **SP** | Stack Pointer | **VAS** | Virtual Address Space |
| **STBR** | Segment Table Base Register | **VFS** | Virtual File System |
| **TCP** | Transmission Control Protocol | **VMM** | Virtual Memory Manager |

# Computer Terminology

## A

### A-drive

The disk drive on which the computer disk is usually put.

### Absolute Reference

A cell reference that contains a dollar sign before the column letter and/or row number to indicate the absolute, or fixed, contents of specific cells. For example, the formula $A$1 + $B$1 calculates only the sum of these specific cells.

### Absolute URL

The full Internet address of a page or World Wide Web (WWW) resource which usually begins with the protocol "http://" and the rest of the location.

### Access

To get information from something, such as a disk or an information service.

### Access Control List

(ACL) A list of the services available on a server, each with a list of the hosts permitted to use the service.

### Access Time

The time interval between the instant that data is requested and the instant that it is received.

### Active Cell

The cell in which you are working, indicated by the current location of the cell pointer.

### Active File

Any file that has been launched or otherwise loaded into memory and is currently running. An active application is represented by a small icon in the upper right corner of the menu bar.

### Active Hyperlink

A hyperlink that is currently selected in a Web browser.

### Active Page

The web page being edited.

### Active X Control

A component that can be put into a page to provide functionality not directly available in HTML (Hypertext Markup Language), such as animation sequences, credit-card transactions, spreadsheet calculations, and others. These controls can be implemented in various programming languages.

### Address

The location of a specific cell or range expressed by the coordinates of column and row; for example, A1.

### Alignment

The horizontal placement of cell contents, for example: left, center, or right.

### Anchors

Cells listed in a range address, for example, in the formula = SUM (A1: A15), A1 and A15 are anchors.

### Animated GIF

A File Containing a series of Graphics Interchange Format (GIF) images that are displayed in rapid sequence in some Web browsers.

### FTP

A File Transfer Protocol (FTP) service in which any user can copy files by logging on with the "name" anonymous.

### Application Software

Any computer program or software designed for a particular purpose, such as home finance, education, graphic design, telecommunication, database management, or word-processing.

**Area Chart**

A line chart in which each area is given a solid color or pattern to emphasize the relationships between the pieces of charted information.

**Argument**

A value, range of cells, or text used in a macro or function. An argument is enclosed in parentheses; for example = SUM (A1 : B1).

**Arithmetic Operator**

A symbol used in formulas, such as + or -, to perform calculations.

**Arrow Keys**

The keys in the lower-right corner of the keyboard; in many applications, you use the arrow keys (or "cursor keys") to move the cursor or insertion point in the direction indicated by the arrow.

**Art Application**

An application program that gives you special tools for drawing, drafting, or painting on the computer screen.

**Article**

A single entry in a discussion group or newsgroup which can include a response to a previous article.

**ASCII (American Standard Code for Information Interchange)**

The predominant method for encoding 7-bit characters on a Personal Computer. HTML tags and URLs must be in ASCII.

**ASP (Active Server Page)**

A method for creating programs that run on a Web server.

**Aspect Ratio**

The ratio of an image's width to its height.

**Attributes**

The styling features such as bold, italics, and underlining that can be applied to cell contents.

**Authentication Database**

A database on a server that matches user names to passwords.

**Auto-format**

A feature that provides preset schemes that can be applied to instantly format a range. EXCEL comes with 16 AutoFormats, which include colors, fonts and numeric formatting—for example.

**Auto-repeat**

The automatic repetition of the keys on the keyboard. If you hold one key down, the computer will keep generating that character automatically until you release the key.

## B

**Background Sound**

A sound file, music, voices, that you associate with a page.

**Backspace**

A key on the keyboard which moves left and erases whatever is to the left of it.

**Backup Copy**

A copy of the contents of a disk made for safe-keeping. Backing up of files ensures that you will not lose information if the original files become lost or damaged.

**Balloon Help**

This is a feature which displays an on-screen description of an object on the screen, such as an icon or an option in a dialogue box. You turn balloons on and off by using the Show Balloons and Hide Balloons commands under the Help menu of the Finder. The Help menu is represented by a balloon icon containing a question mark in the upper right corner of the menu bar.

**Banner**

An image usually displayed at the top of a page in a Web site, containing text and design elements (often to identify the site).

**Banner Ad Manager**

A design feature that shows each of a series of images for a specified number of seconds before changing to the next for transition effects.

**Bar Chart**

The bar chart displays information as a series of horizontal bars.

**Base URL**

A URL assigned to a page to convert "relative URLs" into "absolute URLs" by the addition of a document name or trailing slash /.

**Baseline**

In the text, this is the imaginary line drawn along the main body of the letters.

**Bevel**

A three-dimensional effect applied to the border of an image.

**Bit**

Contraction of the words "binary" and "digit". The smallest item of useful information a computer can handle, usually represented by 1 or 0. Eight bits equal one byte.

**BMP**

The standard bitmap image format on Windows-compatible computers and which can be saved for Windows, OS/2 systems and those which support 24-bit color.

**Bookmark**

A named location on a page that can be the target of a hyperlink.

**Boot**

To load an application from a disk into the memory of the computer. In computer jargon, starting up is "booting".

**Broken Hyperlink**

A hyperlink that does not correctly point to a page or other Internet file.

**Bug**

An error in an application program or a problem with hardware.

**Bulleted List**

A paragraph style that creates a single list element, usually indicated by a "bullet" character. This is also known as an "unordered list."

**Bulletin Board**

An electronic communications forum that hosts posted messages and articles connected to a common subject or theme or interest.

## C

**C-drive**

This usually refers to the hard disk drive inside the computer.

**CAD**

(Computer-Aided Design) This refers to various software programs which allow various types of engineers, inventors, architects and others to create and design blueprints on a computer.

**Cancel Button**

The button pictured with an "X" on it, located on the formula bar. The Cancel button removes the changes made to the contents of the active cell and restores the previous cell contents.

**Caps Lock Key**

A key that can lock into place so that letters you type will come out capitalized. Caps Lock doesn't affect non-alphabetic keys (such as punctuation and symbols). To access these, you must still press the Shift key (on either side of the key board).

**Card**

A circuit board that you can install in a slot inside the computer to expand the computer's memory or give it the means to communicate with a peripheral device.

**Cascading Style Sheet**

An HTML syntax that gives authors control over the formatting of text in web pages.

**CD-ROM**

A compact disk on which a large amount of digitized read-only data can be stored. This stands for "compact disc read-only memory".

**Cell**

The intersection of a row and a column in a spreadsheet ledger. A cell can hold a number, a label, a function, or a formula. This is the smallest component of a table--as part of a row or column.

**Cell Address**

Unique location identified by intersecting column and row coordinates

**Cell Padding**

The space between the contents and inside edges of a table cell.

**Cell Pointer**

A highlighted rectangle around a cell that indicates the active cell.

**Cell Reference**

The address or name of a specific cell. Cell references may be used in formulas and are relative or absolute.

**Cell Spacing**

The amount of space between cells in a table counted as the pixels of the walls of each cell.

**Central Processing Unit (CPU)**

The "brain" of the computer. This is the microprocessor that actually performs the computations in machine language. Some people use the term "CPU" to refer to the entire component—namely the computer that includes the central processing unit.

**CGI (Common Gateway Interface)**

A standard way of extending Web server functionality by executing programs or scripts on a Web server in response to Web browser request.

**Channel**

A technology that allows users to subscribe to a web site to browse off-line and automatically display updated pages on their screen savers through Channel Definition Format (CDF) files.

**Character**

A letter, number or other symbol.

**Chart**

A graphic representation of selected worksheet information. Types include 2-D and 3-D column, bar, pie, area and line charts.

**Chart Title**

The name assigned to a chart.

**Chart Wizard**

A feature on EXCEL that provides a series of dialogue boxes that help create or modify a chart.

**Check box**

A square box (form field) in a dialogue box that you click to turn an option on or off. When marked, the visual is usually an "x."

**Child page**

A page that is part of the web navigation structure and is linked to a parent page (higher on the navigation structure) from which it is accessed.

**Choose**

To pick a command from a menu. Usually you choose a command after selecting something for the computer to act on.

**Circuitry**

A network of wires, integrated circuits, resistors, and other electronic devices and connections, over which electrical impulses travel.

**Clear Key**

A key on the numeric keypad which works the same way that Control-X does in a particular application. This helps clear the numbers. A command used to erase a cell's contents, formatting or both.

**Click**

To position the pointer on an object on the screen, then press and quickly release the mouse button.

**Client**

A program on the Internet that requests files or services from a server.

**Client-side Program**

A program on the Internet that is run on a client computer (*Vs.* a server computer). The client-side programs do not communicate over the Internet but merely requests and receives information.

**Clipart**

A collection of icons, pictures, buttons and other useful image files along with sound and video files that can be embedded or inserted into web pages.

**Clipboard**

A temporary storage area on a computer for cut or copied data and graphics. You can paste the contents of the Clipboard into a file or worksheet. The clipboard holds the information until you cut or copy another piece of data or graphic.

**Close**

A command that puts a file away but keeps the program you're in open so that you can continue to work.

**Color Monitor**

A display device that lets you display text and graphics in color.

**Column Selector Button**

The gray box containing the column letter above the column.

**Command**

A word or character that causes the computer to do something. A command is a request or directions given to a computer.

**Command Key**

The key on the keyboard marked with both the outline of an apple and a propeller symbol (on Macs). When pressed in conjunction (together) with another key, the Command key makes the other key behave differently. The Command key has no effect if it is pressed alone.

**Computer**

An electronic device that performs predefined or programmed computations at a high speed and with great accuracy; a machine that is used to store, transfer, and transform information.

**Computer System**

A collective term for a computer and everything attached to it printer, monitor, CD ROM drives, disk drives, scanners, microphones, and what-not.

**Confirmation Page**

A page displayed in a web browser after a form has been submitted by a user which displays the user's name and other basic data. (This is specified in the "form handler's dialog box.")

**Contrast Knob**

This is a control on your video display that lets you adjust the contrast between light and dark on the screen.

**Control Key**

A key on the keyboard that, when pressed in conjunction with another key, makes the other key behave differently. This Control key has no effect if it is pressed alone.

**Control Panel**

A program that lets you change various features, such as sound, mouse, movement and keyboard options.

**Converter**

A program that changes a text file from one format to another such as to HTML.

**Cookie**

A program that is dropped into a client computer to identify the user whenever he/she accesses a particular web site. Permission is usually requested before a "cookie" is dropped. Special programs remove cookies from computers as well.

**Copy**

A command that copies the selected information and places it on the clipboard.

**Copy-protect**

(write-protect) To make it difficult for someone to duplicate the contents of a disk by either covering over a tab or moving a small button on the back top left of a 3.5" disk to the "lock" position (leaving a square hole at the top of the disk).

**Crash**

When a system, computer or program fails, this is called a crash.

**Crop**

To reduce the size of an image by eliminating all parts outside of a resizable box that is dragged over the image. This term is used for desktop publishing layout programs as well as web page building ones.

### Cryptography

The encoding of information on a computer so that others may not access such data.

### Cursor

A blinking underline, rectangle, box, line or other symbol that marks you place on the screen. It shows you where your next action will take place. This is called an "insertion point".

### Cursor Keys

The keys (usually called "arrow keys") in the lower-right corner of the keyboard. In many applications, you use these keys to move the cursor or insertion point in the direction indicated by the arrow.

### Custom Dictionary

A list of words not in the standard dictionary but that an author wants accepted by the spell checker as correct. Additions to this dictionary could include names, acronyms, new words, and other such entries.

### Cut

To remove text or graphics from a document by using the Cut command. The most recent "clipping" is stored on the Clipboard of the computer so that you can paste it somewhere else if you wish

### Cut and Paste

To move something from one place in a document to another. Cutting and pasting is the computer equivalent of using scissors to clip something and glue to paste the clipping somewhere else.

### Cybercast

The term which refers "money in cyberspace" or rather to the possibility of someday converting to a system of using computers to record each individual's cash holdings *vs*. the use of coinage and paper money.

### Cyberspace

A term which refers to an indefinite place in which computer messages, files, communications, and such exist inside the magnetized disks, in computer hard drives, and in transmission over phone lines. This is seen as a "virtual" place, which is not fully real.

## D

### Data

Information, especially raw or unprocessed information.

### Database Application

A type of application that helps you keep track of lists of information. Database applications make it easy to recall and update information and to create reports of subsets of information.

### Data Disk

A disk that contains your work, letters, budget, pictures, and so on.

### Data Marker

Visible representation of a data point, such as a column or pie slice.

### Data Point

Individual piece of data plotted in a chart.

### Data Series

The selected range in a worksheet that EXCEL converts into a graphic and displays as a chart.

### Default Image Hyperlink

In an image map, this is the hyperlink to follow when a user clicks in an area without hotspots on the image.

### Default Setting

Most programs have default settings which automatically provide certain information or guidelines or parameters for a certain program. The computer automatically uses these settings unless directed otherwise.

### Delete

A command that removes cell contents from a worksheet. Delete also merely means to erase certain information, as from a file.

### Desk Top

This refers to the information on the (active) screen or the file(s) which the computer user has called up and is working on.

**Dialogue Box**

A window that displays when you choose a command whose name is followed by an ellipses. A dialogue box allows you to make selections that determine how the command affects the selected area.

**Directory**

This is a "table of contents" of the contents of a disk drive, a disk, or file server.

**Disk Drive Light**

A light, usually on the front of a disk drive, that comes on when the drive is loading information from a disk or storing information on a disk. Sometimes, this is called an "in-use light." When the light is on, it is not safe to insert or remove disks from the disk drive.

**Diskette**

A 3.5 inch storage medium, also known as a floppy, which can be 800 kilobytes or 1.4 megabytes in storage capacity.

**Display**

A general term used to describe what you see on your screen when you're using a computer. This may include video effects, tables, letters, or numbers.

**Document**

A discrete collection of information you create with a computer program, including memos, pictures, budgets, text, and so on.

**Dot-matrix Printer**

A mid-level printer which users a series of dots to create the text and pictures on "hard copy" or paper copies of files.

**Double-click**

To position the pointer where you want an action to take place, and then press and release the mouse button twice in quick succession without moving the mouse.

**Download**

To take information off of the Internet or from other sources.

**Drag**

To position the pointer on something, press and hold the mouse button, move the mouse, and then release the mouse button. When you release the mouse button, you either highlight a selection or move an object to a new location.

**Drag and Drop**

A way of moving or copying cells, rows, and columns by dragging the data with the mouse to a new worksheet location.

**Drill-and-practice Application**

A type of educational application that presents information, tests your memory retention of the material, and gives feedback based on your answers.

**Drive**

A mechanism in a computer or an area of a network used for retrieving and storing files. Personal computers usually have one hard disk drive labeled C and two drives labeled A and B that read removable floppy disks.

**Drop-down Menu Field**

A form field that presents selections in a drop-down menu style and may contain many fields or only one.

**Dummy Column or Row**

Blank column or row included at the end of a range that enables a formula to adjust when columns or rows are added or deleted.

**Disk Striping**

Storing a bit of information across several discs (instead of storing it all on one disc and hoping that the disc doesn't crash).

## E

**Edit**

Add, delete or change the contents of a cell or worksheet or file.

**Edit Menu**

A menu in most mouse-based programs that lists editing commands such as Copy, Cut, and Paste.

**Editor**

An interactive program that can create or modify files of a particular type.

**Eject**

To remove a disk from a disk drive.

**Electronic Mail (e-mail)**

Messages sent over telephone lines to computer through modems or a computer network or over the Internet.

**Electronic Spreadsheet**

A computer program that performs calculations on data and organizes information. A spreadsheet is divided into columns and rows that form individual cells.

**Ellipses**

A series of dots following a command, indicating that more choices are available through a dialog box.

**Embedded Files**

Inserted clip art, images, sounds, and video clips that have been inserted on a page.

**Enter Key or Enter Button**

A key on the numeric keypad that confirms a choice or tells a program you're ready to proceed. In most cases, the Return key also serves this function.

**EPS (Encapsulated Postscript)**

A type of graphics file that can be incorporated into other documents.

**Error Message**

A message that appears on the computer screen to alert you to a failure in the communication process.

**ESC Key**

A key used in many applications to get back to a menu or cancel a procedure that is in progress. "ESC" is an abbreviation for "escape". This is usually located in the top left of your keyboard.

**Ethernet**

A type of local area network (LAN).

**Exploding Pie Slice**

A slice of a pie chart (for statistics) that has been pulled away from a pie to add emphasis.

**Extension**

Software programs that expand the capabilities of system software. They include drivers which make it possible for the computer to use a certain printer or other device and programs that add features to the Finder or the system software.

**External Drive**

A hard drive or removable cartridge drive that is not housed within the body of a computer.

**e-commerce (electronic commerce)**

Business transactions which incorporate the use of ICTs to enhance interactions and exchanges, and which augment or replace physical contact or exchanges.

**Electrical Grid**

The network of power lines used to deliver electricity to inhabited areas.

**Electronic Contract Enforceability**

The degree to which electronic contracts, or agreements processed over the Internet or computer networks, are upheld in a legal setting and considered the equivalent of paper-based contracts with handwritten signatures.

## F

**FAQ (Frequently Asked Questions)**

A common document on the Internet that contains a list of questions and answers on a common subject or theme. On the WWW, questions are often hyperlinks to the answers.

**Fax**

(short for "facsimile" which means a copy) A method or machine device for transmitting documents, drawings, photographs, or the like by telephone or radio for exact reproduction elsewhere; an exact copy or reproduction so transmitted.

**Fiber Optics**

Cables made from bundles of glass or plastic fibers for high-bandwidth data transfer using beams of light carrying electromagnetic signals.

**Frame Relay**

A telecommunications technology for the internetworking of local area Network (LANs). Frame relay may be carried over a variety of lines, including fiber optics and ISDN.

**Field**

A category of information in a database document. If your database is an address book, for example, "name" and "address" will be two of the fields.

**File**

A named collection of information stored on a disk either information created by a user or pre-recorded information. As an Internet protocol, "file" refers to those on a disk or Local Area Network (LAN).

**File Menu**

A menu in mouse-based applications that lists commands that affect whole documents, such as Open, Save, Print, and Quit.

**File Name**

The name you give your file or document before you save it on a disk. This name should help you identify and retrieve this file.

**File Server**

A centralized computer software program which "serves" various files and computer programs to a number of computers on a network.

**File System**

A system for organizing the sections on a disk so that your application can keep track of where data is stored. You must initialize any disks you'll be using with a particular application for use with that application's file system.

**Fill Down**

A command that duplicates the contents of the selected cell in the range selected below the cell pointer.

**Fill Handle**

Small square in the lower-right corner of the active cell used to copy cell contents.

**Fill Right**

A command that duplicates the contents of the selected cells in the range selected to the right of the cell pointer.

**Filter**

A tool that converts an image or a file.

**Finger**

An Internet program that shows information about the users currently logged on to a computer.

**5.25-inch Disk**

A disk which is 5.25 inches in diameter, with a storage capacity of 143 K (the equivalent of about 70 pages of text).

**Folder**

An icon that represents a sub-directory. Folders give you a visual representation of the way you can group related documents together on a disk.

**Font**

Complete set of characters in one design, size, and style. The name given to a collection of characters with a specific design. Hundreds of styles are available.

**Footer**

Text that appears at the bottom of every page or every other page in a document.

**Form**

A set of data-entry fields on a page processed on a server. The user submits the form by clicking on a button or image, and the form is sent by a form handler.

**Form Field**

A data-entry field on a web page.

**Format**

The physical division of space on a disk into sections—where information can be stored. A disk's format is established as part of the initialization process.

**40-column Display**

A text mode in which 40 characters per line (rather than 80) are displayed on the screen.

**Formula**

A set of instructions that you enter in a cell to perform numeric calculations (adding, multiplying, averaging, etc.); for example, +A1+B1.

**Formula Bar**

The rectangular area, above the worksheet window, that displays a cell's contents, including numbers, text, and formulas, when you click a cell. You can use the formula bar to enter and edit data in the active cell.

**Frame**

A named sub-window of a frames page. This may be scrollable and resizable and may have a border or outline.

**FTP (File Transfer Protocol)**

An Internet service that transfers files from one computer to another through phone lines.

**Function**

A built-in formula that you can use in spread sheet application to calculate an average, a square root, a total, and so on.

**Function Key**

A key that tells an application to carry out a particular activity or function (e.g. print a document, save a document, etc.). Some applications use the number keys on the numeric keypad as function keys.

## G

**Garbage**

The garbled symbols and signs which a computer sometimes puts out after a computer error.

**Gopher**

The Internet protocol where files are displayed in a hierarchical menu.

**Graphics**

Information presented in the form of pictures or images or drawings.

**Graphics Application**

Any application program in which you work with graphics. Examples are art applications, business graphics applications, clip-art applications, desk-top or newspaper publishing.

**EPS (Encapsulated PostScript)**

This is a popular format for storing object-oriented artwork. It can also store bit-maps, but bit-mapped EPS files are usually huge, in terms of disk space. EPS has two subtypes : ASCII text format and Binary format.

An EPS file usually contains two versions of the graphic. The main image is a resolution independent PostScript (text) description of printing on a PostScript printer. 2) The second is a low-resolution bit-mapped PICT preview that can be displayed quickly on screen. This double image scheme enables page-layout programs to import, crop, rotate and scale high quality EPS images while using the quick rendering PICT portion to provide feedback for the user. If the EPS file has no corresponding PICT preview, the graphic will appear as a shaded square on the computer screen.

**Gridlines**

Horizontal lines within a chart that make the chart easier to read.

## H

**Hacker**

A person (or persons) or illegally enter or "hack into" computer systems (which are often protected by code words and other systems) in order to steal information.

**Hard-copy**

A printed copy (on paper) of an electronic document.

**Hard Drive**

A computer's internal disk drive using a non-removable storage format. Used for the storage of data, documents and the computer's programs and operating system.

**Hard Disk**

A storage device that can hold much more information than a 3.5 inch disk or a 5.25 inch disk. Unlike a 3.5 inch and 5.25 inch disks, a hard disk is sealed into its drive inside the computer.

**Hardware**

Those parts of the computer system that you can see and touch: the computer, the peripheral devices, the cables used to connect them, and the cords that supply them with power.

### Header

Text that appears at the top of every page or every other page of a document.

### Heading

A paragraph style in large, bold typeface usually used to name pages and parts of pages.

### Hidden Field

A form field invisible to the user but which supplies information to a form handler.

### Hidden Folder

A folder that cannot be viewed in a Web browser.

### Home Page

This is the graphic and text which a person or institution or group may set up on the Internet which may be accessed by others. Addresses of other locations may be high-lighted on this page for easy access by "net users" in order to gain information.

This is considered the "gateway" or point-of-entry page for a site.

### Home Row

The row of keys on the keyboard where the fingers rest when they aren't reaching for other keys. In the standard keyboard layout, the home row contains from left to right A, S, D, F, J, K, L, and;.

### Horizontal Line

This is a horizontal graphic element on a web page used to separate sections of this page.

### Host Name

Network location.

### Hotspot

A graphically-defined area in an image that contains a hyperlink and is indicated by the changing appearance of the pointer/cursor.

### Hover Button

An animated button on a web page activated when the mouse pointer is moved over the hover button or when it is clicked.

### Hyperlink

A pointer from text or an image map to a page or other type of file on the World Wide Web. Hyperlinks are the primary way to navigate between pages and among web sites without the need to type in long URLs.

### Hypertext

Any textual information on a computer which contains jumps to other information (the jumps known as "hyperlinks").

## I

### Image

A picture or graphics file that can be inserted on a web page and displayed in a browser.

### Image Bullet

Images or graphics used as bullet characters in a bulleted list.

### Image Map

An image containing one or more invisible regions (hot spots) which are assigned hyperlinks to other locations or information.

### Image Toolbar

A toolbar that contains commands to change or manipulate images.

### Initialize

To divide a disk into sections where information can be stored and to write a file system on the disk so that an application can keep track of where data is stored. Disks must be initialized before you can save information on them. Another word for "initialize" is "format".

### Input

Information traveling into the computer like key presses and mouse moves and clicks. (in general) Information that produces desired results in a work sheet.

### Insertion Point

A blinking vertical or horizontal line that marks your place on the screen. The insertion point shows you where your next action will take place. This is also called the "cursor".

**Integrated Software**

A group of application programs, usually on one disk, designed to share data.

**Interface**

The way things communicate among each other.

**Internal Web**

A WWW site created within an organization and accessible only to organization members on an intranet.

**Internet**

A series of networks of globally connected computers which transmit files (graphics, text, others) through telephone wires. This wide area network (WAN) system (software and interface) system enables people to transmit messages in seconds around the world for a low cost.

**Intranet**

A computer network internal to an organization that supports Internet applications especially the WWW. Most are set up so users can access the information without allowing access by "outsiders" through the use of firewalls and access codes.

**IP (Internet Protocol)**

Internet software that divides information into packets for transmission over the Net.

**Internet Cafes**

Public establishments offering access to Internet-enabled terminals in addition to other services, such as food and drink. Also known as cybercafes and online cafes.

**ISDN (Integrated Services Digital Network)**

A high-speed communications network which combines voice, data and video into single cables.

**ISP (Internet Service Provider)**

A company which offers Internet access (and possibly other services such as e-mail and webhosting) to individuals or companies through either temporary or dedicated connections.

## J

**Jacket**

The plastic covering that protects a 5.25 inch disk.

**Joystick**

A peripheral device which allows users to play video games or computer games which demand fast reflexes and decision-making.

**Justify**

To format a page of text so that the left margin, the right margin, or both margins are a constant width for all lines.

## K

**K**

Abbreviation for "kilobyte". A unit of measure for a computer memory, equaling 1024 bytes.

**Keyboard**

A peripheral device that provides a common way to communicate with the computer. The computer's keyboard looks like the keyboard on a typewriter, but the compute keyboard keys can be programmed for many uses.

**Keyboard-based Application**

An application that you control by issuing commands with the keyboard.

**Keyword**

A word you designate when you're entering information into certain kinds of database applications. Later, when you want to retrieve that information, you type the key word.

**Kernel**

The kernel is used to refer to the central component of most computer Operating Systems. Managing the system's resources is one of its responsibilities. Different kernels perform different tasks, which depend on their design and implementation.

**KVM Switch**

The Keyboard, Video, and Mouse together constitute the KVM Switch. This is a hardware

device using which a user can control multiple computers. Though multiple computers are connected to the KVM, a smaller number can also be controlled at any time given.

## L

### Label Command (or Volume Label)

Descriptive text or other information that identifies the rows and columns of a worksheet. Labels are not included in calculations.

### LAN (Local Area Network)

A group of computer workstations connected to one or more common servers for the sharing of files, printing services and Internet access. Usually found in offices and schools.

### Leased Line

A permanent network connection between two points (e.g. a business and an ISP) that is leased from a telephone operator.

### Landscape

Term used to refer to printing across the wider dimension of a page, generally 11" horizontally by 8 1/2" vertically.

### Laptop

A small portable computer ranging from 10-20 pounds which may be used conveniently on business trips, in classrooms, and in other situations where traditional personal computers may be less efficient.

### Laser Printer

A printer which uses laser to print out words and graphics. This is one of the most sophisticated types of printers today.

### Left Arrow Key

A key used in many applications to move the cursor one character to the left. In some applications, the cursor erases characters as it moves to the left.

### Legend

A key explaining the information represented by colors or patterns in a chart.

### Line Break and Feed

The end of a line of text. You can force a line break by pressing "Return", or you can let the application break lines for you. This is a special character that forces a new line on a page without creating a new paragraph.

### Line Chart

A graph of data that is mapped by a series of lines. Line charts show changes in data or categories of data over time and can be used to document trends.

### Line Feed

An advance to the next line, usually in reference to paper movement in the printer.

### List

A group of paragraphs which are formatted in a similar way to show "membership in a set" or a sequence of steps for menus, bulleted lists, directories, definitions, indexes, or other groupings.

### Load

To transfer data or programs into the computer from a disk.

### Log On

To establish contact with a computerized information service or other remote computer.

## M

### Mainline

A telephone line; the connection between the customer premises equipment (e.g., telephone) or public telephone and the central office. Includes all lines that are active and usable, rather than the entire installed base of lines.

### Mbps (Megabits per Second)

A unit for measuring the speed of transmission in a digital connection; one million bits of data per second.

### Mobile Wireless

Wireless telephony which allows for the movement of end-user equipment. Mobile wireless networks are set up as a grouping of base stations, each with its own coverage "cell." It is this concept that gave rise to the term "cellular phone."

**Modem**

Abbreviation for "modulator/demodulator." Modems allow the transmission of data between computers (digital devices) over analog lines. Modems are required for connectivity where broadband services are unavailable.

**Multiplexer**

A device which aggregates transmission channels on a single medium, such as a telephone line or radio spectrum, and enables the sharing of these resources for more efficient bandwidth allocation.

**Main Menu**

The first menu you see in keyboard-based applications. The main menu presents the application's top level of options.

**Marquee**

A region on a page which displays a horizontally scrolling text message.

**Megabyte (MB)**

A unit of measure for computer memory; 1 megabyte equals 1,048,576 bytes.

**Megahertz (MHz)**

One million cycles per second.

**Memory**

Integrated circuits (chips) that store instructions for the microprocessor.

**Menu**

A list of choices presented by an application.

**Menu Bar**

In most mouse-based applications, the horizontal strip at the top of the screen that contains menu titles.

**Menu List**

A list of short paragraph entries formatted with minimal white space between them.

**Menu Title**

In mouse-based applications, a word, phrase, or picture in the menu bar that designates one menu. When you point to a menu title and hold down the mouse button, you can see what's in the menu.

**Meta Tag**

An HTML tag that must appear in the <head> portion of a page and which provides information about a page such as the "generator" which indicates the editor that created the HTML page.

**Mode**

A state that determines the computer's behavior.

**Mode Indicator**

A box located on the far left of the status bar that informs you of the program's status. For example, when a program is performing a task, the words on the screen will indicate that a function is in progress.

**Modem**

A device in a computer which connects to a telephone line in order to allow the computer to send and receive messages over the telephone lines.

**Monitor**

A peripheral device that displays instructions from the application to you and shows what you've typed into the computer's memory on its screen. A monitor is like a television set without channels.

**Mouse**

The small device which you roll around on a flat surface next to your computer. When you move the mouse, the pointer on the screen moves correspondingly.

**Mouse Button**

The button on top of the mouse. You press the mouse button to choose commands from menus or when you want to move items around on the screen.

**Mouse Pointer**

An arrow that indicates the current location of the mouse on the desktop. The mouse pointer changes shapes at times depending on the application and task being executed or performed.

**Multi-hosting**

The ability of a server to support more than one Internet address and more than one home page also known as "multihoming."

**MacPaint**

Named after the first Mac paint program, this format holds bit-maps at 72DPI, and is limited to a single 8 × 10 inch vertically-oriented page. MacPaint saves in this format, and several other applications can also: Digital Darkroom, PixelPant, SuperPaint, and others.

**MOOV**

This is the file format that is used by QuickTime, Apple's video and animation compression standard. QuickTime is a System Extension that allows Macs running System 6.0.8 or System 7 to utilize the various animation programs that adhere t the QuickTime standard.

There are quite a few programs that use QuickTime : Adobe Premiere, DIVA Video Shop, MacroMedia Director, Passpoer Producer, and AuthorWare Professional, being among the most popular. These programs allow you to mix and edit QuickTime MOOVs, PICS files, captured video segments, and recorded sound files.

## N

**Name Box**

The left most area on the formula bar that shows the name or address of the area currently selected. For example, "A1" refers to cell A1 of the current worksheet.

**Navigation Bar**

A graphical or textual page that incorporates navigation hyperlinks to pages that are part of a web structure.

**Nested List**

A list contained within a member of another list, usually indicated by an indentation.

**Network**

A group of computers linked together so that their users can share information and peripheral devices.

**Network Location**

A unique name that identifies an Internet server also known as the "host name" and "internet address." This network location is found in URL and usually has two or more parts separated by periods.

**Number Format**

A format applied to values to express numeric concepts, such as currency, date, and per cent.

**Numbered Lists**

The HTML paragraph style which presents data in an ordered list of items headed by numbers. This may also be known as "ordered lists."

**Numeric Keypad**

The number keys on the right side of the keyboard that are laid out like the keys on an adding machine. In most cases, you can use these keys interchangeably with the number keys on the top row of the keyboard. Some programs use the numeric keypad as special function keys.

## O

**Operator**

A telephone company; a business that provides telecommunications services.

**Object**

A chart or graphic image that can be moved and re-sized and contains handles when selected.

**On-line**

To get "on-line" means to open a line of communications into the Internet.

**On-line Help**

Information that is available on the computer display.

**Operating System**

A set of programs that, among other things, controls the way information is loaded into memory, the way the computer works with that information, the way information is stored on a disk, and the way the computer communicates with a printer and other peripheral devices.

**OPTION Key**

A key that, when pressed in conjunction with another key, creates a special effect.

**Output**

Information traveling out of the computer, Or, this could be the end result of a work sheet.

## P

### Packet Loss

An error that occurs when data networks are overly congested. When pieces of data ("packets") are unable to be transmitted, they are sometimes "thrown out" by the network. Packet loss may or may not be disruptive to the recipient of the data, depending on the severity of loss.

### Penetration

The degree to which a technology has been adopted by a community. Teledensity is a measure of the penetration of telephone services.

### Piracy

The unauthorized duplication of goods protected by intellectual property law (e.g. copying software unlawfully).

### Programming

The act of creating software or some other set of instructions for a computer.

### Proxy

A server setup designed to offer either firewall security or faster access to cached content normally accessible only through slower connections.

### Page

A document on a web site written in HTML language.

### Page Template

A pre-designed generic page which may be used as a base to create new web pages.

### Page Title

A text string identifying a page.

### Password

A string of characters that allows a user access to an Internet service (assuming that special membership is a requirement for that access).

### Paste

A command that moves information on the Clipboard to a new location.

### Paste Special

A command that enables you to paste formulas as values, styles or cell contents.

### Peripheral Device

A device that is connected to the printer, such as a printer or modem or scanner.

### Pie Charts

A circular chart that displays data as slices of a pie. A pie chart is useful for showing the relationship of parts to a whole; pie slices can be pulled away or exploded from the pie for emphasis.

### Plug-in

Part of software modules that integrate into web browsers and offer a range of interactive and multimedia capabilities.

### Point Size

This refers to the physical size of text, measured in points. One inch equals 72 points.

### Pointer

In mouse-based applications, a market moves across the screen when you move the mouse across your desk.

### Port

A port is a location usually at the back of the computer through which certain things may be connected such as a joystick or other device.

### Print Preview

A window that displays a reduced view of the area to be printed, to give computer users a sense of what the layout or text may look like once printed.

### Printer

A device that produces a paper copy of the information you create using the computer.

### ProDOS

Acronym for Professional Disk Operating System.

### Program Selector

A program that lets you switch application programs without restarting the computer.

### Prompt

A character displayed on the screen to prompt the user to take some action. The most common

prompt is the "C prompt" in which the computer hard drive or "C" requests directions on what the computer should perform next.

**Property**

The characteristic of a certain item for page elements such as tables, graphics, charts, marquees, and text data.

**Publish**

The process of launching the web page into the public for use.

**Publishing Program**

A software program which allows users to bring text and graphics together into publishable hard copy (books, files, reports, newsletters, newspapers, and others), such as Pagemaker. This may also have rudimentary graphics capabilities.

**Pull-down Menu**

A menu that is hidden until you use the mouse to press its title.

**PICT**

Although PICT suggests an acronym, it isn't. PICT is the oldest generic file format on the Mac. It can hold a mix of bit-maps and objects. PICT objects and bit-maps can be any of eight colors: white, black, cyan, magenta, yellow, red, green and blue.

The PICT format can hold bit-maps with resolutions greater than 72DPI, but some programs may convert high-resolution bit-maps back to 72DPI. Suitable for medium-quality line art and low-resolution bit-maps. When graphics are copied to the clipboard, they are usually converted to PICT format.

**PICT 2**

This format is an extension of the original PICT version, and has two subtypes : a 16-million color version commonly called 24-bit PICT2, and the more prevalent 8-bit PICT2, which can hold up to 256 colors. Color palettes can be saved with PICT2 formatted graphics for importation into programs that can understand them. PICT2 is the preferred format for presentation graphics.

**Post Script**

A PostScript file is a pure text file that contains a description of the image, without the PICT image that EPS offers. When a PostScript file is sent to a PostScript printer, the printer interprets the instructions in the file to create the objects as they will appear on the page after printing.

**PICS**

A PICS file is essentially a collection of PICT or PICT2 bit-maps in a sequential order, much like movie frames. It's the storage standard for programs that can create animation, such as MacroMedia Director and Adobe Premiere. It's also an output option for 3-D applications such as MacroMedia's Swivel 3D, Specular's Infini-D, and DynaWare's DynaPerspective, for example—that can animate objects or viewpoints to product sophisticated action, simulations and structural fly-throughs. PICS files can be huge, depending on their frame size, number of colors and number of frames.

**QUEST Computer**

The name of the Seattle Public Libraries Computer system for users to find information (magazines, newspapers, microfilm, film, books, and others) throughout their library system.

## R

**RAID**

Redundant Array of Inexpensive Disks. A method of spreading information across several disks set up to act as a unit, using two different techniques :

**Radio Button**

Circle in a dialog box that allows you to choose one option from a list of options. Choosing one will eliminate the others as choices.

**Random-access Memory (RAM)**

Built-in computer memory where applications and data are stored temporarily for the microprocessor. Anything stored in RAM is erased when you switch off the power; you must save copies on disks if you want permanent copies.

**Range**

A selected group of adjacent cells.

**Range Format**

A format applied to a selected range in a worksheet.

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**Range Name**

A name applied to a selected range in a worksheet.

**Read**

To load information from a disk into the computer's memory.

**Registered User**

A user of a website whose name and password has been recorded in that site and which allow him/her entry.

**Relative Cell Reference**

Used to indicate a relative position in a worksheet. This allows you to copy and move formulas from one area to another of the same dimensions. Excel, for example, automatically changes the column and row numbers to reflect the new position.

Repair (disinfect, remove) One of the functions of software applications to disinfect viruses on your computer.

**RESET Key**

The key on the keyboard marked with a triangle. You can press "Reset" in combination with Command and Control to restart the computer (on some).

**Resolution**

The degree of clarity of your display.

**RETURN Key**

A key that you press to move the cursor to the beginning of the next line. The Return key is also used in many applications to accept choices or to indicate that you've finished doing something and are ready to proceed.

**Row Height**

The vertical dimension of a cell.

**Row Selector Button**

Gray box containing the row number to the left of the row.

**RW-CD-ROM (Rewritable Compact Disk Read-only Memory)**

A technology which allows users to not only "read" a CD-ROM but to write on it and change the information in it.

## S

**Satellite**

A communications device in orbit above the Earth.

**Software**

The programs or other "instructions" that a computer needs to perform specific tasks. Examples of software include word processors, e-mail clients, web browsers, video games, spreadsheets, accounting tools and operating systems.

**Software Developers**

The professional and amateur programmers who create software for use on computers.

**Save**

To store an application or data on a disk, as opposed to storing it temporarily in the memory of the computer. A command used to save incremental changes to a workbook.

**Save As**

A command used to create a duplicate of the current work book.

**Scan**

To search in the slots of the computer for a disk drive controller card. The computer scans when you first switch on the power. It looks first in slot 7; if it doesn't find a startup device there, it proceeds to the next-highest-numbered slot until it finds a start up device.

**Scanner**

A peripheral device to a computer which may input graphics or photos or text into a computer.

**Screen**

Part of the monitor where information is displayed.

**Scroll**

To move through a document.

**Scroll Bars**

Bars that appear on the right and bottom borders of the window that allow you to scroll the window vertically and horizontally to view information not currently visible in the current worksheet.

**Search Criteria**

Text, values or formulas you want to change using Find and Replace.

**Search and Replace**

To look for a particular word or phrase throughout a document and substitute another in its place.

**Security Software**

Programs that are used to restrict access to the data and files on a computer.

**Selection Handles**

Small black boxes at the corners and sides of charts and graphic images, indicating a chart is selected and can be moved or re-sized using the handles.

**Send**

To transfer a message from one location to another.

**Shareware**

Computer software programs which individuals write and put out on the Internet for free use by those who want to use them. (Over 140,000 free titles exist in the shareware library.)

**Sheet Tab**

A description at the bottom of each worksheet that identifies the sheet in a workbook. In an open workbook, move to a worksheet by clicking its tab.

**Sheet Tab Scrolling Buttons**

These enable you to move among sheets within a workbook.

**Software**

Instructions, usually stored on disks, that tell the computer what to do.

**Space Bar**

The bar at the bottom of the keyboard. Pressing the Space bar inserts a space character in your text at the insertion point.

**Spam**

To flood an e-mail address with many complaints and messages because the user of that e-mail address has done something offensive to other Internet e-mail users.

**Spelling Checker**

A companion application that you use with a word-processing application to check for miss-pelled words.

**Start Up**

The action necessary to turning on a computer. A disk with all the necessary program files to start up the computer. To load an application from a disk into the memory of the computer.

**Startup Drive**

A disk with the necessary software to start up the computer.

**Surf**

To "surf" the Internet means to go from one location to another in search of information.

**Surge Protector**

An electrical device which includes a fuse which does not allow a power surge to harm sensitive devices such as computers.

**Streaming**

Taking packets of information (sound or visual) from the Internet and storing it in temporary files to allow it to play in continuous flow.

**Stylus and Tablet**

A input device similar to a mouse. The stylus is pen shaped. It is used to .draw. on a tablet (like drawing on paper) and the tablet transfers the information to the computer. The tablet responds to pressure.the firmer the pressure used to draw, the thicker the line appears.

## T

**TCP/IP (Transmission Control Protocol/ Internet Protocol)**

The set of protocols used for the Internet and by organizations for communications between networks.

**Telecenter**

A facility that offers community members the ability to use ICTs in a publicly shared manner. Telecenters often provide the only connectivity available to many community members, and their services may be offered with or without a fee.

**Telecommunications**

The networks that support or the act of communication across a distance through telephone, cable and radio signals.

**Teledensity**

A term commonly used to describe the number of telephone lines per some unit of the population (often per 100 people); the density of telephone lines in a community.

**Transactional Security**

The degree to which online transactions, such as credit card orders, are safe from tampering or other unauthorized intervention.

**Twisted Pair Copper Wire**

The most common type of telephone line. The copper allows for fast signal transmission, and the twisted wires reduce transmission errors by eliminating interference from nearby wires.

**Tab**

A key that, when pressed, moves the insertion point to the next tab marker.

**Tab Marker**

At indicates the position to which the cursor will move when you press the Tab key.

**Telecommunications**

The exchange of information with other computers or with commercial information services over phone lines.

**Text Annotations**

Labels added to a chart to draw attention to a particular area.

**Text Block**

A chunk or "block" of highlighted text.

**3.5 Inch Disk**

A disk 3.5 inches in diameter. This is one of the most common storage mediums used for computers. Each disk may store 800 K of information or about 400 pages of text.

**Thumbnail**

A miniature version of an image in desktop publishing or web page building.

**Time Stamp**

A component that is replaced by the date and time a page was last edited or updated.

**Title Bar**

The horizontal bar at the top of a window that shows the name of the window and lets you move the window. This displays the application name and workbook. Until you save the workbook or file and give it a name, there is likely a default name depending on the program.

**Toggle Button**

A choice that, when clicked, turns an option on. Clicking it again turns the option off.

**Tool Bar**

A horizontal bar within the window that contains buttons for the most frequently used commands. A tool bar can be positioned along the edge of the worksheet window or can float within its own window.

**Tool Tip**

Name and description of a button on the toolbar that appears when the mouse pointer is positioned over the button. The name appears under the button and the description in the status bar.

**Transformer**

An electrical device which converts electrical power from one voltage to another--in order to accommodate various computers. Some computers made abroad run on 220 V vs. our 120 V. in the US.

**Troubleshooting**

Diagnosing and solving a problem.

**Trackball**

Input device that controls the position of the cursor on the screen; the unit is mounted near the keyboard, and movement is controlled by moving a ball.

**Terabytes (TB)**

A thousand gigabytes.

**Teraflop**

A measure of a computer's speed. It can be expressed as a trillion floating-point operations per second.

### TIFF (Tag Image File Format)

This is the most flexible and reliable method for storing bit-mapped images in various resolutions, shades of gray and color. It cannot, however, store object-oriented images. TIFF was created specifically for storing gray-scale data, and it is the standard for scanned images such as photographs. TIFF has three subtypes.

Monochrome TIFF stores only black and white images. Gray-Scale TIFF can hold 256 shades of gray and Color TIFF can hold up to 16.8 million colors. Although TIFF is considered to be a graphics standard, some programs save TIFF files with subtle variations that are overlooked by other applications capable of dealing with TIFF files, effectively limiting the file to the program used to create it. The European standards committee, the CCITT, is working on a proposed new TIFF standard that will be recognized worldwide. (It was released in 1993.)

## U

### UNIX

A multi-user, multitasking operating system that exists in many forms and uses.

### Up Arrow Key

A key used in many applications to make the cursor move up one line.

### UPS

Universal Power Supply or Uninterruptible Power Supply. An electrical power supply that includes a battery to provide enough power to a computer during an outage to back-up data and properly shut down.

### USB

A multiple-socket USB connecter that allows several USB-compatible devices to be connected to a computer.

### URL (Uniform Resource Locator)

A string that supplies the Internet address of a web site or resource on the WWW. The most common type begins "http://."

### Utility

Programs that perform special operations, such as installing or updating software, checking for damage on a disk, magnifying an image on a screen, etc.

### Usenet Groups

Small online communities formed around Usenet (short for Users' Network) discussion groups. Usenet is a type of bulletin board system for discussion and news postings.

### UWIN

The name of the University of Washington program which enables researchers to access information about their library resources as well as access the Internet.

## V

### Values

Numbers, formulas, or functions used in calculators.

### Video Teleconferencing

A remote "face-to-face chat," when two or more people using a webcam and an Internet telephone connection chat online. The webcam enables both live voice and video.

### Virtual Memory

Using part of your hard drive as though it were "RAM".

### Video Clip

A short video sequences that may be included or embedded into a web page or site.

### Virus

A program that contains the software instructions necessary to make exact replicas of itself and insert these instructions into other executable programs. Each time an infected program is launched, the viral code is executed, usually resulting in the infection of other programs. Viruses do vary in the degree of harm that they can cause.

### Volume

A general term for a storage device, storage medium or a destination for information. This is often used in reference to hard drives, cartridges, CD ROMS, floppy diskettes, and file servers. A volume can be an entire disk or only part of a disk. It has a name and a volume directory with the same name.

## W

### Web Designer

A person or business that designs and prepares content for the World Wide Web, including text, images, site architecture and multimedia.

### Web Hosting

Providing space on Internet servers for the storage of World Wide Web sites which can be accessed by others through the network. This service is usually offered by ISPs or web hosting specialists.

### Web Server

A specialized computer inside a network which sends out web content (pages, etc.) when a request is made by a web browser client. A website itself is hosted on the web server.

### Website

An information resource on the World Wide Web. Websites may provide information on any topic.

### Wireless Local Loop

The provision of telephony services to residences and businesses by use of a fixed wireless network (rather than a mobile wireless network). Networks based on wireless local loop (WLL) can be installed more quickly and less expensively than those using copper lines.

### Wireless Telephony

Telephone services based on signaling over radio frequencies rather than over fixed wires. Wireless telephony includes mobile wireless and wireless local loop, as well as microwave, satellite and spread spectrum radio based telephony.

### World Wide Web (WWW)

An Internet-based system for the retrieval of information from distributed servers by use of a client or browser. The World Wide Web supports text, graphics and multimedia, and is a key medium for communication, business and entertainment in the Networked World.

### WAV

A sound format (pronounced .wave.) used to reproduce sounds on a computer.

### Webcam

A video camera/computer setup that takes live images and sends them to a Web browser

### WAIS (Wide Area Information Service)

This supports searching over the Internet.

### WAN (Wide Area Network)

A computer network that spans a long distance and uses specialized computers to connect smaller networks to communicate.

### Watermark

An image that appears on the backgrounds of pages to help identify them and which does not scroll as the page moves.

### What-if Analysis

Decision-making feature in which data is changed and automatically re-calculated.

### Window

In mouse-based applications, one or more areas on the screen showing one or more documents at a time. Files show up as rectangular windows on the screen.

### Word-processing Application

Any application designed to make writing, editing, spell-check, thesaurus use, and such on the computer easier and faster.

### Workbook

A collection of related worksheets contained within a single file.

### Worksheet

An electronic spreadsheet containing 256 columns by 16,384 rows.

### Worksheet Window

A framed area of the Excel window containing a grid of columns and rows that is called a worksheet.

### Write

To record information on a disk.

### Write-protected (or Copy-protected)

Locked or protected disk which cannot be copied or changed. Such a disk has its "lock" button moved up to leave an open space in the upper left corner of the back side of the disk.

**WYSIWYG (What You See is What You Get)**

An editing interface in which a file being made is displayed as it will appear to an end-user.

## X

**X-axis**

The horizontal line in a chart.

**X-axis label**

A label describing the x-axis of a chart.

## Y

**Y-axis**

The vertical line in a chart.

**Y-axis label**

A label describing the y-axis of a chart.

## Z

**Zoom**

A feature that enables you to focus on a larger or smaller part of the worksheet in Print Review or in some pre-print features.

**Zoom Box**

A small square in the upper right corner of a window which, when clicked, will expand the window to fill the whole screen.

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ISBN 978-93-5013-547-1

UPKAR PRAKASHAN, AGRA-2