



# **ACT - ASSOCIATION OF COMPUTER TEACHERS MALAPPURAM**

## **COMPUTER APPLICATION (COMMERCE)**

### **CLASS XI**

***Prepared by:*** \_\_\_\_\_

- ◆ LIJU MATHEW
- ◆ PRIYA M D
- ◆ MOHAMMED JASIM K
- ◆ ABDUL MAJEED C
- ◆ VARUN C S
- ◆ ROSHID P K

- MARTHOMA HSS CHUNGATHARA
- GHSS PURATHUR
- DHOHSS POOKKARATHARA
- GHSS PATTIKKAD
- PMSAMAHSS CHEMMANKADAVU
- MES HSS MAMPAD

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# CHAPTER 1

## Fundamentals of Computer

### Data and Information

**Data** denotes raw facts and figures such as numbers, words, etc. that can be processed or manipulated.

Eg:- Suresh, 17, 12

**Information** is the meaningful and processed form of data.

Eg:-

Name	Age	Class
Suresh	17	12

### Comparison between Data & Information

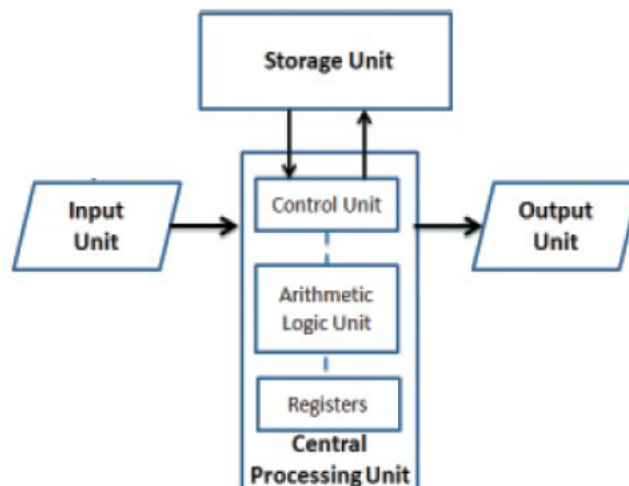
Data	Information
Raw facts and figures	Processed data
Similar to raw material	Similar to the finished product
Cannot be directly used	Helps in taking decisions
Does not give precise and clear sense	Clear and meaningful

### Data processing

- **Data processing** refers to the operations or activities performed on data to generate information.
- Different Stages of Data processing are:
  1. Capturing data
  2. Input of data
  3. Storage of data
  4. Processing data
  5. Output of information
- 6. Distribution of information

### Functional units of a computer

The functional units of a computer are: Input Unit, Central Processing Unit(CPU), Storage Unit and Output Unit.



### 1. Input Unit

Accepts instructions and data for processing.  
Eg:- Keyboard, mouse

### 2. Central Processing Unit (CPU)

The CPU is the brain of the computer. All major computations and comparisons are made inside the CPU.

The functions of CPU are performed by three components:-

- (i) **Arithmetic Logic Unit(ALU)**: It performs all arithmetic and logical operations.
- (ii) **Control Unit(CU)**: It manages and co-ordinates all other units of the computer.
- (iii) **Registers**: These are the temporary storage areas inside the CPU.

### 3. Storage Unit

Store data and instructions, intermediate results and final results.

### 4. Output Unit

Supplies the results to the outside world.  
Eg:- Monitor, Printer

## Computer

It is an electronic device for storing and processing data according to instructions given to it.

## Characteristics of Computers

**Advantages:** Speed, Accuracy, Diligence, Versatility, Huge memory

**Limitations:** Lack of IQ, Lack of decision making power

## Number system

- The number of symbols used in a number system is called **base** or **radix**.

Number System	Base	Symbols used	Example
Binary	2	0, 1	$(1101)_2$
Octal	8	0, 1, 2, 3, 4, 5, 6, 7	$(236)_8$
Decimal	10	0, 1, 2, 3, 4, 5, 6, 7, 8, 9	$(5876)_{10}$
Hexadecimal	16	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F (A, B, C, D, E, F represents 10, 11, 12, 13, 14, 15 respectively)	$(12AF)_{16}$

- **MSD**: The leftmost digit of a number is called **Most Significant Digit (MSD)**.
- **LSD**: The right most digit of a number is called **Least Significant Digit (LSD)**.


## Number Conversions

### Decimal to binary conversion

Repeated division by 2 and grouping the remainders. Remainders will be either 0 or 1

**Example:** Convert  $(30)_{10}$  to binary.

2	30	Remainders
2	15	0
2	7	1
2	3	1
2	1	1
	0	1





### Octal to decimal conversion

Multiply octal digit by place value (power of 8) and find their sum.

**Example:** Convert  $(167)_8$  to decimal.

$$(167)_8 = 1 \times 8^2 + 6 \times 8^1 + 7 \times 8^0$$

$$= 64 + 48 + 7 = 119$$

$$(167)_8 = (119)_{10}$$

Weight	$8^2$	$8^1$	$8^0$
Octal digit	1	6	7

### Hexadecimal to decimal conversion

Multiply hexadecimal digit by place value (power of 16) and find their sum.

**Example:** Convert  $(2B5)_{16}$  to decimal.

$$(2B5)_{16} = 2 \times 16^2 + 11 \times 16^1 + 5 \times 16^0$$

$$= 512 + 176 + 5$$

$$= 693$$

$$(2B5)_{16} = (693)_{10}$$

Weight	$16^2$	$16^1$	$16^0$
Hexadecimal digit	2	B	5

### Octal to binary conversion

Converting each octal

Octal digit	0	1	2	3	4	5	6	7
Binary equivalent	000	001	010	011	100	101	110	111

digit to its 3 bit binary equivalent.

**Example:** Convert  $(437)_8$  to binary.

3-bit binary equivalent of each octal digits are

$$\begin{array}{ccc} 4 & 3 & 7 \\ \downarrow & \downarrow & \downarrow \\ 100 & 011 & 111 \end{array}$$

$$(437)_8 = (100011111)_2$$

### Hexadecimal to binary conversion

Converting each hexadecimal digit to its 4 bit binary equivalent.

**Example:** Convert  $(AB)_{16}$  to binary.

Octal digit	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Binary equivalent	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111

4-bit binary equivalent of each hexadecimal digits are

$$\begin{array}{cc} A & B \\ \downarrow & \downarrow \\ 1010 & 1011 \end{array}$$

$$(AB)_{16} = (10101011)_2$$

### Binary to octal conversion

Grouping binary digits to group of 3 bits from right to left and then each group is converted to its octal equivalent.

**Example:** Convert  $(10111000011)_2$  to octal.

Group the given binary number from right as shown below:

if the left most group does not have 3 bits, then add leading zeros to form 3 bit binary.

$$\begin{array}{cccc} 010 & 111 & 000 & 011 \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 2 & 7 & 0 & 3 \end{array}$$

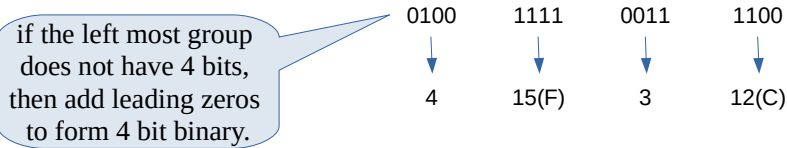
$$( \quad )_8$$

### Binary to Hexadecimal conversion

Grouping binary digits to group of 4 bits from right to left and then each group is converted to its hexadecimal equivalent.

**Example:** Convert  $(100111100111100)_2$  to hexadecimal.

Group the given binary number from right as shown below:



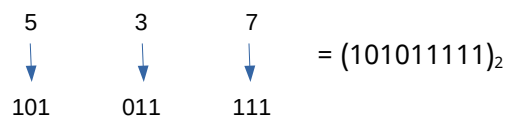
$$(100111100111100)_2 = (4F3C)_{16}$$

### Octal to hexadecimal conversion

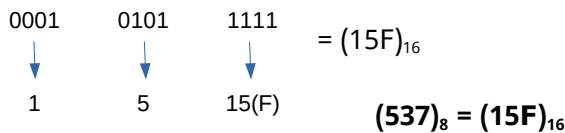
Convert octal to binary and then binary to hexadecimal.

**Example:** Convert  $(537)_8$  to hexadecimal equivalent.

First convert  $(537)_8$  into binary.



Then convert  $(101011111)_2$  into hexadecimal.



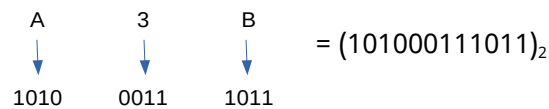
$$(537)_8 = (15F)_{16}$$

### Hexadecimal to octal conversion

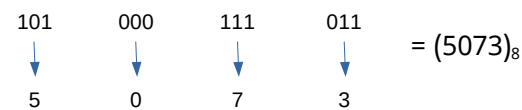
Convert hexadecimal to binary and then binary to octal.

**Example:** Convert  $(A3B)_{16}$  into octal equivalent.

First convert  $(A3B)_{16}$  into binary.



Then convert  $(101000111011)_2$  into octal.



$$(A3B)_{16} = (5073)_8$$

### Representation of integers

There are three methods for representing an integer number in computer memory. (i) Sign and magnitude representation, (ii) 1's complement representation, (iii) 2's complement representation

#### i) Sign and magnitude representation

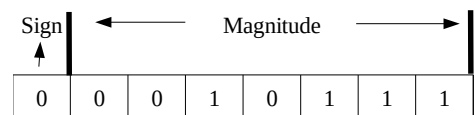
- First find binary equivalent of integer and write it in 8-bit form.
- Make the first bit 1 for negative numbers and 0 for positive numbers.

**Example:** Represent +23 in sign and magnitude form.

Binary of 23 in 8-bit form =  $(00010111)_2$

Number is positive, so first bit is 0.

So +23 can be represented as  $(00010111)_2$

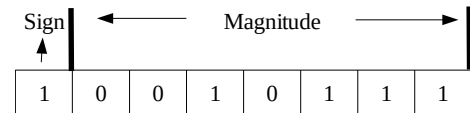


**Example:** Represent -23 in sign and magnitude form.

Binary of 23 in 8-bit form =  $(00010111)_2$

Number is negative, so first bit is 1.

So -23 can be represented as  $(10010111)_2$



### ii) 1's complement representation

- 1's complement of a binary is obtained by replacing every 0 with 1 and every 1 with 0.
- If the number is negative, it is represented as 1's complement of 8-bit form binary.
- If the number is positive, the 8-bit form binary itself is the 1's complement.

**Example:** Represent +23 in 1's complement form.

Binary of 23 in 8-bit form =  $(00010111)_2$

+23 in 1's complement form =  $(00010111)_2$  (For +ve numbers, no need to find 1's complement)

**Example:** Represent -23 in 1's complement form.

Binary of 23 in 8-bit form =  $(00010111)_2$

-23 in 1's complement form =  $(11101000)_2$  (by replacing 0 with 1 and 1 with 0)

### iii) 2's complement representation

- 2's complement of a binary number is calculated by adding 1 to its 1's complement.
- If the number is negative, it is represented as 2's complement of 8-bit form binary.
- If the number is positive, 8-bit form binary itself is the 2's complement.

**Example:** Represent +23 in 2's complement form.

Binary of 23 in 8-bit form =  $(00010111)_2$

+23 in 2's complement form =  $(00010111)_2$  (For +ve numbers, no need to find 2's complement)

**Example:** Represent -23 in 2's complement form.

Binary of 23 in 8-bit form =  $(00010111)_2$

-23 in 1's complement form =  $(11101000)_2$  (by replacing 0 with 1 and 1 with 0)

-23 in 2's complement form =  $11101000 +$

$$= \begin{array}{r} 1 \\ \hline (11101001)_2 \end{array}$$

### Representation of floating point numbers

- Any number in floating point notation contains two parts, **mantissa** and **exponent**.
- Eg: 25.45 can be written as  $0.2545 \times 10^2$ , where 0.2545 is the mantissa and the power 2 is the exponent.

### Representation of characters

Different methods to represent characters in computer memory are: ASCII, Unicode, ISCII, EBCDIC

#### ASCII

- It stands for **American Standard Code for Information Interchange**
- ASCII uses 7 bits for each character, can represent only 128 characters.
- Another version is ASCII-8, which uses 8 bits, can represent 256 characters.

#### EBCDIC



- It stands for **Extended Binary Coded Decimal Interchange Code**.
- It is an 8 bit code used in IBM Machines. It can represent 256 characters.

### ISCII

- It stands for **Indian Standard Code for Information Interchange** or **Indian Script Code for Information Interchange**.
- It is an 8 bit code for representing various writing systems of India.

### Unicode

- Unicode used 16 bits which can represent up to 65,536 characters.
- It can represent data in almost all written languages of the world.

### Sample Questions

1. Meaningful and processed form of data is known as .....
2. The number of symbols used in a number system is called .....
3. ASCII stands for .....
4. The base of hexadecimal number system is .....  
(2, 8, 10, 16)
5. CPU stands for .....
6. Distinguish between data and information.
7. Define Data processing. List the stages of data processing.
8. Explain why computers are considered as the best electronic data processing machines?
9. List down the limitations of computers.
10. Name the components of CPU.
11. Convert  $(1010)_2$  to decimal.
12. Convert  $(35)_{10}$  to binary.
13. Fill in the blanks.  
(a)  $(DA)_{16} = (\dots\dots\dots)_2$   
(b)  $(25)_{10} = (\dots\dots\dots)_8$
14. What are the methods of representing integers in computer memory?
15. What are the methods of representing characters in computer memory?
16. Write a short note on Unicode.
17. Write short notes on ASCII.
18. Represent -25 in the following forms:  
(Hint: Use 8 bit form of representation).  
(a) Sign and Magnitude (b) 1's complement (c) 2's complement
19. With the help of a block diagram, explain the functional units of a computer.

## CHAPTER 2

# Components of the Computer System

A computer has two major components - *Hardware* and *Software*

### Hardware

- The tangible and visible parts of a computer is called **hardware**.  
Eg:- Processor, Motherboard, Keyboard, etc.

The hardware components of a computer are

- Processor
- Motherboard
- Peripherals and ports
- Memory
- Input devices
- Output devices

### Processor

- *Processor / CPU / Microprocessor* is responsible for all computing and decision making operations and coordinates the working of a computer.

Eg:- Intel core i3, core i5, core i7, AMD Quadcore

Processor has three parts:

- ALU – Arithmetic and Logic Unit
- CU – Control Unit
- Registers

**ALU** performs all Arithmetic and logical calculations

**CU** controls the operations of all other units of Computer

**Registers** are temporary storage areas inside CPU. Registers speeds up the execution of programs.

Important registers inside a CPU are:

**(i) Accumulator:** It is used to store intermediate arithmetic and logic results.

**(ii) Memory Address Register (MAR):** It stores the address of a memory location from which data will be read or to which data will be written by the processor.

**(iii) Memory Buffer Register (MBR):** It holds the data, either to be written to or read from the memory by the processor.

**(iv) Instruction Register (IR):** It stores the instructions to be executed by the processor.

**(v) Program Counter (PC):** It holds the address of the next instruction to be executed.

### Motherboard

- A motherboard is a Printed Circuit Board to which all the major components of a computer (processor, memory, etc.) are connected.

### Peripherals and ports

- **Peripherals** are devices connected to a computer system.  
Eg:- input devices, output devices
- **Ports** are slots on the motherboard to connect external devices.  
Different ports are Serial, Parallel, USB, LAN, PS/2, Audio, VGA, HDMI, etc.

#### a. Serial port

- A serial port transmit data one bit at a time.

- It was used to connect modem, mouse and keyboard.

**b. Parallel port**

- Parallel ports can transmit several bits of data at a time.
- It is used to connect a printer or scanner to the computer.

**c. USB (Universal Serial Bus) port**

- USB provides high speed data communication between devices.
- It is used to connect devices like keyboard, mouse, printer, scanner, etc.

**Advantages:**

- USB ports are capable of supplying electric power to external devices.
- USB devices can be connected and disconnected even when the power is on.

**d. LAN (Local Area Network) port / Ethernet port**

- It is used to connect a computer to a network.
- RJ45 connector is used.

**e. PS/2 port**

- Invented by IBM
- Used for connecting keyboard and mouse. Very slow.

**f. Audio ports**

- Used to connect audio devices like speakers, microphone, etc.
- Audio ports are divided into: Line in, Line out, Mic in

**g. Video Graphics Array (VGA) port**

- It is used to connect a monitor or a projector to a computer.

**h. High Definition Multimedia Interface (HDMI)**

- Used to transfer both high-definition video and multi channel audio over a single cable.

**Memory**

- **Memory** is used to store data and instructions temporarily or permanently.
- Classified into two: **Primary memory** and **Secondary memory**.

**Memory measuring units**

Binary Digit =	1 Bit	1 MB (Mega Byte) =	1024 KB
1 Nibble =	4 Bits	1 GB (Giga Byte) =	1024 MB
1 Byte =	8 Bits	1 TB (Tera Byte) =	1024 GB
1 KB (Kilo Byte) =	1024 Bytes	1 PB (Peta Byte) =	1024 TB

a.

**Primary memory**

*Primary memory* is used to store data and applications temporarily while the computer is running.

Three types of primary memory are *RAM*, *ROM* and *Cache*.

**Comparison between RAM and ROM**

<b>RAM (Random Access Memory)</b>	<b>ROM (Read Only Memory)</b>
It is faster than ROM.	It is a slower memory.
It stores the operating system, application programs and data temporarily.	It stores the program required to boot the computer.
It allows reading and writing.	Allows reading only.
It is volatile, i.e. it will lose its data if the power is turned off.	It is non-volatile, i.e. it keeps its data even if the power is turned off.

**Different types of ROMs are:**

- PROM - Programmable ROM
- EPROM - Erasable Programmable ROM
- EEPROM - Electrically Erasable Programmable ROM

**Cache memory**

- Cache memory is a small and fast memory between the processor and RAM.
- Frequently accessed data and instructions are stored in cache memory for quick access.
- Cache is faster than RAM.
- Cache is more expensive than RAM.

**b. Secondary memory (Auxiliary memory)**

- Secondary memory is used to store large amount of data or programs permanently.
- It is non-volatile, i.e. its contents are retained even when the device is powered off.
- It is much larger in size than RAM.
- It is slower than RAM.
- It acts as a backup.

The major categories of secondary storage devices are:

- (i) Magnetic storage devices. Eg:- magnetic tapes, floppy disks, hard disks.
- (ii) Optical storage devices. Eg:- CD, DVD, Blu-Ray DVD
- (iii) Semiconductor storage devices. Eg:- USB flash drive, Flash memory cards

**Comparison of different types of memory**

Storage	Speed	Capacity	Relative Cost	Volatile
Registers	Fastest	Lowest	Highest	Yes
Cache	More Fast	Low	Very High	Yes
RAM	Very Fast	Moderate	High	Yes
Hard Disk	Moderate	Very High	Very Low	No

**Input devices**

An **input device** is used to feed data and instructions into the computer.

**Different types of input devices are:**

- 1. Keyboard:** It is an input device used to input alphabets, numbers and other characters.
- 2. Mouse:** It is a hand-held device that controls the movement of the cursor on a display screen.
- 3. Light pen:** It is a light-sensitive pointing device used to draw pictures on a computer screen.
- 4. Touch screen:** It allows the user to operate the computer by simply touching on the display screen.
- 5. Graphic tablet:** It allows artists to create graphical images.
- 6. Touchpad:** It is a pointing device used to move the mouse pointer on a display screen.
- 7. Joystick:** It is a pointing device commonly used for playing video games.
- 8. Microphone:** It is used to input sound.
- 9. Scanner:** It is an input device that scans documents such as photos and pages of text.

on **10. Optical Mark Reader (OMR):** It reads pencil marks made on pre-defined positions the OMR form. It is used to process competitive exam results quickly and accurately.

**11. Barcode Reader/Quick Response (QR) code reader**

- Barcode readers are electronic devices for reading printed barcodes.
- A QR code is similar to barcodes. Barcodes are single dimensional whereas QR codes are two dimensional. It can store website URLs, plain text, phone numbers, etc.

**12. Magnetic Ink Character Recognition (MICR) Reader:** It is used in banks for faster clearing of cheques.

**13. Biometric sensor:** It is used to identify unique human physical features like fingerprints, retina, etc.

**14. Smart card reader:** A smart card is a plastic card that stores and transacts data (Eg:- ATM Card). Smart card readers are used to access data in a smart card.

**15. Digital camera:** It can take pictures and videos and that can be transferred to a computer.

## Output devices

*Output device* is used to present information from a computer system.

### Hard copy and Soft copy output

- *Hard copy outputs* are permanent outputs which can be used at a later date or when required.  
Eg. for Hard copy output device: Printer, Plotter
- *Soft copy outputs* are electronic and are available on the screen in a digital form.  
Eg. for Soft copy output device: Monitor

## Different types of output devices are:

### 1. Monitor

An output device used to display information from a computer.

#### Different types of Monitors are:

**a. Cathode Ray Tube (CRT) monitor:** Similar to old television sets. Use more power, produce lot of heat.

**b. Flat panel monitor:** It is thinner, lighter in weight, consume less power, emit less heat.

Eg:- LCD Monitors, LED Monitors, Plasma Monitors, OLED Monitors.

### 2. LCD projector

It is used for displaying video, images or computer data on a large screen.

### 3. Printer

**Printers** are used to produce hardcopy output.

Classified into two:- **impact** and **non-impact** printers.

**Impact printers** make direct contact with the paper while printing.

Eg:- Dot-matrix printers.

#### **Dot Matrix Printer (DMP)**

- Printing material: Ink ribbon
- Cheaper to print, Carbon copy possible, slow, noisy, printer is expensive.

**Non-impact printers** do not touch the paper while printing.

Eg:- Inkjet, Laser and Thermal printers

#### **Inkjet printer**

- Printing material: Liquid ink
- Quiet, high print quality, printers are inexpensive, ink is expensive.

#### **Laser printer**

- Printing material: Ink powder
- Quiet, prints faster, high print quality, Toner is expensive, Device is expensive.

#### **Thermal printer**

- Printing material: Heat sensitive paper.
- Quiet, faster, smaller, lighter, consume less power, portable.

#### **4. Plotter**

- It is an output device used to produce hard copies of large graphs and designs on the paper.
- It is used in the design of cars, ships, aircrafts, buildings, highways etc.

#### **5. Three dimensional (3D) printer**

- It is a new generation output device used to print 3D objects.
- It can print ceramic cups, plastic toys, metal machine parts, etc.

#### **6. Speakers**

- Speakers are the output device that produces sound.

### **e-Waste**

**e-Waste** refers to electronic products nearing the end of their "useful life".

Eg:- discarded computers, mobile phones, television sets, refrigerators, etc.

#### **e-Waste disposal methods**

**a. Reuse:** It refers to second-hand use.

**b. Incineration:** It is a combustion process in which the waste is burned at a high temperature.

**c. Recycling:** It is the process of making new products from old devices.

**d. Land filling:** In this method soil is excavated and e-waste is buried in it.

#### **Why should we be concerned about e-Waste?**

- Electronic waste contains some toxic substances such as mercury, lead, etc.
- The toxic materials can cause cancer and many other health problems, if not properly managed.

#### **Students' role in e-Waste disposal**

- Stop buying unnecessary electronic equipments.
- Try to repair faulty devices instead of buying a new one.
- Try to recycle electronic equipments.
- Buy rechargeable instead of disposable batteries.
- Buy products with good warranty.

#### **Green computing or Green IT**

- The environmentally responsible and eco-friendly use of computers and their resources is known as **green computing**.

#### **To promote green computing the following four approaches are employed:**

(i) Green design, (ii) Green manufacturing, (iii) Green use, (iv) Green disposal

#### **Software**

- Software is a set of programs that help us to use the computer system.
- Two types of software: *System software* and *Application software*

#### **System software**

It is a set of one or more programs designed to control the operations of a computer.

#### **Components of system software are:**

Operating system, Language processors and Utility software.

### a. Operating system

- It is a set of programs that acts as an interface between the user and computer hardware. Example:- DOS, Windows, Unix, Linux

### Major functions of an Operating System are:

Process management, Memory management, File management and Device management

### Computer languages

**Low Level Language:** machine-oriented languages. Two types:

- a. Machine language:* The language, which uses only binary digits 0 and 1.
- b. Assembly language:* is an intermediate-level symbolic programming language. It uses mnemonic symbols like ADD, SUB, etc.

**High Level Language** is like English language and is simpler to understand. Not understandable to the computer. Example: C++

### b. Language processor

- It translates programs written in high level language or assembly language into its equivalent machine language.

#### Types of language processors

**Assembler:** It converts assembly language into machine language.

**Interpreter:** It converts a high level language program into machine language line by line.

**Compiler:** It converts the whole high level language program into machine language at a time.

### c. Utility software

- Utility software is a set of programs which help users in system maintenance tasks.

#### Some of the utility programs are:

*(i) Compression tools:* Large files can be compressed so that they take less storage area.

Eg: WinZip, WinRAR

*(ii) Disk defragmenter:* Consolidates fragmented files on a computer hard disk.

*(iii) Backup software:* Backup means duplicating the disk information so that in an event of disk failure this backup may be used.

*(iv) Antivirus software:* Antivirus software is a utility program that scans the computer system for viruses and removes them. Eg: Norton Antivirus, Kaspersky

### Application software

- Software developed for specific purpose is called application software.
- It includes *general purpose software* and *specific purpose software*.

#### a. General purpose software

- Software that can be used for a variety of tasks. It is classified as:
  - Word processing software Eg: MS Word, Open Office Writer

- Spreadsheet software Eg: Microsoft Excel, Open Office Calc
- Presentation software Eg: Microsoft PowerPoint, Open Office Impress.
- Database software Eg: Microsoft Access, Oracle
- Multimedia software Eg: Adobe Flash, Media Player

**b. Specific purpose software**

- Tailor-made software to satisfy the needs of an organisation. Also known as *customised software*.  
Eg: Payroll System, Inventory Management System, HR Management System.

**Free and open source software**

- It gives the user the freedom to use, copy, distribute, examine, change and improve the software. Eg:- GNU/Linux, GIMP, Mozilla Firefox, OpenOffice.org

**Four Freedoms of Free Software**

- Freedom 0 - The freedom to run program for any purpose.
- Freedom 1 - The freedom to study how the program works and adapt it to your needs.
- Freedom 2 - The freedom to distribute copies of the software.
- Freedom 3 - The freedom to improve the program and release your improvements to the public.

**Freeware and Shareware**

Freeware	Shareware
Copyrighted software available free of cost for an unlimited period.	Commercial software give users a chance to try the software before buying it.
All the features are free.	All features are not available.
Freeware programs can be distributed free of cost.	Shareware may or may not be distributed freely.

**Proprietary software**

- It is a software that is an exclusive property of its developer and cannot be copied or distributed without permission.  
Eg:- Microsoft Windows OS, MS Office

**Humanware**

- Humanware or liveware refers to humans who use the computer.  
Eg:- Computer programmers, Computer Operators, System Administrators, etc.

**Sample Questions**

1. 1 Byte = ..... bits
2. Name the software that translates assembly language program into machine language program.
3. Write the full form of HDMI.
4. OMR stands for .....
5. What is the importance of registers in computer system? Name any two registers.
6. Name any four *ports* on the motherboard.
7. Give two examples for *free and open source software*.



8. Compare RAM and ROM.
9. What is an input device? List and explain any two input devices.
10. What is an output device? List few commonly used output devices.
11. Categorize devices given below into input devices and output devices.  
(Joystick, Scanner, Plotter, Microphone, Printer, Mouse, VDU, Speaker)
12. Compare dot matrix printers and laser printers.
13. Give two examples for non-impact printers.
14. Which printer is widely used as portable printer? Why?
15. Define (a) Plotter (b) 3D Printer
16. What is e-Waste? List and explain different e-waste disposal methods.
17. Define the term, green computing. How can you implement green computing?
18. Define (a) Assembler (b) Interpreter (c) Compiler
19. Define operating system. Give two examples for OS.
20. List four major functions of operating system.
21. What do you mean by free and open source software? Give two examples.
22. What are the four freedoms which make up free and open source software?
23. Compare Freeware and Shareware.

# CHAPTER 3

## Principles of Programming and Problem Solving

### Approaches in problem solving

- Top down design
- Bottom up design

### Phases in programming

- Problem identification
- Preparing Algorithms and Flowcharts
- Coding the program
- Translation
- Debugging
- Execution and testing
- Documentation

### Problem Identification

- In this phase we will be able to identify the data involved in processing, its type and quantity, formula to be used, activities involved, and the output to be obtained.

### Algorithm

- It is a step-by-step procedure to solve a problem.

#### Characteristics of an Algorithm




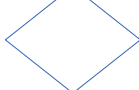

- Should begin with instructions to accept inputs.
- Use variables to refer the data
- Each and every instruction should be precise and unambiguous.
- The total time to carry out all the steps in the algorithm must be finite.
- After performing the instructions given in the algorithm, the desired results must be obtained.

*The algorithm which will be executed faster with minimum amount of memory space is considered as the best algorithm for the problem.*

### Flowcharts

- The pictorial representation of an algorithm is known as **flowchart**.

#### Flowchart symbols

1.  **Ellipse:** used to indicate START and STOP.
2.  **Parallelogram:** used as the input/output symbol.
3.  **Rectangle:** used to represent the processing step.
4.  **Rhombus:** used as decision symbol.
5.  **Flow lines:** used to indicate the flow of operation.

#### Advantages of flowchart

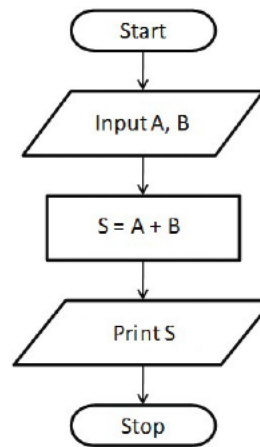
- Better communication
- Effective analysis
- Effective synthesis
- Effective synthesis

### Limitations of Flowchart

- Time consuming
- Modification is difficult

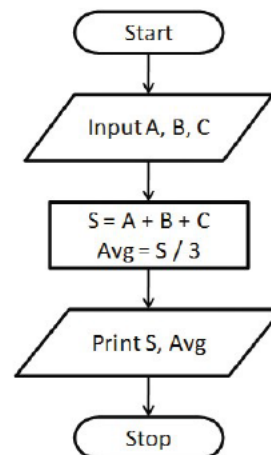
**Eg: Write an algorithm and draw a flowchart to find the sum of two numbers**

- Step 1: Start
- Step 2: Input A, B
- Step 3:  $S = A + B$
- Step 4: Print S
- Step 5: Stop



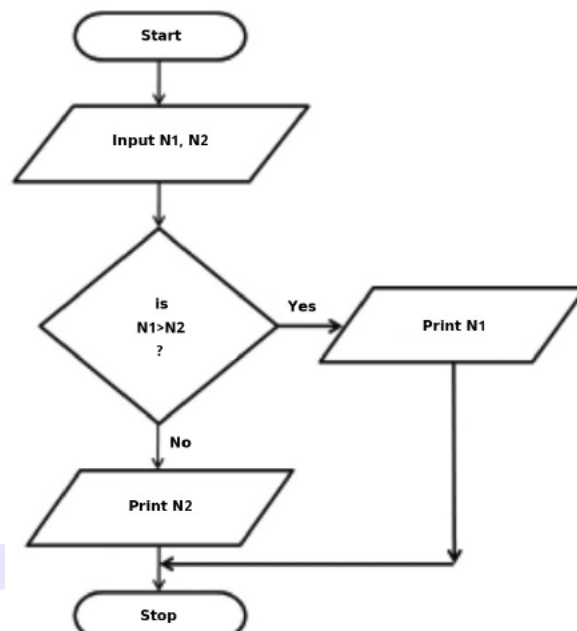
**Eg: Write an algorithm and draw a flowchart to find the sum and average of three numbers**

- Step 1: Start
- Step 2: Input A, B, C
- Step 3:  $S = A + B + C$
- Step 4:  $Avg = S / 3$
- Step 5: Print S, Avg
- Step 6: Stop



**Eg: Write an algorithm and draw a flowchart to find the biggest of two numbers.**

- Step 1: Start
- Step 2: Input N1, N2
- Step 3: If  $N1 > N2$  Then
- Step 4: Print N1
- Step 5: Else
- Step 6: Print N2
- Step 7: End of If
- Step 8: Stop



## Coding the program

- The process of writing program instructions to solve a problem using a High Level Language is called **coding**.
- The program written in High Level Language is called **source code**.

## Translation

- **Translation** is the process of converting a program written in high level language into its equivalent version in machine language.
- The program in machine language (Binary language) is called **object code**.

<i>Source code</i>	----->	<i>Translation</i>	----->	<i>Object code</i>
--------------------	--------	--------------------	--------	--------------------

## Debugging

- Programming errors are known as '**bugs**'. The process of detecting and correcting errors is called **debugging**.

### **There are three types of errors:**

**Syntax errors:** Errors which occur when the rules or syntax of the programming language are not followed.

**Logical errors:** Logical error, is due to improper planning of the program's logic.

**Run-time errors:** Errors which occur during program execution. Eg:- division by zero

## Execution and testing

- It involves running the program to process the test data that will produce 'known results'.

## Documentation

- Writing comments in the source code is known as **internal documentation**.
- It will help in debugging process and program modification at later stage.
- Preparing user manual and system manual are known as **external documentation**.

## Sample Questions

1. Pictorial representation of algorithm is known as .....
2. .... is a step by step procedure to solve a problem.
3. Which flow chart symbol has one entry flow and two exit flows?
4. In a flowchart, ..... is used as the input/output symbol.
5. Source code is converted into object code during ..... phase in programming.  
(Execution, Coding, Documentation, Translation)
6. A program written in High Level Language is called .....
7. List any two limitations of flowcharts.
8. Write any two advantages of flowcharts
9. Program errors are known as .....
10. What is debugging?
11. List different phases in programming.
12. Define: (a) Syntax errors (b) Logical errors (c) Run-time errors
13. Write an algorithm to find the sum and average of 3 numbers.
14. What is the importance of proper documentation in programming ?
15. How will you choose the best algorithm for a problem ?

# CHAPTER 4

## Getting Starting with C++

### Character set

- Fundamental units of C++ Language. It consists of letters, digits, special characters, white spaces

### Tokens

- Tokens are Fundamental building blocks of C++ program. (Lexical units)

### Classification of Tokens

- **Keyword (Reserved word):** They convey a specific meaning to the compiler.  
Eg: float, if, break, switch

- **Identifiers:** Names given to different program elements.
  - (a) *Variable: Name given to memory location.*
  - (b) Label: Name given to a statement.
  - (b) Function name: Name given to a group of statements.

#### Rules to form an identifier:

- Identifier is a sequence of letters , digits and underscore.
- The first character must be letter or underscore
- Keyword cannot be used as an identifier.
- Special characters or white spaces cannot be used  
Eg: score, score1, score\_1, INT

- **Literals(Constants):** Constant values used in program.
  - (a) Integer literals: Whole numbers. Eg: 23, -145
  - (b) Floating literals: Constants having fractional parts. Eg: 12.5, 1.87E05
  - (c) Character literals: A character in single quotes. Eg: 'a', '8'  
Escape sequences are character constants used to represent non graphic symbols. Eg: '\n', '\t'
  - (d) String literals: One or more characters within double quotes. Eg: "a", "score1"
- **Operators:** Symbols that indicate an operation. Eg: +, <, \*, &&
- **Punctuators:** Special symbols used in C++ program. Eg: # ; ( ] }

### Sample Questions

1. The non graphic symbols in C++ can be represented by using .....
2. The tokens that convey a specific meaning to the language compiler are called .....
3. Which among the following is not a character literal ?  
( 'a' , '\a' , a , '8' )
4. Pick odd one out  
(sum , break, add, num\_1 )
5. Classify the following identifiers as valid or invalid. If invalid, give a reason.  
a) Height\_1 b) \_Height1 c) 1Height d) Height 1
6. Identify the tokens in the following C++ statement  
int x=100;

7. What is the difference between float and "float" ?
8. Categorise the following into different types of tokens  
a. result    b. %    c . #    d. Float
9. Differentiate between the literals 'p' and "p" in C++.
10. What are the rules to define an identifier ?
11. Define token in C++. Name the tokens available in C++ with one example each.
12. What are *escape sequence characters* in C++? Give an example.
13. Differentiate between *character literal* and *string literal*.
14. Distinguish between keywords and identifiers.
15. The following are invalid identifiers in C++. Write reason for each  
a) Id#          b) void          c) 2ab          d) avg hgt
16. Name any two types of identifiers.

## CHAPTER 5

### Data Types and Operators

**Data types:** Used to identify nature and type of data stored in a variable.

**Fundamental data types:**

Data type	Type of value	Memory (bytes)	Eg:
<b>void</b>	null or empty data	0	
<b>char</b>	character values	1	'A', '\n'
<b>int</b>	integer values	4	84, -4
<b>float</b>	real values	4	5.6, -89.5
<b>double</b>	Real values(more precision than float)	8	

} Integral datatypes

} Floating point datatypes

} Numerical datatypes

Float data has a precision of 7 digits and double data has a precision of 15 digits

**Variables:** Names given to memory locations.

Eg: int Num=18;

1001	i. <i>Variable name</i> : The name of the variable. ( <b>Num</b> )
18	ii. <i>Memory address(L-value)</i> :The memory address.( <b>1001</b> )
Num	iii. <i>Content(R-value)</i> :The value stored in the variable.( <b>18</b> )

**Operators:** Symbols that indicate an operation. Eg: +, <, \*, &&

*In the expression a+b, + is the **operator** and a and b are the **operands**.*

#### Classification of operators

##### (1) Based on number of operands:

Category	No. of	Example
Unary	1	Unary +, unary -, ++,--
Binary	2	+, &&, <
Ternary	3	?:

##### 2. Based on nature of operation

(a) Arithmetic operators : Used for arithmetic operations such as addition(+), subtraction(-), multiplication(\*), division(/) and modulus (%).

x	y	x+y	x-y	x*y	x/y	x%y
7	3	10	4	21	2	1(remainder)

(b) Relational operators:

Used for comparing numeric data, resulting in either **true** (1) or **false** (0). The relational operators are <(less than), >(greater than), <=(less than or equal to), >=(greater than or equal to), ==(equal to), !=(not equal to).

x	y	x<y	x>y	x<=y	x>=y	x==y	x!=y
7	3	0	1	0	1	0	1

**(c) Logical operators:**

Used to combine logical values, resulting in true or false. The logical operators are &&(AND), || (OR) and !(NOT)

E1	E2	E1&&E2	E1
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	1

E	!(E)
0	1
1	0

Eg: (2>5) && (4<6) results in 0  
 (2>5) || (4<6) results in 1  
 !(2>5) results in 1

**Input / Output operators:**

- The **get from (extraction)** operator (>>) is used for input. Eg: cin>>a;
- The **put to (insertion)** operator (<<) is used for output. Eg: cout<<a;

**Assignment operator (=)**

- Used to store a value in a variable. Eg: a=5;

**Difference between = and == operators.**

=	==
Assignment operator	Relational operator
Assigns value to a	Compares values

**Expressions:** Combination of operators and operands.

- (a) Arithmetic expressions: contains arithmetic operators. Eg: m + n \* y
  - (i) Integer expressions:** contains integer operands.
  - (ii) Floating point(Real) expressions:** contains real operands.
  - (iii) Constant expressions:** contains constant values. (eg: 5+7/3)
- (b) Relational expressions: contains relational operators. Eg: x > y
- (c) Logical expressions: contains logical operators. Eg: a<b && c>d

**Statements:** Smallest executable unit of a program. *C++ statement ends with semicolon (;)*

- 1. Declaration statement:** Specifies the type of data that will be stored in a variable.  
 Syntax: datatype var\_name;  
 eg: float avg;
- 2. Assignment statements:** It stores a value to a variable. Eg: a=15;
- 3. Input statements:** Specifies an input operation. Eg: cin>>score;
- 4. Output statement:** Specifies output operation. Eg: cout<<score;

The multiple use of input/output operators in a single statement is called **cascading of I/O operators.**



```
Eg: cin>>x>>y>>z;
     cout<<"Sum="<<S;
```

### Sample Questions

1. The \_\_\_ data\_type is used for null or empty set of values.
2. Which among the following is the insertion operator?  
( << , >> , < , > )
3. The fundamental data\_type that uses 8 bytes of memory is \_\_\_.
4. Predict the output of the following expressions if m=7 and n=2  
(i) m/y      (ii) m%y      (iii) (m==n)      (iv) (m>10)&&(n<5)
5. Distinguish between == and = operators.
6. What is the importance of data\_type ? Name two integral data\_types in C++.
7. Find the R value and memory size of the variable total from the following c++ statement  
float total = 34.6;
8. How is a binary operator different from a unary operator? Give one example each.
9. Write a C++ statement to declare a variable to store the mark of a student.
10. What are statements in C++? Explain any three types of statements with an example each.
11. The following are some fundamental data types in C++. Arrange them in any order of size (memory usage).  
int , void , double , char
12. Which are the numerical data types in C++?
13. Explain Logical operators in C++

## CHAPTER 6

### Introduction to Programming

#### Basic structure of a C++ Program

```
#include <headerfile>      ----> line 1
using namespace identifier; ----> line 2
int main()                 ----> line 3
{
    statements;
    return 0;
}
```

#### Line 1: Preprocessor directive :

Instructs the compiler to perform an action before actual compilation. Starts with the symbol #.

eg: #include<iostream> --instruction to link the header file iostream.

#### Line 2: namespace statement:

Tells the compiler to use namespace **std** in this program. std is the standard namespace in which a lot of objects, including cin and cout are defined.

#### Line 3: Function header:

main() is the essential function for every C++ program. A C++ program starts and ends within the main() function.

#### A sample program

```
#include<iostream>
using namespace std;
int main()
{
    cout<<"Hello, Welcome to C++";
    return 0;
}
```

#### Guidelines for coding

- Use suitable naming convention for identifiers
- Use clear and simple expressions
- Use comments wherever needed
- Relevance of indentation

#### Comments

Comments in C++ are used to describe the program.

There are two ways to write comments in C++:

- *Single line comment*: The characters // (two slashes) is used to write single line comments.
- *Multiline comments*: Anything written within /\* and \*/ is treated as comment

#### Variable Initialisation:

(a) Supplying the initial value to a variable at the time of declaration.

eg: int n =5 ; or int n(5);

(b) Supplying the initial value to a variable during execution (dynamic initialisation).

eg: float sum=a+b;

#### Arithmetic assignment operators (C++ short hands)

The operators which combine arithmetic and assignment operators. They are +=, -=, \*=, /=, %=

eg:  $a=a+5$  can be given as  $a+=5$        $a=a/10$  can be given as  $a/=10$

### Increment (++) and Decrement (--) operators

++ is used to **increment** the value in a variable by 1.

-- is used to **decrement** the value in a variable by 1.

**a++** (post increment form) and **++a** (pre increment form) are same as  $a=a+1$  or  $a+=1$

**a--** (post decrement form) and **--a** (pre decrement form) are same as  $a=a-1$  or  $a-=1$

(A post-form denotes use, then change method and a pre-form denotes change, then use method)

<pre>int m=5; n=m++; (Now n -&gt; 5 and m -&gt; 6)</pre>	<pre>int m=5; n=--m; (Now n -&gt; 4 and m -&gt; 4)</pre>
--	--

### Type modifiers

- Used to change the range and size of data\_type
- Type modifiers in C++ are **long, short, signed and unsigned**

### Type conversion

- Conversion of the data\_type of an operand to another.

#### Two types of conversion:

**1. Implicit (Type promotion):** This is done by the compiler and the conversion is from lower data\_type to higher.

Eg:  $5/2.0 \Rightarrow 2.5$  (Here, int datatype of 5 is converted to float by compiler. Thus the result of the float expression is also float)

**2. Explicit (Type casting):** This is done by the programmer explicitly and conversion can be to any data\_type.

Eg:  $5/(int)2.0 \Rightarrow 2$  (Here, programmer uses type casting (int) to convert the float data\_type of 2.0 to int. Thus the result of this integer expression is also an integer.)

### Sample Questions

1. .... is the essential function for every C++ program.
2. Pick out the symbol which indicates a preprocessor directive.  
( " , \$ , #, { )
3. Give the output for the following C++ code segment  

```
int a=10, b=20;
a=b++;
cout<<a<<'\n'<<b;
```
4. Give the equivalent statement using arithmetic assignment operator for the following.  
(a)  $a=a*35$ ;      (b)  $sum=sum+num$ ;
5. What is variable initialisation? Give examples
6. Write four statements to increment the value of x by 1.
7. Write the output of given C++ statements giving explanations  
1.  $cout \ll 5/2$ ;  
2.  $cout \ll 5.0/2$ ;
8. Write C++ statements/expression for the following.  
a) Display the message "We shall overcome"  
b) Initialise an integer variable num with 25.
9. Explain type conversion in C++, listing out the different types with examples.
10. Write a C++ program to display the message, "Stay home, stay safe".

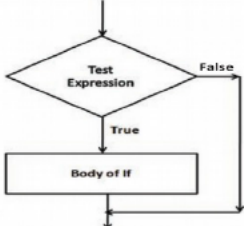
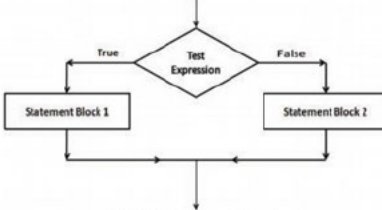
## CHAPTER 7 Control Statements

### Control Statements

The statements used to change the normal sequential flow of program execution.

Two types: (1) Decision (2) Iteration

**1. Decision (Selection) Statements** : Statements are selected for execution based on a condition.

Statement	Syntax	Example
if statement	<pre>if ( test expression ) {     statement block; }</pre> 	<pre>if (mark &gt;= 18)     cout &lt;&lt; "Passed" ;</pre>
if ..... else statement	<pre>if ( test expression ) {     statement block 1; } else {     statement block 2; }</pre> 	<pre>if (mark &gt;= 18)     cout &lt;&lt; "Passed" ; else     cout &lt;&lt; "Failed " ;</pre>
if .... else ... if ladder	<pre>if ( test expression ) {     statement block 1; } else if ( test expression 2 ) {     statement block 2 ; } else if (test expression 3 ) {     statement block 3 ; } ..... else {     statement block n; }</pre>	<pre>if (mark &gt;= 80)     cout &lt;&lt; "A Grade"; else if (mark &gt;= 60)     cout &lt;&lt; "B Grade " ; else if (mark &gt;= 40)     cout &lt;&lt; "C Grade"; else     cout &lt;&lt; "D Grade";</pre>
switch statement	<pre>switch(variable / expression) {     case constant_1 : statement 1;                     break;     case constant_2 : statement 2;</pre>	<pre>switch(n) {     case 1 : cout &lt;&lt; "One";             break;     case 0 : cout &lt;&lt; "Zero"</pre>

	<pre>break; case constant_3 : statement 3; break; ..... default : statement n; }</pre>	<pre>break; default : cout&lt;&lt;"Invalid"; }</pre>
--	--	--

### Comparison between switch and if else if ladder

switch	if else if ladder
Permits multiple branching.	Permits multiple branching.
Can be used only for checking equality	Any relational or logical condition can be checked
Case constant is integer or character	Can compare against a set of values including floating numbers
Uses <b>default</b> when no match is found, and <b>break</b> is used to exit.	When no condition is true, else block executes.

All switch statements can be converted to else if ladder. But not all if-else if can be converted to switch.

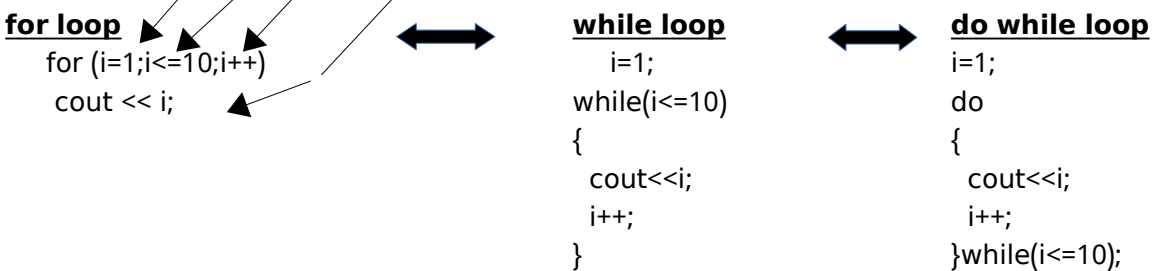
### 2. Iteration (Looping) statements

Statements that allow repeated execution of a set of one or more statements.

**There are 3 loops in C++** : while, for, do-while

A loop has the following components:

- Loop components:**
- (1) initialisation: statement that gives starting value to loop variable (**i=1**)
  - (2) condition - the test expression. (**i<=10**)
  - (3) updation - statement that changes the value in loop variable (**i++**)
  - (4) body of loop- set of statements to execute repeatedly (**cout<<i;**)



Here, *i* is the loop variable (its value controls the loop).

[All the three loops given above produce the same output - displays numbers from 1 to 10]

Statement	Syntax	Example
for loop	<pre>for (initialisation ; test expression ; update expression) { Body of the loop; }</pre>	<pre>for (i=1;i&lt;=10;++) cout&lt;&lt;i;</pre>

while loop	<pre> Initialisation; while (test expression) {     Body of the loop;     Update expression ; } </pre>	<pre> i=1 ; while (i&lt;=10) {     cout&lt;&lt;i;     ++i; } </pre>
do....while loop	<pre> Initialisation; do {     Body of the loop;     Update expression ; }while(test expression); </pre>	<pre> i=1 ; do {     cout&lt;&lt;i;     ++i; }while(i&lt;=10); </pre>

### Entry controlled loop

1. condition before loop body
2. loop will run only if condition is true  
eg: for, while

### Exit controlled loop

1. condition after loop body
2. loop will run at least once even if condition is true/false  
eg: do while

### Sample Questions

1. The ..... block is executed in a switch, if no matching conditions are found.  
(case, break, default, else)
2. Pick the odd one out  
( while , do ... while , for )
3. Control Statements can be classified in to two. Explain each with example.
4. Write any two selection statements in C++ ?
5. Explain loop elements with a suitable example
6. How is entry controlled loops different from exit controlled loops ?
7. Compare switch and if else if ladder
8. "There are situations where if ..else if ladder cannot be rewritten using switch statement.

What

are the situations?

9. Do as instructed :

- (a) Rewrite using switch

```

if(ch==1) cout<<"Red";
else if (ch==2) cout<<"Blue";
else if (ch==3) cout<<"Green";
else cout<<"Wrong code";

```

- (b) Rewrite using do while and identify the loop components.

```

for (a=5; a<=20; a++)
{
    cout<<a*a ;
}

```

## CHAPTER 8

### Computer Networks

- Its a group of computers and other devices connected to each other electronically through a communication medium

#### Need for Network

##### Resource sharing

- Any hardware /software resource in one system can be shared with other systems in the network.

##### Price performance ratio

- The cost of purchasing licensed software for each computer, can be reduced by purchasing network versions of such software in a network.

##### Communication

- The computer network helps users to communicate with any other computer in the network through its services like e-mail, chatting, video conferencing, etc.

##### Reliability

- In a network, it is possible to backup data on multiple computers. This helps users to retrieve data in the case of failures in accessing data.

##### Scalability

- Computing capacity can be increased or decreased easily by adding or removing computers to the network.

#### Some key terms

**Bandwidth:** It measures the amount of data that can be sent over a specific connection in a given amount of time.

**Noise:** It is unwanted electric or electromagnetic energy that lowers the quantity of data signals.

**Node:** Any device which is directly connected to a network is called a Node.

#### Data Communication System

- Data Communication is the exchange of digital data between any two devices through a medium of transmission.
- 5 basic elements:

**Message:** It is the information to be communicated.

**Sender:** The computer or devices that is used to sending messages.

**Receiver:** The computer or device that receives the messages.

**Medium:** It is the physical path through which a message travels from the sender to the receiver.

**Protocol:** The rules under which message transmission takes place between the sender and the receiver.

#### Communication Medium

- The medium for data transmission over a computer network is called communication channel or communication medium.
- Two types: (1) Guided (2) Unguided

#### Guided Medium

- Coaxial cable, twisted pair cable (Ethernet cable) and optical fibre cable  
**(a) Twisted pair cable (Ethernet cable)**

- Most widely used
- Two types: (1) Unshielded Twisted pair (UTP), (2) Shielded Twisted Pair (STP)

***Characteristics of UTP cable***

- Low cost
- Thin and flexible
- Easy installation
- Carry data upto a length of 100m

***Characteristics of STP cable***

- Better immunity against noise
- Expensive
- Difficult to install
- RJ-45 connector is used to connect UTP/STP twisted pair cable to a computer.

**(b) Coaxial cable**

- Carries data to long distance 185-500m
- High band width
- Less noise
- Thicker than twisted pair
- Less flexible
- Difficult to install

**(c) Optical fibre cable**

- Data travels as fast as light
- High bandwidth
- Carries data for a long distance
- It uses light for data transmission
- Most expensive and efficient
- Installation and maintenance are difficult

**Unguided Medium**

- Electro magnetic waves are used for wireless communication

**(a) Radio Waves**

- Frequency range is 3KHz to 3 GHz
- Used for short and long distance communication
- Waves are transmitted in all directions
- Inexpensive than wired media
- Can penetrate through most objects
- Transmission can be affected by motors and other electric equipments
- Less secure
- Permission required for radio wave transmission

**(b) Microwaves**

- Frequency range is 300MHz to 300GHz
- Travels in straight line
- Can not penetrate any solid object
- Inexpensive than wired media

**(c) Infrared Waves**

- Frequency range is 300GHz to 400THz
- Used for short range communication
- Line of sight transmission



- Only two devices can communicate at a time
- Can not cross solid objects
- The longer the distance the weaker the performance

### **Wireless Communication technologies using radio waves**

#### **(a) Bluetooth**

- Frequency range is 2.402GHz to 2.480GHz
- Used for short distance communication
- Used in cell phones, laptops, mouse, keyboard etc.
- It cannot connect upto 8 devices simultaneously
- Slow data transfer rate

#### **(b) Wi-Fi**

- Frequency range is 2.4GHz to 5GHz
- Data transmission speed upto 54Mbps
- It can be used to connect more number of devices simultaneously
- Used for communication upto 375ft

#### **(c) Wi-MAX**

- Worldwide Interoperability for Microwave Access
- Frequency range is 2GHz to 11GHz
- Used to provide high speed wireless internet access over very long distances
- Hundreds of users can connect to a single station
- High speed connection upto 70Mbps
- Weather conditions may interrupt the signal
- High power consumption

#### **(d) Satellite link**

- Uses Geostationary satellites
- These satellites contains an electronic device called transponder
- Transponders are used to amplify and re-broadcast signals to earth
- Transmission of signals from earth to a satellite is called uplink
- Transmission of signals from satellite to earth is called Downlink
- Uplink frequency is 106GHz to 30.0GHz
- Downlink frequency is 1.5GHz to 20.0GHz
- It can cover a large area of the earth
- Expensive
- Requires legal permission and authorisation

### **Data Communication Devices**

- Its an interface between computer and the communication channels

#### **Network Interface Card(NIC)**

- It breaks up data into manageable units
- Translate the protocol
- Some NIC cards have wireless connection
- Data transfer rate is 1Gbps

#### **Hub**

- Used to connect devices of same network
- It transmit the packet to all other computers connected to it
- It increases the network traffic and reduces the effective band width

#### **Switch**

- A switch is a device that connects several computers to form a network.
- It is an intelligent device, because it can transmit the received data to the destination only.
- It will store the addresses of all the devices connected to it .

#### **Repeater**

- Used to regenerate the signals through a communication medium

#### **Bridge**

- A bridge is a device used to segmentize a network.
- A network can be split into different segments and can be interconnected using a bridge.
- This reduces the amount of traffic on a network.

#### **Router**

- A router is a device that can interconnect two networks of the same type using the same protocol.
- It can find the optimal path for data packets to travel and reduce the amount of traffic on a network.

#### **Gateway**

- A gateway is a device that can interconnect two different networks having different protocols.
- It can translate one protocol to another.
- It can find the optimal path for packets to reach the destination.

### **Data Terminal equipments**

- Data terminal equipment is a device that controls data flowing to or from a computer.

#### **Modem**

- A modem is a device used for communication between computers through telephone lines.
- The name is formed from **modulator and demodulator**.
- It converts digital signals received from a computer to analog signals for telephone lines and vice versa.

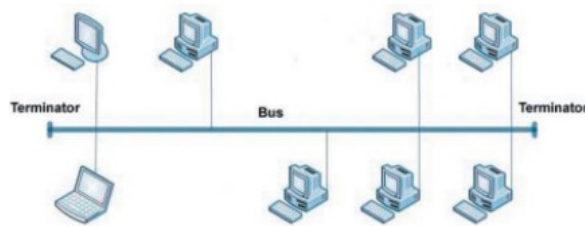
#### **Multiplexer/Demultiplexer**

- Multiplexing divides the physical medium into logical segments called frequency channels
- Multiplexer combines the inputs from different sources and sends them through different channels of a medium
- A demultiplexer separates the signal and send them to destination

### **Network Topologies**

- The way in which the nodes are physically interconnected to form a network.
- Major topologies are bus, star, ring and mesh

#### **Bus Topology**

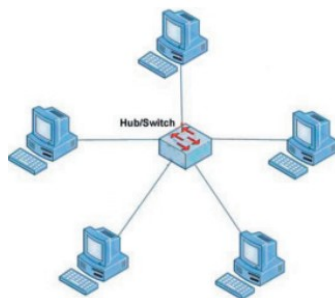


- In bus topology, all the nodes are connected to a main cable called bus.
- A small device called a terminator is attached to each end of the bus.
- If a node has to send data to another node, it sends data to the bus. The signal travels through the bus and each node checks the bus and only the intended node will accept the data. When the signal reaches the end of the bus, the terminator absorbs the signal from the bus.

➤ **Characteristics of bus topology**

- 1) Easy to install.
- 2) Requires less cable length and hence it is cost-effective.
- 3) Failure of a node does not affect the network.
- 4) Failure of cable (bus) or terminator leads to a breakdown of the entire network.
- 5) Fault diagnosis is difficult.
- 6) Only one node can transmit data at a time.

**Star Topology**

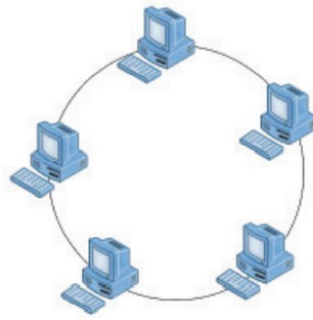


- In star topology, each node is directly connected to a hub/switch.
- If any node has to send some information to any other node, it sends the signal to the hub/switch.
- The signal is then broadcasted (in the case of a hub) to all the nodes but is accepted only by the intended node.
- In the case of a switch, the signal is sent only to the intended node..

**Characteristics of star topology**

- 1) More efficient compared to bus topology.
- 2) Easy to install.
- 3) Easy to diagnose faults.
- 4) Easy to expand depending on the specifications of the central hub/switch.
- 5) Failure of hub/switch leads to failure of the entire network.
- 6) Requires more cable length compared to bus topology.

**Ring Topology**

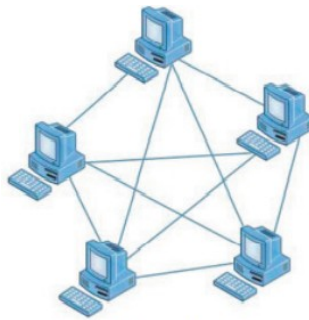


- In ring topology, all nodes are connected using a cable that loops the ring or circle.
- A ring topology is in the form of a circle.
- Data travels only in one direction in a ring.
- Each node regenerates the signal and passes to the next node until it reaches the intended node reaches.

**Characteristics of ring topology**

- 1) No signal amplification is required as each node amplifies the signal.
- 2) Requires less cable length and hence is cost-effective.
- 3) If one node fails, the entire network will fail.
- 4) Addition of nodes to the network is difficult.

**Mesh Topology**



- In mesh topology, every node is connected to other nodes.
- There will be more than one path between two nodes.
- If one path fails, the data will take another path and reach the destination.

**Characteristics of mesh topology**

- 1) Network will not fail even if one path between the nodes fails.
- 2) Expensive because of the extra cables needed.
- 3) Very complex and difficult to manage.

**Types of network**

- On the basis of the area covered, computer networks are classified as:

- PAN - Personal Area Network
- LAN - Local Area Network
- MAN - Metropolitan Area Network
- WAN -Wide Area Network

**Personal Area Network (PAN)**

- PAN is a network of communicating devices (computer, mobile, tablet, printer, etc.) in the proximity of an individual.
- It can cover an area of a radius of few meters.

**LAN (Local Area Network)**

- LAN is a network of computing and communicating devices in a room building or campus.
- It can cover an area of few meters to few kilometers.

**MAN (Metropolitan Area Network)**

- MAN is a network of computing and communication devices within a city.
- It can cover an area of a few kilometers to a few hundred kilometers radius.
- MAN is usually formed by interconnecting a number of LANs and individual computers.

**WAN (Wide Area Network)**

- WAN is a network of computing and communicating devices crossing the limits of a city, country, or continent.
- It can cover an area of hundreds of Kilometers in radius.

**Summary of PAN, LAN, MAN, WAN**

Parameter	PAN	LAN	MAN	WAN
<b>Area covered</b>	Small area (Up to 10 m radius)	A few meters to few Km (Up to 10 Km radius)	A city and its vicinity (Up to 100 Km radius)	Entire country, continent, or globe
<b>Transmission speed</b>	High speed	High speed	Moderate speed	Low speed
<b>Networking cost</b>	Negligible	Inexpensive	Moderately expensive	Expensive

**Logical classification of networks**

- Based on the role of the computer in the network
- Two categories: peer to peer and client server

**Peer to peer**

- No dedicated servers
- Any computer can act as a client or as a server at any instance
- Ideal for small networks

**Client-Server**

- The client server architecture consists of high end computer called server.
- Classification of servers are:

File server: A computer that holds and manage files on a network

Web server: A computer dedicated to responding to requests for webpages

Print server: Redirect the print job from the clients to specific printers

Database server: Allow clients to modify, view or delete data in a common database

**Network protocols**

- Its a set of rules to be followed in a network when devices in the network exchange data each other

**TCP/IP**

- Transmission Control Protocol/Internet Protocol
- Used to interconnect network devices on the local networks and then internet
- The data is first broken in to smaller packets by TCP then send
- Internet Protocol(IP) is responsible for the delivery of each of these packets to the right destination

- HTTP, FTP and DNS are the three sub protocols of TCP/IP protocol

### HTTP

- Hypertext Text Transfer protocol
- It is a standard protocol for transferring request from client side and to receive responses from server side
- The pair of HTTP request and response is called HTTP session
- HTTP is transmission medium independent
- Its a stateless protocol

### FTP

- File Transfer Protocol
- It is the easiest way to transfer files between computers over the internet
- A FTP client program can be used to upload and download files(FileZilla, CuteFTP etc.)

### DNS

- Domain Name System
- Returns the IP address of the domain name that we type in the browser's address bar
- DNS maintain a database to store domain names and IP address information of all websites on the internet

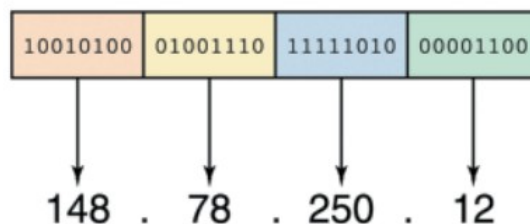
## Identification of computers over a network

### Media Access Control (MAC) addresses

- A universally unique address (12 digit hexadecimal number) assigned to each NIC (Network Interface Card) by its manufacturer.
- MAC addresses are usually written in one of the following two formats:
- MM : MM : MM : SS : SS : SS or MM - MM - MM - SS - SS - SS
- The first half (MM:MM:MM) of a MAC address contains the ID number of the adapter manufacturer.
- The second half (SS:SS:SS) of a MAC address represents the serial number assigned to the adapter (NIC) by its manufacturer.
- eg. 00:A0:C9 : 14:C8:35

### Internet Protocol (IP) Address

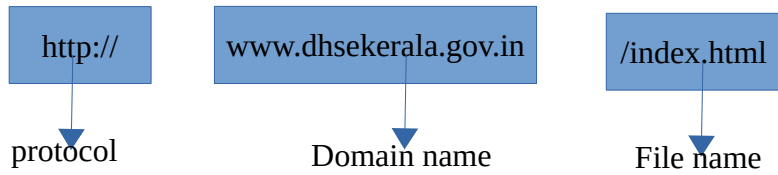
- An IP address is a unique 4 part numeric address assigned to each node on a network, for their unique identification.
- An IP address is a group of four bytes (or 32 bits) each of which can be a number from 0 to 255.



### Uniform Resource Locator(URL)

- Its a formatted string used to identify a network resource on the internet

- URL consists of letters, numbers and punctuations
- Three parts :
  - (1) Network Protocol
  - (2) Domain name
  - (3) Filename



**Protocol**

- Indicate the protocol is used to access the information specified in the domain

**Domain Name**

- It is the name assigned to a server through domain name system

**File Name**

- It is the file to be opened

<b>Generic Domain Names</b>		<b>Country Specific Domain Names</b>	
.com	Commercial Business	.in	India
.edu	Educational Institutions	.au	Australia
.gov	Government agencies	.ca	Canada
.mil	Military	.ch	China
.net	Network organisations	.jp	Japan
.org	Nonprofit organisations	.us	USA

# CHAPTER 9

## Internet

### History of internet

- Internet is developed by United States Department of Defence by the name ARPANET (Advanced Research Project Agency Network)
- ARPANET uses TCP/IP protocol for communication
- ARPANET considered as first wide area connection
- Vincent Gray Cerf is considered as the father of internet
- Tim Berners Lee proposed the idea of World Wide Web(WWW)
- He and his team are credited with inventing HTTP and HTML
- **Internet** is an interconnected system of computer networks that serves the users all over the world
- **Intranet** is a private computer network similar to internet
- When an intranet is made accessible to some computers that are not part of a company's private network it is called an **extranet**

### Connecting the computer to the internet

- The following hardware and software requirements are required to connect a computer to the internet
  1. A computer with network interface card
  2. Modem
  3. Telephone connection
  4. An internet account given by an Internet service provider(ISP)
  5. Software like Browser

### Types of connectivity

#### Dial-up Connectivity

- Uses conventional telephone line and a dial up modem to dial and connect to the server at the Internet Service Provider
- These type of connection uses a 56kbps modem
- Maximum speed is 56kbps
- Less costly
- Requires exclusive use of telephone connection

#### Wired broadband Connectivity

- 'always on' connections
- do not need to dial and connected
- Uses a broadband modem and allow us to use the telephone even while using the internet

Dial-up connection	Wired broadband connection
Slow connection, speed upto 56kbps	High speed connection , speed higher than 256kbps
Requires dialling to connect to ISP	Always on connection
Exclusive use of telephone connection	Simultaneous use of voice and internet
Uses dial-up modem	Uses broadband modem



- Popular broadband technologies are Integrated Service Digital Network(ISDN), Cable Internet, Digital Subscriber Line(DSL), Leased Lines and Fiber to the Home(FTTH)
  - 1. Integrated Services Digital Network(ISDN)**
    - Capable of transporting voice and database
    - Uses two lines, one for voice and other for data
    - Data transfer rates upto 2Mbps
  - 2. Cable Internet**
    - Uses coaxial cables laid for television signal transmission to our home
    - Uses a cable modem
    - It can provide speed between 1Mbps to 10Mbps
  - 3. Digital Subscriber Line (DSL)**
    - Uses standard telephone lines
    - Use the copper telephone lines for both internet communication and for making the voice calls simultaneously
    - ADSL(Asymmetric Digital Subscriber Line) is the common subcategory
    - Speed ranges from 256Kbps to 24Mbps
    - Most popular broadband service available in india
  - 4. Leased line**
    - It is the dedicated lines used to provide internet facility
    - Speed ranges from 2Mbps to 100Mbps
  - 5. Fibre To The Home (FTTH)**
    - Uses optical fibers for data transmission
    - High speed connectivity

#### **Wireless broadband connectivity**

- Popular wireless broadband accesses are Mobile Broadband, Wi-Max, Satellite Broadband and Wi-Fi
  - 1. Mobile Broadband**
    - Its a wireless internet access using mobile phone
    - The modem is built into the devices like mobile phones, tablet etc.
    - Offer the freedom to allow the user to access the internet from anywhere on the move
    - It uses the cellular network of the mobile phones for data transmission
  - 2. Wi-Max**
    - Worldwide Interoperability for Microwave Access
    - Its an alternative for wired broadband
    - It can provide wireless internet access upto a distance of 50KM
    - It can provides speed upto 70Mbps
  - 3. Satellite broadband**
    - Internet connectivity is provided through satellite
    - A very small aperture Terminal (VSAT) dish antenna and a transceiver (Transmitter and Receiver) are required at the users location
    - Speed upto 1Gbps
    - Most expensive forms of broadband internet
    - Used by banks, stock exchanges, governments etc.

#### **Internet Access sharing methods**

##### **1. Using LAN**

- The internet connection in a computer can be shared among other computers in the LAN

- It can be done using the features of the Operating system or using proxy server software

## **2. Using Wi-Fi network**

- The internet connectivity can be shared using Wi-Fi router or wireless network access point, popularly called hotspot
- It has a range of about 100 meters
- Less secure than wired connection

## **3. Using Li-Fi network**

- Fast optical version of wifi
- Data rate is 100Mbps
- It can be used in aircrafts and hospitals

## **Services on Internet**

- The internet offers a variety of services like WWW, e-mail, search engines, social media.

### **1) World Wide Web (WWW)**

- WWW is a huge client-server system consisting of millions of clients and servers connected together.

#### **a) Browser :**

- A web browser is a software that we use to retrieve or present information and to navigate through web pages in the World Wide Web.
- Some common browsers are Google Chrome, Internet Explorer, Mozilla Firefox, Opera, and Safari.

#### **b) Web browsing:**

- Traversing through the web pages of World Wide Web is called web browsing.

### **2) Search engines**

- Internet search engine websites are special programs that are designed to help people to find the information available in World Wide Web.
- Search engine programs search documents available on the World Wide Web for specified keywords.
- It returns a list of the documents/web pages matching the keywords.
- Some of the most popular web search engine sites are Google, Bing, Yahoo Search, Ask, etc.

### **3) E-Mail**

- Electronic mail or e-mail is a method of exchanging digital messages between computers over Internet.

#### **Sections of an e-mail**

To (Recipient Address), Cc (Carbon copy), Bcc (Blind carbon copy), Subject, Content

#### **Advantages of using e-mail**

Speed, Easy to use, Provision of attachments, Environment friendly, Reply to an e-mail, Cost-effective, Available anywhere anytime

#### **Disadvantages of using e-mail**

E-mails may carry viruses, Junk mails

### **4) Social media**

- Social media refers to the use of mobile and web-based technologies through which individuals and communities can create, share, discuss and modify content.

#### **Classification of social media.**

##### **a) Internet forums**

- It is an online discussion website where people can engage in conversations in the form of posted messages.

- e.g. Ubuntu Forum.

#### **b) Social blogs**

- It is a discussion or informational website consisting of entries or posts displayed. e.g. Blogger and WordPress

#### **c) Microblogs**

- Microblogs allow users to exchange short sentences, individual images or video links. e.g. Twitter.com

#### **d) Wikis**

- Wikis allow people to add content or edit existing information in a web page, to form a community document. e.g. wikipedia.org

#### **e) Social networks**

- Social networking sites allow people to build personal web pages and then connect with friends to communicate and share content. e.g. facebook.com and LinkedIn.

#### **f) Content communities**

- Content communities are websites that organise and share contents like photos, videos, etc. e.g. YouTube

### **Advantages of social media**

- Bring people together, Plan and organise events, Business promotion, Social skills

### **Limitations in use of social media**

- Intrusion to privacy, Addiction, Spread rumours

### **Cyber Security**

- It is used to provide protection of valuable information such as credit card information from unauthorized access.

#### **1) Computer Virus**

- A virus is a bad program to damage routine working of a computer system.
- A computer virus is a program that attaches itself to another program or file enabling it to spread from one computer to another without our knowledge and interferes with the normal operation of a computer.

#### **2) Worm**

- It is a stand alone malware program that replicates itself in order to spread to other computers.
- Worms spread from computer to computer on its own.

#### **3) Trojan Horse**

- It appears as a useful software but it is harmful software's and it will delete useful softwares or files.

#### **4) Spams**

- Sending an email without recipients consent to promote a product or service is called spamming. Such an email is called spam

#### **5) Hacking**

- It is a process of trespassing computer networks.
- In computer networking, hacking is a technical effort to manipulate the normal behavior of network connections and connected systems.
- Hacking performed by computer security experts are called ethical hacking and such hackers are called white hats
- Computer criminals break into secure networks to destroy data or make the network unusable. Such hackers are called black hats
- Grey hat hackers fall between white and black hackers

#### **6) Phishing**

- It is an attempt to get other information such as username, password, bank a/c details etc by posing as the original website, mostly that of banks and other financial institutions.
- Phishing websites have URLs and home pages similar to their original ones.
- The act of creating such a misleading website is called **spoofing**.

#### **7) Denial of Service attack**

- Due to this attack the computer forced to restart and this result refusal of service to the genuine users.

#### **8) Man in the Middle attacks**

- It is an attack in which the an attacker secretly intercepts electronic messages send by the sender to the receiver and then modifies the messages and retransmit it to the receiver.

### **Preventing network attacks**

#### **1) Firewall**

- A firewall is a system of computer hardware and software that provides security to the computer network in an organisation.
- A firewall controls the incoming and outgoing network traffic by analysing the data

#### **2) Antivirus scanner**

- It is a tool used to scan computer files for viruses, worms and Trojan horses and cure the infected system.
- When an antivirus program scans a file and notices that the file matches a known piece of malware, the antivirus program stops the file from running, and puts it into 'quarantine'.
- Quarantine is a special area for storing files probably infected with viruses.

#### **3) Cookies**

- Cookies are small text files that are created when we visit a website that keep track of our details.
- Cookies remembers our user name, preferences, e-mail address, etc.

### **Guidelines for using computers over Internet**

- Do not open any e-mail attachment that you are not sure about the sender.
- Download files only from reputed sources.
- Do not use/copy software that you cannot confirm the origin.
- Avoid clicking on pop-up advertisements.
- Make sure the firewall is set and turned on.
- Use strong passwords. Change passwords at regular intervals.
- Update the virus definitions of your antivirus program periodically online.
- Keep a regular backup of your important files.
- Be careful about giving personal data online.

# CHAPTER 10

## IT Applications

### e-Governance

- Government uses Internet and communication technology for delivering their services for the people.

### Types of interactions in e-Governance

#### 1) Government to Government (G2G)

- It is the sharing of data or information between government department or organizations.

#### 2) Government to Citizens (G2C)

- It creates an interface between the government and citizens. Here the citizens enjoy a large range of public services.

#### 3) Government to Business (G2B)

- The business people can interact with the government by using ICT tools.

#### 4) Government to Employee (G2E)

- Government uses information and communication tools for the interaction with their employees.

### e-Governance Infrastructure

#### 1. State Data Center (SDC)

- Responsible for delivering online services for the citizens, keeping the central database of the state, securing data storage.

#### 2. Kerala State Wide Area Network (KSWAN)

- It acts as a backbone of the e-Governance infrastructure
- It connects Thiruvananthapuram, Kochi, and Kozhikode as its hubs and extends to all the 14 districts linking each of the 152 Block Panchayaths.

#### 3. Common Service Centers (CSC)

- It is the front end delivery point of the e-Governance services for the rural areas.
- It helps in utility payments such as electricity, telephone and water bills, submission of on line applications etc.
- Eg: Akshaya Centres

### e-Business

- It is the sharing of business information, maintaining business relationships and conducting business transactions with the help of information technology.

#### 1. e-Commerce and e-Business

- e-Commerce covers business transaction that involves exchange of money
- e-Business includes all aspects of running a business such as marketing, obtaining raw materials or goods, customer education, looking for suppliers, etc.

#### 2. Electronic Payment System (EPS)

- A system of financial exchange between buyers and sellers in an online environment is called EPS.
- The financial exchange is done by credit/debit card, electronic cheque or digital cash.

#### 3. e-Banking

- it is the automated delivery of banking services directly to customers through electronic channels.

### Advantage of e-Business

- It overcomes geographical limitation
- Reduces the operational cost
- It minimises travel time and cost
- It remains open all the time
- We can locate the product quicker from the wider range of choice

### **Challenges to e-Business**

- Lack of knowledge about e-Business and its possibilities.
- Rural population do not possess plastic money- credit card, debit card and net banking system.
- If not used with caution, customers may lose valuable information like their credit card number, passwords, etc.
- Customers don't have this 'touch and feel' advantage.
- Efficient shipment facility is needed.

### **e-Learning**

- The use of electronic media and IT in education is termed e-Learning.

### **e-Learning Tools**

#### **1. Electronics Book Reader (e-Books)**

- Portable computer devices that are loaded with digital book content via communication interfaces is called electronic books reader

#### **2. e- Text**

- Textual information available in electronic format is called e-Text

#### **3. Online Chat**

- It is a real-time exchange of text messages between two or more persons over the internet

#### **4. e-Content**

- The e-Learning materials such as videos, presentations, animations, graphics etc. are called e-Content.

#### **5. Educational TV channels**

- These television channels are dedicated for e-Learning purpose.
- These channels broadcast recorded classes on various subjects, interviews with experts, lab experiments etc.

### **Advantages of e-Learning**

- It can offer courses on a variety of subjects to large number of students from a distant location.
- Cost for learning is much less
- Students can do online courses from various nationally or internationally reputed institutions.
- Time and place is not a constraint for e-Learning.

### **Challenges to e-Learning**

- Face to face contact between students and teachers is not possible.
- Limited interaction between teachers and students
- Computers or any similar kind of devices and high speed Internet is required for e-Learning
- Students will not get any individual attention
- Hands-on practicals in real laboratory scenario is also a constraint in e-Learning.

### **ICT application in health care**

- **Medical equipments:** Most of the medical equipments such as ECG, ECHO test, TMT, CT scanner etc...work with the help of computers.

- **Electronic Medical Record (EMR):** It is a digital version of a paper chart that contains all of a patient's medical history from one practice.
- **Web based support:** Internet is used by the doctors to acquire information to diagnose and give treatments to the patients who are suffering from diseases.
- **Telemedicine:** With the help of Tele-Medicine equipment doctors and nurses can examine patients in remote location by monitoring patients condition. Telemedicine is implemented with a telephone and computer.
- **Research and development:** The role of computers in different field of research and development unavoidable.

#### **ICT enabled services:**

- **Business Process Outsourcing (BPO):** The process of hiring a third party service provider to do the operations and responsibilities of specific business functions. It may also involve transferring of employees and asset from one firm to another. It increases the efficiency in services and saves cost.  
Eg. Customer care service.
- **Knowledge Process Outsourcing (KPO):** Knowledge and information related work is carried out by different company or subsidiary within the organization. It includes data search, data integration, market research etc.
- **Call center:** A call center (also called service center, sales center, contact center etc..) is a telephone service facility set up to handle a large number of incoming and outgoing calls for supporting various responsibilities of an organization.
- **Teleconferencing:** Teleconferencing is a meeting or conference held between two or more parties in remote locations by use of IT infra structure and services.
- **Video Conferencing:** Video conferencing is a type of teleconferencing in which the video of the parties involved in the conference is also included. A video camera and microphone and communication system is needed.

#### **Sample Questions**

1. Write any two challenges for implementing e-Governance.
2. e-Learning allows us to overcome many limitations of conventional teaching-learning process.
  - a) Name any three e-Learning tools for enhancing e-Learning process.
  - b) Write any three advantages of e-Learning.
3. Compare the advantage and disadvantages of implementing e-Business.
4. Almost all services and business are available online now.
  - a) Name the system that facilitates money transaction between buyers and sellers in such cases.
  - b) Explain the infrastructure of e-Governance.
5. Briefly describe any two benefits of e-Governance.
6. Distinguish between teleconferencing and video conferencing?
7. What is the role of ICT in Health care?
8. What is mean by Knowledge Process Outsourcing (KPO)?