Computer fundamental

INTRODUCTION TO COMPUTER

1 . WHAT IS COMPUTER?

- **The word "computer" is comes from the word "TO COMPUTE" means to calculate.**
- **A computer is normally considered to be a calculation device which can perform the arithmetic operations very speedily.**
- **A computer may be defined as a device which operates upon the data.**
- **Data can be in the form of numbers, letters, symbols, size etc. And it comes in various shapes & sizes depending upon the type of computer application.**
- **A computer can store, process & retrieve data as and when we desired.**
- **The fact that computer process data is so fundamental that many people have started calling as "Data Processor".**
- **A computer first it gets the Data, does Process on it and then produces Information.**

- **DEFINITION OF COMPUTER**
  - **A computer is an electronic device which takes input from the user, processes it and gives the output as per user's requirement.**
  - **So the main tasks of performed by the computer are:**
    - **Input**
    - **Process**
    - **Output**

2 . THE CHARACTERISTICS OF COMPUTER

Some important characteristics of the computer are as follow:

- **Automatic:**
  - **Computers are automatic machines because it works by itself without human intervention.**
  - **Once it started on a job then carry on until the job is finished.**
  - **Computer cannot start themselves**

- They can works from the instructions which are stored inside the system in the form of programs which specify how a particular job is to be done.

- **Accuracy:**
  - The accuracy of a computer is very high.
  - The degree of accuracy of a particular computer depends upon its design.
    - Errors can occur by the computer. But these are due to human weakness, due to incorrect data, but not due to the technological weakness.
- **Speed:**
    - Computer is a very fact device. It can perform the amount of work in few seconds for which a human can take an entire year.
    - While talking about computer speed we do not talk in terms of seconds and milliseconds but in microseconds.
    - A powerful computer is capable of performing several billion (109) simple arithmetic operations per second.
- **Diligence:**
    - Unlike human beings, a computer is free from monotony, tiredness & lack of concentration.
    - It can continuously work for hours without creating any error & without grumbling.
    - If you give ten million calculations to performed, it will perform with exactly the same accuracy & speed as the first one.
- **Versatility:**
  - It is one of the most wonderful features about the computer.
    - One moment it is preparing the results of a particular examination, the next moment it is busy with preparing electricity bills and in between it may be helping an office secretary to trace an important letter in seconds.
- **Power of remembering:**
    - Computer can store and recall any amount of data because of its high storage capacity of its storage devices.
    - Every piece of information can be retained as long as desired by the user and can be recalled as and when required.
    - Even after several years, if the information recalled, it will be as accurate as on the day when it was filled to the computers.
- **No I.Q.**
  - A computer is not a magical device; it processes no intelligence of its own.
  - Its I.Q. is zero.

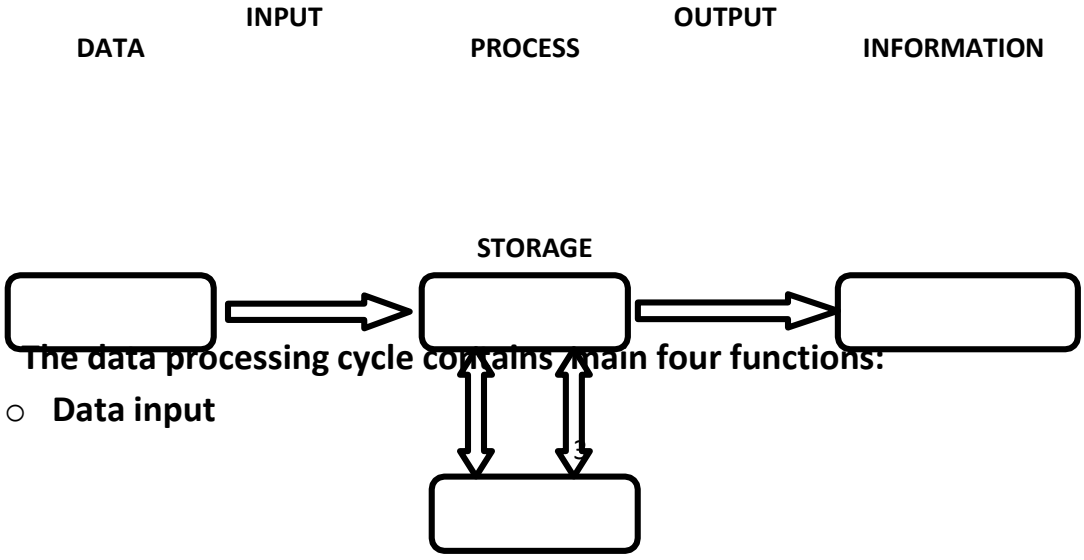
- It has to be told what to do & in what sequence.
- It cannot take its own decision.

3. DATA PROCESSING CYCLE OF COMPUTER.

- The computer Data Processing is any process that a computer program does to enter data & summarise, analyse or convert data into useable information.
- The process may be automated & run on a computer.
- It involves recording, analysing, storing, summarising & storing data.
- Because data are most useful when it is well presented & informative.

The Data Processing Cycle:

- Data Processing cycle described all activities which are common to all data processing systems from manual to electronic systems.
- These activities can be grouped in four functional categories, viz., data input, data processing, data output and storage, constituting what is known as a data processing cycle.
- The main aim of data processing cycle is to convert the data into meaningful information.
- Data processing system are often referred to as Information System.
- The Information System typically take raw Data as Input to produce Information as Output.



- The data processing cycle contains main four functions:
  - Data input

- Data process
- Data storage
- Data output

- **DATA INPUT**
  - The term input refers to the activities required to record data.
  - It's a process to entered data in to computer system.
    - So before we input any data, it is necessary to check or verify the data context.
- **DATA PROCESSING**
    - The term processing includes the activities like classifying, storing, calculating, comparing or summarising the data.
    - The processing means to use techniques to convert the data into meaningful information.
- **DATA OUTPUT**
    - It's a communication function which transmits the information to the outside world.
  - After completed the process the data are converted into the meaningful in
    - Sometimes the output also includes the decoding activity which converts the electronically generated information into human readable form.
- **DATA STORAGE**
  - It involves the filling of data & information for future use.

4. THE CLASSIFICATION OF THE COMPUTER BY DATA PROCESSED

The computers are divided mainly three types on the based on data processed:

1. Analog computers
2. Digital computers
3. Hybrid computers

Analog computers:

- In Analog Computers, data is represented as continuously varying voltage and operate essentially by measuring rather counting.
- As the data is continuously variable, the results obtained are estimated and not exactly repeatable.
- It can able to perform multiple tasks simultaneously and also capable to work effectively with the irrational number. E.g. 1/8 = 0.125 and 1/6=0.1666

- **Voltage, temperature and pressure are measured using analog devices like voltmeters, thermometers and barometers**.

Digital Computers

- **The digit computer is a machine based on digital technology which represents information by numerical digit.**
- **In Digital Computers data is represented as discrete units of electrical pulses. The data is measured in quantities represented as either the 'on' or 'off' state.**
- **Therefore, the results obtained from a digital computer are accurate.**
- **Virtually all of today's computers are based on digital computers.**

Hybrid Computers

- **It combines the good features of both analog & digital computers.**
- **It has a speed of analog computer & accuracy of digital computer.**
- **Hybrid Computers accept data in analog form and present output also in digitally.**
- **The data however is processed digitally.**
- **Therefore, hybrid computers require analog-to-digital and digital-to-analog converters for output**. **Space Vehicles, Ultrasound machine, missiles etc. are examples of Hybrid Computer.**

5. THE CLASSIFICATION OF THE COMPUTER BY DATA PROCESSING:

The computers are classified in four types on the based on data processing.

- **Micro computer**
- **Mini computer**
- **Mainframe computer**
- **Super computer**

Micro Computer:

- **Micro computers are the computers with having a microprocessor chip as it central processing unit.**
- **Originated in late 1970s.**
- **First micro computer was built with 8 bit processor.**
- **Microcomputer is known as personal computer.**
- **Designed to use by individual whether in the form of pc's, workstation or notebook computers.**
- **Small in size and affordable for general people.**
- **Ex: IBM PC, IBM PC/XT, IBM PC/AT**

Mini Computer:

- **Mini computers are originated in 1960s.**
- **Small mainframes that perform limited tasks.**
- **Less expensive than mainframe computer.**
- **Mini computers are Lower mainframe in the terms of processing capabilities.**
- **Capable of supporting 10 to 100 users simultaneously.**
- **In 1970s it contains 8 bit or 12 bit processor.**
- **Gradually the architecture requirement is grown and 16 and 32 bit.**
- **Minicomputers are invented which are known as supermini computers.**
- **Ex: IBM AS400**

Mainframe Computer:

- **A very powerful computer which capable of supporting thousands of user simultaneously.**
- **It contains powerful data processing system.**
- **It is capable to run multiple operating systems.**
- **It is capable to process 100 million instructions per second.**
- **Mainframes are very large & expensive computers with having larger internal storage capacity & high processing speed.**
- **Mainframes are used in the organization that need to process large number of transaction online & required a computer system having massive storage & processing capabilities.**
- **Mainly used to handle bulk of data & information for processing.**
- **Mainframe system is housed in a central location with several user terminal connected to it.**
- **Much bigger in size & needs a large rooms with closely humidity & temperature.**
- **IBM & DEC are major vendors of mainframes.**
- **Ex : MEDHA, SPERRY, IBM, DEC, HP, HCL**

Super Computer:

- **Most powerful & most expensive computer.**
- **Used for complex scientific application that requires huge processing power.**
- **Used multiprocessor technology to perform the calculation very speedy.**
- **They are special purpose computers that are designed to perform some specific task.**

- **The cost of the super computer is depended on its processing capabilities & configuration.**
- **The speed of modern computer is measured in gigaflops, teraflops and petaflops.**
    - **Gigaflops= 109 arithmetic operation per second.**
    - **Teraflops=1012 arithmetic operation per second.**
    - **Petaflops=1015 arithmetic operation per second.**
- **Ex: PARAM , EKA, BLUE GENE/P**

6. THE GENERATION OF THE COMPUTERS.

In Computer language, "Generation" is a set of Technology. It provides a framework for the growth of the computer technology. There are totally Five Computer Generations till today. Discussed as following.

First Generation:

- **Duration: 1942-1955**
- **Technology: vacuum tube**
    - **Used as a calculating device.**
    - **Performed calculations in milliseconds.**
    - **To bulky in size & complex design.**
    - **Required large room to place it.**
    - **Generates too much heat & burnt.**
    - **Required continuously hardware maintenance.**
    - **Generates much heat so must air-conditioner rooms are required.**
    - **Commercial production is difficult & costly.**
    - **Difficult to configure.**
    - **Limited commercial use.**
    - **ENIAC, EDVAC, EDSAC are example of 1st generation computer.**

Second Generation:

- **Duration: 1955-1964**
- **Technology: transistor**
    - **10 times Smaller in size than 1st generation system.**
    - **Less heat than 1st generation computers.**
    - **Consumed less power than 1st generation system.**
    - **Computers were done calculations in microseconds.**
    - **Air-conditioner is also required.**
    - **Easy to configure than 1st generation computers.**

- More reliable in information.
- Wider commercial use.
- Large & fast primary/secondary storage than 1st generation computers.

Third Generation:

- **Duration:** 1965-1975
- **Technology:** IC chip
  - Smaller in size than 1st & 2nd generation computers.
  - Perform more fast calculations than 2nd generation systems.
  - Large & fast primary/secondary storage than 2nd generation computers.
  - Air –conditioner is required.
  - Widely used for commercial applications.
  - General purpose computers.
  - High level languages like COBOL & FORTAN are allowed to write programs.
  - Generate less heat & consumed less power than 2nd generation computer.

Fourth Generation:

- **Duration:** 1975-1989
- **Technology:** Microprocessor chip
  - Based on LSI & VLSI microprocessor chip.
  - Smaller in size.
  - Much faster than previous generations.
  - Minimum hardware maintenance is required.
  - Very reliable as computer to previous generation computers.
  - Totally general purpose computer.
  - Easy to configure.
  - Possible to use network concept to connect the computer together.
  - NO requirement of air-conditioners.
  - Cheapest in price.

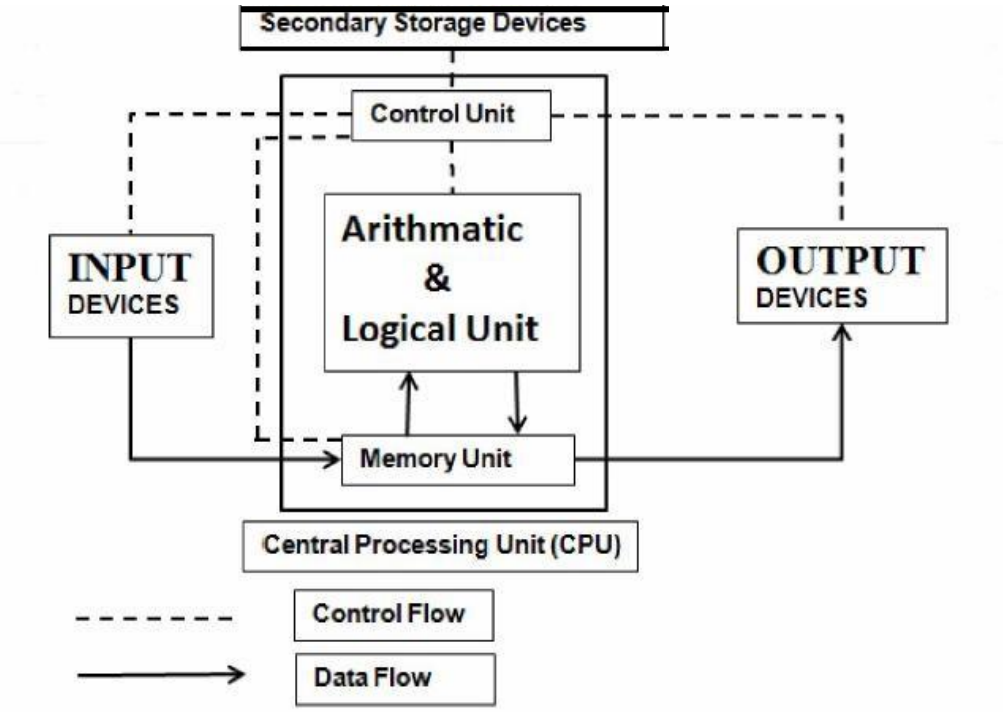
Fifth Generation:

- **Duration:** 1990 to Present
- **Technology:** ULSI microprocessor chip
  - Much smaller & handy.
  - Based on the ULSI chip which contains 100 million electronic components.
  - The speed of the operations is increased.
  - Consumed less power.
  - Air-conditioner is not required.
  - More user friendly interface with multi-media features.
  - High level languages are allowed to write programs.
  - Larger & faster primary/secondary storage than previous generations.

- Notebook computers are the example of 5th generation computers.

7. . EXPLAIN THE BLOCK DIAGRAM OF COMPUTER OR EXPLAIN THE SIMPLE MODEL COMPUTER.

A simple computer system comprises the basic components like Input Devices, CPU (Central Processing Unit) and Output Devices as under:



- **Input Devices:**
  - **The devices which are used to entered data in the computer systems are known as input devices.**
  - **Keyboard, mouse, scanner, mike, light pen etc are example of input devices.**

FUNCTION OF INPUT DEVICES

- **Accept the data from the outside worlds.**
- **Convert that data into computer coded information.**
- **Supply this data to CPU for further processing.**

- **Output Devices:**
  - **The devices which display the result generated by the computer are known as output devices.**
  - **Monitor, printer, plotter, speaker etc are the example of output devices.**

FUNCTIONS OF OUTPUT DEVICES

- **Accept the result form the CPU.**
- **Convert that result into human readable form.**

- Display the result on the output device.

- **Memory Unit:**
  - The data & instruction have to store inside the computer before the actual processing start.
  - Same way the result of the computer must be stored before passed to the output devices. This tasks performed by memory unit.

FUNCTIONS OF MEMORY UNIT

- Store data & instruction received from input devices.
- Store the intermediate results generated by CPU.
- Store the final result generated by CPU.

- **Arithmetical & Logical Unit:**
  - The ALU is the place where actual data & instruction are processed.
  - All the calculations are performed & all comparisons are made in ALU.
  - Performs all arithmetical & logical operations.
  - An arithmetic operation contains basic operations like addition, subtraction, multiplication, division.
  - Logical operations contains comparison such as less than, greater than, less than equal to, greater than equal to, equal to, not equal to.

- **Control Unit:**
  - It controls the movement of data and program instructions into and out of the CPU, and to control the operations of the ALU.
  - In sort, its main function is to manage all the activities within the computer system.
  - Controls the internal parts as well as the external parts related with the computer.
- **CPU:**
  - The Unit where all the processing is done is called as Central Processing Unit.
  - It contains many other units under it.
  - Main of them are:- Control Unit And ALU (Arithmetic & Logic Unit)

INPUT DEVICES

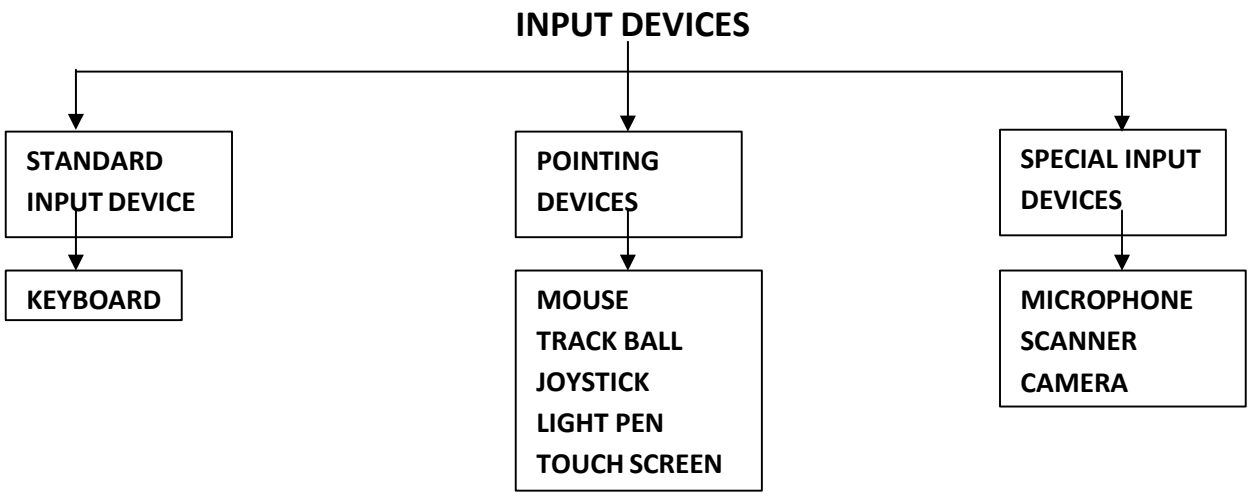
1 . WHAT IS INPUT DEVICES?

- **The Input devices are the devices which are used to enter the data in the computer system.**
- **Keyboard, mouse, scanner, microphone are the example of input devices.**

FUNCTIONS OF INPUT DEVICES:

- **Accept the data from the outside worlds.**
- **Convert that data into computer coded information.**
- **Supply this data to Central Processing Unit for further processing.**

CLASIFICATION OF INPUT DEVICES:



OUTPUT DEVICE

1 . WHAT IS OUTPUT DEVICE.

- **The output devices are the devices which are used to display the result generated by the computer system.**
- **Monitor, printer, plotter, speaker are the example of output devices.**

FUNCTIONS OF OUTPUT DEVICES:

- **Accept the result from the CPU.**
- **Convert that result into human readable form.**
- **Supply this result to output device.**

The monitor is the common output device mostly used It is a softcopy output device.

- **It can be thought of as a high resolution TV set.**
- **The monitor can also determine if the display will be colour, black and white, or include graphical objects (pictures).**

- **The printer is a most commonly used output device.**
- **It is used to producing the hard copy output.**
- **It prints characters, symbols & graphics on the paper.**
- **Printer can be categorised according to the technology used in printer, speed, and approach of printing, colours, language & the quality of printing.**
- **Mainly printer can be classified in two types:**
    - **Impact printer**
    - **Non impact printer**

- **The speaker is output device which is connected to computer's soundcard.**
- **The speaker output the sound generated by the sound card.**
- **Audio data is generated by computer is send to audio card which is located inside extension slot.**
- **It can translate data into audio signal which are sending to speaker.**

RAM

- **The complete name of RAM is random access memory which is also known as Primary memory.**
  - **It is called read/write memory because data can be read as well as write in RAM.**
- **It is called random access because you can directly access any data from RAM if you know row & column cell.**
- **The RAM chip is fixed on the mother board & the mother board is designed in such a way that its memory capacity can be enhanced by adding more RAM chip.**
  - **RAM is a VOLETILE memory.**
  - **RAM chips are of two types:**

DRAM:

- **Dynamic Random Access Memory is a volatile memory that allows fast access to data and is ideal for use as the primary store of computer systems.**
- **However, the information is stored as electrical charges and the charges need to be constantly refreshed in order for the data to be maintained.**

SRAM:

- **Static Random Access Memory is also a volatile memory.**
- **Once data is written into the chip, it is maintained as long as power is supplied to it; it does not need refreshing.**
  - **However, SRAM is slower than DRAM and it is also more expensive.**

ROM

- **The complete name of ROM is read only memory.**
- **The data stored permanently & can't be altered by the programmer.**
- **Data stored in ROM chip can be read & used but cannot be changed.**
- **This memory also known a field storage permanent storage or dead storage.**
- **It is basically used to store manufacturer programmed & user program.**
- **Most of the basic operations are carried out by electronic circuits which are known as micro programs.**
  - **These programs are stored in ROM. For ex. System Boot Loader.**

HARD DISK

- **Hard disks are most popular secondary storage device.**
- **It supports the direct access of the data.**
- **It's a thin magnetic plate which is made of metal in both side coated withmagnetic material.**
- **The disk is divided in many tracks & the data is store in both side of the disk.**
- **The disk pack consists of multiple disk plates.**
- **The disk drive pack has a separate read/write head for each disk surface.**
- **The disk drive consists of motor to rotate the disk pack about its axis at a speed of about 5400 revolution per minute.**

- **The drive also has a set of magnetic heads mounted on arms.**
- **The arm assembly is capable of moving in & out in radial direction.**
- **The hard disk drive has become the most indispensable secondary storage device in micro-computers.**
- **It is fast and speeds of less than 10 (ms) milliseconds are achievable.**
- **Storage capacity is large and it is not uncommon for micro-computers.**

CD-ROM

- **CD-ROM (Compact Disk – Read Only Memory) is a non-erasable backing store which can hold large amounts of data.**
- **It's a shiny silver colour metal disk of 5 ¼ inch and the storage capacity about 650 megabytes.**
- **Large volume production is achieved by automated processes similar to that of audio compact disks.**
- **Many of today's micro-computers come with CD-ROM readers and as a result, CD-ROM is popularly used for distribution of software, digitized graphic images as well as Multi-Media material.**
- **Information is written on the disk surface by shining a laser beam.**
- **As a disk rotates the laser beam traces out a continuous spiral.**
- **It's known as WORM (Write Once Read Many) disk technology.**
- **The data can be read time and again but, once the data is stored, it cannot be erased or changed.**

Advantages:

- **Cost per bit is Low.**
- **Need not have any mechanical read/write heads to read/write data.**
- **Compact in size.**
- **Light weight**

Disadvantages:

- **Read only storage medium.**
- **Slower access speed than magnetic disk.**

NUMBER SYSTEM

Introduction

- All digital computers store numbers, letters, and other characters in coded form.
- The code used to represent characters is the Binary Code – i.e. a code made up of bits called Binary Digits.
- Every character is represented by a string of "0s" and "1s" – the only digits found in the binary numbering system.

"0" or "1" = bit (Binary Digit)
8 bits = 1 Byte (1 Character)
1024 Bytes = 1 KB (Kilo Bytes)
1024 KB = 1 MB (Mega Byte)
1024 MB = 1 GB (Giga Byte)
1024 GB= 1 TB (Terra Byte)

- When data is typed into a computer, the key board converts each key stroke into a binary character code. This code is then transmitted to the computer.
- When the computer transmits the data to the any device, each individual character is communicated in binary code. It is then converted back to the specific character while displaying or printing the data.

Number Systems

- Numbers earlier consisted of symbols like I for 1, II for 2, III for 3 etc. Each
- Symbol represented the same value irrespective of its position in the number.
- This approach is called an additive approach. As time passed positional numbering systems were developed. In such a system the number of symbols is few and they represent different values depending on the position they occupy.
- Now we know that numbers can be represented by arranging symbols in various positions.

Decimal Number System (Base 10)

- In the decimal system the successive positions to the left of the decimal point represent units, tens, hundreds, thousands etc. For example if we consider
- The number 7762, the digit 2 represents the number of units, 6 represents the number of tens, 7 the number of hundreds and 7 the number of thousands. (7 x 1000) + (7 x 100) + (6 x 10) + (2 x 1) = 7762
- Thus as we move one position to the left, the value of the digit increases by ten times. We can see that the position of the number affects its value.

- These kinds of number systems are therefore called positional number systems.
- In other words the number of symbols used to represent numbers in the system is called the base of that system. In short we can say that the value of each digit in the number system is determined by:
    - The digit itself
    - The position of the digit in the number itself
    - The base of the system.
- The Roman numbering system uses symbols like I, II, III, IV, V etc. To represent the decimal numbers 1, 2, 3, 4, and 5.
- As we can see this follows an additive approach and hence is not conductive to arithmetic.

Binary Number System (Base 2)

- We now come to a different number system – the Binary number system.
- This binary number system has a base of two, and the symbols used are "0" And "1".
- In this number system, as we move to the left the value of the digit will be two times greater than its predecessor. Thus the values of the places are: 64 32 16 8 4 2 1

Converting Decimal To Binary

- In conversion from decimal to any other number system, the steps to be followed are:
    - Divide the decimal number by the base of 2.
    - Note the remainder in one column and divide the quotient again with the base. Repeat this process until the quotient is reduced to a zero.

Example:

- The decimal number is 65

2	65	1
2	32	0
2	16	0
2	8	0
2	4	0
2	2	0
	1	

- The binary number of 65 is 1000001

Converting Binary To Decimal

The decimal number of 100001 is

$= (1*2^6)+(0*2^5)+(0*2^4)+(0*2^3)+(0*2^2)+(0*2^1)+(1*2^0)$

$= (1*64) + (0*32) + (0*16) + (0*8) + (0*4) + (0*2) + (1 * 1)$

= 64 + 0 + 0 + 0 + 0 + 0 + 1

= 65

- The decimal number of 1000001 is 65

Octal Number System (Base 8)

- A commonly used positional system is the Octal System. The octal system has a base of 8.
- The values increase from left to right as 1, 8, 64, 512, 4096,….

Converting Decimal To Octal

- In conversion from decimal to any other number system, the steps to be followed are:
  - Divide the decimal number by the base of the 8.

Example:

- The decimal number is 224

8	224	0
8	28	4
8	3	3

- The octal number of 224 is 340

Converting Octal To Decimal

- The octal number is 340
- $= (3*8^2)+(4*8^1)+(0*8^0)$
- = (3*64) + (4*8) + (0*1)
- = 192 + 32 + 0
- = 224
- The decimal number of 340 is 224

Converting Binary Octal

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

Converting from Binary to Octal

- **The binary number must be divided into groups of three from the octal point – to the right in case of the fractional portion and to the left in case of the integer portion. Each group can then be replaced with their octal equivalent.**
- **Example**
- **Binary 101010101010100**

  101 010 101 010 100

  5 2 5 2 4
- **So, 52524 is the Octal equivalent of binary 101010101010100**

Converting Octal to Binary

- **Each octal digit is replaced with the appropriate 'triple' of binary digits.**

  e.g. 65

  6 5

  110 101
- **The binary equivalent of the Octal number 65 is 110101**

Hexadecimal Number System (Base 16)

- **There is another commonly used positional system, hexadecimal system.**
- **The hexadecimal system has a base of 16, so the value increases from left to right as 1, 16, 256, 65536,. . . .**
- **We need to keep a simple table in mind before we attempt any conversion from hexadecimal or vice-versa.**

Converting Decimal To HexaDecimal

- **In conversion from decimal to any other number system, the steps to be followed are:**
  - **Divide the decimal number by the base of 16.**

Example:

- **The decimal number is 370**

16	**370**	**2**
16	**23**	**7**
16	**1**	**1**
	0	

- **The hexadecimal number of 370 is 172**

Converting Hexadecimal To Decimal

The hexadecimal number 172

$= (1*16^2) + (7*16^1) + (2*16^0)$

$= (1*256) + (7*16) + (2*1)$

$= 256+112+2$

= 370

- **The decimal number of 172 is 370**

Converting Binary to Hexadecimal

- **Each hexadecimal digit is represented by 4 binary digits.**

Binary Hexadecimal

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

- **To convert a binary number to its hexadecimal equivalent we split the quantity into groups of four onwards, as before.**
- **Each of this group of four is directly converted into their hexadecimal equivalent.**
- **We may add zeros to the left of the number if necessary.**
- **example**

  Binary 10101011000010

  0010 1010 1100 0010

  2 A C 2

- **So, the hexadecimal equivalent of binary 10101011000010 will be 2AC2**

Converting Hexadecimal to Binary

- **The conversion from hexadecimal to binary consists of writing off the binary**

Equivalent of each hexadecimal digit in groups of four.

- e.g.

  Hexadecimal 1901A0412C

  0001 1001 0000 0001 1010 0000 0100 0001 0010 1100

  1 9 0 1 A 0 4 1 2 C

- Thus the required binary number can be written as:

  1100100000001101000000100000100101100

Converting Hexadecimal to Octal

- Write 4 digit binary numbers for each hexadecimal.
- Arrange the entire number sequence into group of 3 bit section.
- If any bit is missing add 0 on leftmost section.
- Now write down octal equivalent of each 3 bit section.
- Example:
- The hexadecimal number is 2A35.

  2 A 3 5

  0010 1010 0011 0101

  000 010 101 000 110 101

  0 2 5 0 6 5

- The octal number is 25065

Converting Octal to Hexadecimal

- Write 3 digit binary number for each octal.
- Arrange the entire number sequence into group of 4 bit section.
- If any bit is missing add 0 on leftmost section.
- Now write down hexadecimal equivalent of each 4 bit section.
- Example:
- The octal number is 25065.

  2 5 0 6 5

  010 101 000 110 101

  0010 1010 0011 0101

  2 A 3 5

The hexadecimal number is 2A35

Binary Arithmetic

- **All the arithmetic operations are possible in binary numbering system like addition, subtraction, multiplication and division All the Arithmetic operations are done in binary number system are explained as under:**

Addition

- **For binary addition the following rules of binary addition are to be considered:**
  - **0 + 0 = 0**
  - **0 + 1 = 1**
  - **1 + 0 = 1**
  - **1 + 1 = 0 (carry 1 to the next column to the left)**
  - **1 + 1 + 1 = 1 (carry 1 to the next column)**
- **e.g. 1 Add two binary numbers 11011 and 111**
- **Carry**

```
  1 1 1 1
  1 0 1 1 1
+   1 1 1
-----------
  1 0 0 0 1 0 (Answer)
```

Subtraction

- **Though there are other methods of performing subtraction, we will consider the method of subtraction know as complementary subtraction.**
- **This is a more efficient method of subtraction while using electronic circuits. We will be following three steps to perform subtraction:**
  - **Find the complement of the number you are subtracting.**
  - **To the complement of the number we obtained in step 1, we add the number we are subtracting from.**
  - **If there is a carry of 1 add the carry to the result of the addition else re complement the sum and attach a negative sign.**
- **How do we find the complement of a binary number ? We have to invert all the bits. e.g. Number Complement**
  10001101 01110010
  00101010 11010101
- **Consider the following example of subtraction:**
  e.g. 1
  1010101 – 1001100
- **Step-1. Find the complement of 1001100**
  0110011

- **Step-2. Add the number you are subtracting from**

Carry 1 1 1 0 1 1 1

1 0 1 0 1 0 1

+ 0 1 1 0 0 1 1

---

0 0 0 1 0 0 0

+ 1 (Continue since there is a carry of 1)

---

0 0 0 1 0 0 1 (Answer)

e.g. 2

101100 – 11100101

- **Step-1. Find the complement of 11100101**

00011010

- **Step-2. Add the number you are subtracting from**

Carry 0 1 1 1

0 0 1 0 1 1 0 0

+ 0 0 0 1 1 0 1 0

0 1 0 0 0 1 1 0

- **Step-3. Since there is no carry we are complement the result**

10111001

attach a negative sign

- **- 10111001 (Answer)**

Multiplication

- **Multiplication**
- **Multiplication in binary follows the same rules that are followed in the decimal system. The table to be remembered is:**
- **0 x 0 = 0**
- **0 x 1 = 0**
- **1 x 0 = 0**
- **1 x 1 = 1**
- **e.g.**

1010 * 1001

1010

x 1001

1010
0000
0000
1010

101101 0

- The answer is (1011010)

Division

- Table for binary division is given as under:
- 0 / 1 = 1
- 1 / 1 = 1
- The steps for binary division are:
  - Start from the left of the dividend.
  - Perform subtraction in which the divisor is subtracted from the dividend
  - If subtraction is possible put a 1 in the quotient and subtract the divisor from the corresponding digits of the dividend else put a 0 in the quotient
  - Bring down the next digit to the right of the remainder.
  - Execute step 2 till there are no more digits left to strating down from the dividend.
- e.g.
- 100001 / 110

```
        0101        (quotient)
110 | 100001
       110
      1000
       110
       100
       110
       1001
       110
         11        (reminder)
```

Unit Of Information (Codes)

- Most computers do not represent characters as pure binary numbers.
- They use a coded version of true binary to represent letters and special symbols as well as decimal numbers.
- Coding of characters has been standardized to enable transfer of data between computers.
- Codes used are:
    - BCD
    - ASCII
    - EBCDIC

BCD

- BCD stands for Binary Coded Decimal.
- BCD code is one of the early computer codes.
- It is based on the idea of converting each digit of a decimal number into its binary equivalent rather than converting the entire decimal into binary form.
- All decimal digits are represented in BCD by 4 bit.
- Each decimal digit is independently converted into a 4 bit binary number & so the conversion process is very easy.
- 4 bit BCD can be used to represents only decimal numbers because 4 bits are insufficient to represent various characters.
- By using 4 bit BCD only 16 possible characters are represented.
- So the BCD code was extended from 6-bit code and it is possible to represent 64 characters.

ASCII

- ASCII stands for American Standard Code for Information Interchange.
- In this form of representation, each character (which includes alphabets, digits and symbols) is assigned a particular pattern of bits.
- For example, A is represented as binary 1000012, B as 10000102 and so on.
- The standard ASCII character set uses 7 bits and can be used to represent 128 different characters.
- It uses one extra parity bit for parity check.
- Other forms of ASCII codes use an extra bit to extend the representation to 256 characters.
- However, characters represented from binary are not universally agreed upon.
- The most popular form is the set used by IBM.
- ASCII is commonly used to exchange data between data processing and communication systems.

EBCDIC

- **EBCDIC stands for Extended Binary Coded Decimal Interchange Code.**
- **It uses 8 bits and can represent 256 distinct characters.**
- **It also uses one extra parity bit for parity check.**
- **The EBCDIC code is used in IBM mainframe models and other similar machines.**
- **Electronic Circuits are available to transform characters from ASCII to EBCDIC and vice-versa and can also be achieved using computer programs.**

LANGUAGES, OPERATING SYSTEM & SOFTWARE PACKAGES

Introduction

- **A computer can only do what a programmer asks it to do.**
- **To perform a particular task programmer writes a sequence, called the program.**
- **An instruction command given to the computer to perform a certain specified operation on the given data.**
- **Now as we know only human languages and computer knows only machine language, we need some media through which we can communicate with the computer.**
- **So we can complete our desired task. That media is Language.**
- **Languages are tools human can use to communicate with the hardware of a computer system.**
- **Each language has a systematic method of using symbols of that language.**
- **In English, this method is given by the rules of grammar.**
- **Similarly, the symbols of particular one computer language must also be used as per set of rules which are known as the "Syntax" of that language, the language which you are using.**
- **Computer Languages can be classified into three broad categories:**

LANGUAGES

MACHINE LANGUAGE	ASSEMBLY LANGUAGES	HIGH-LEVEL LANGUAGES

WHAT IS MACHINE LANGUAGE?

- **Computer programs are written using many different computer Languages but the language which is understood by the computer without translating program is called machine language.**
- **Machine language is normally written as string of binary 1s and 0s.**
- **A machine language instruction has two part format.**

OPCODE (OPERATION CODE)	OPERAND (ADDRESS)

- **The 1st part is the operation code which tells the computer what function to be performed.**
- **The 2nd part is the operand which tells the computer where to find & store data to be manipulated.**
- **So each instruction tells the computer what operation to perform & the length & location of the data field which are involved in the operation.**

Advantages

- **Programs can be executed immediately upon completion because it doesn't require any translation.**
- **Now extra storage space is needed.**
- **Programmer has complete control over the performance of the hardware.**

Disadvantage

- **Tedious to program**
- **Difficult to program**
- **Difficult to modify**
- **Time consuming to code**
- **Error prone**
- **Operation codes have to be memorised**
- **Assignment of memory is done by programmer**
- **Time consuming for development**
- **Programs development are machine dependent**
- **Preparation of programs was slow and costly.**

ASSEMBLY LANGUAGE.

- **Assembly language is a language which allows instruction & storage location to be represented by letters & symbols, instead of number.**
- **A program written in an assembly language is called assembly language program or symbolic program.**
- **Assembly language was introduced in 1952.**
- **Machine language was tedious to code and errors were expected to arise in bulk.**
- **To solve these problems mnemonic codes and symbolic addresses were developed.**
- **It allows using alphanumeric mnemonic codes instead of numeric code for the instructions in instruction set. For example using ADD instead of 1110 or 14 to add.**

- **The storage locations are to be represented in the form of alphanumeric addresses instead of numeric address.**
- **Format of assembly language is similar to machine language:**

MNEMONIC CODE	SYMBOLIC ADDRESS

Example of Assembly language instruction:

- **This instruction adds value of NUM1 to the AX (Accumulator Register).**
- **The symbolic language made program writing so much easier for the Programmers but it must be translated into machine code before being used for operation.**
- **The translation is actually done by a special translating program.**

Assembler

- **Assembler is a special program (translator) which translates symbolic operation codes into machine codes, and symbolic address is addressed into an actual machine address.**

Advantage

- **Easier to use, code and understand.**
- **Easier to correct error.**
- **Easier to modify.**
- **No worry about addresses.**
- **Easily relocatable.**
- **Efficiency of machine language.**
- **Can use Macros (Macro is a bunch of instruction referred as a single name)**

Disadvantage

- **Machine depended.**
- **Programs have to be translated before execution.**
- **Translation of programs takes up time.**
- **Knowledge of hardware is required.**
- **Additional storage area needed for the source programs and object code.**

Examples of Assembly Language

- **Microsoft Assembly Language (MASM), Turbo Assembler**

HIGH LEVEL LANGUAGE.

- **The machine language & assembly language requires a good knowledge of internal structure of computer.**
- **The both languages are machine dependent & it is difficult to solve error.**
- **To remove this limitation the high level language are introduced.**

- **The high level languages machine independent so it can be easily ported & executed on any computer.**
- **The high level language programs do not require any knowledge of internal structure of computer so the programmer concentrate on the logic of problem rather than internal structure of computer.**
- **It enables the programmer to write instructions using English words & familiar mathematical symbols & expression so the program makes easier to code & understand.**
- **It requires a translator program to convert high level program into machine language.**

Compiler

- **Compiler is a special program (translator) which translates high level programs into machine codes.**

Advantages:

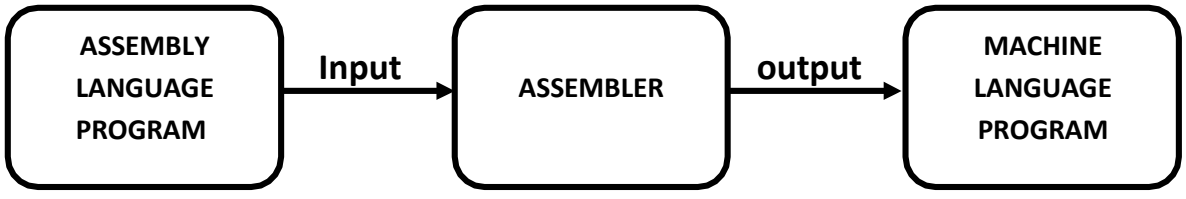
- **Machine independent.**
- **Easier to learn, use and understand.**
- **Easier to correct error.**
- **Easier to maintain.**
- **Less time & efforts.**
- **Easily relocatable.**
- **Program preparation cost is low.**
- **Few errors.**

Disadvantages:

- **Less flexible.**
- **Lower efficiency.**
- **Require more time & storage space.**

ASSEMBLER

- **A computer can directly execute only machine language programs so the assembly language program must be converted into its equivalent machine language program before can be executed.**
- **This translation is done with the help of a translator program which is known as assembler.**
- **Assembler is a special program (translator) which translates symbolic operation codes into machine codes, and symbolic address is addressed into an actual machine address.**



(Source Program) ONE TO ONE CORRESPONDENCE (Object Program)

- As shown in figure that the input to assembler is the assembly language program (source program) and the output is the machine language program (object program).
- Assembler translates each assembly language instruction into equivalent machine language instruction.
- There is one to one correspondence between the assembly language instructions of source program & the machine language instruction of its equivalent object program.
- In case of assembly language program the computer not only has to run the program but also must first run assembler program to translate the original assembly language program into machine language program.
- So the computer has to spend more time in getting desired answer.

COMPILER

- A computer can directly execute only machine language programs.
- So the high level language program must be converted into its equivalent machine language program before can be executed.
- This translation is done with the help of a translator program which is known as compiler.
- A compiler is a translator program which translates a high level language program into equivalent machine language program.
- The process of translating is shown in below figure:

(Source Program) ONE TO MANY CORRESPONDENCE (Object Program)

- As shown in figure that the input to compiler is the high level language program (source program) and the output is the machine language program (object program).
- High level language instructions are macro instructions.
- The compiler translates each high level language instruction into set of machine language instructions rather than a single machine language instruction.
- There is one to many correspondence between high level language instructions of source program into equivalent object program.
- During the translation the source program is only translates not executed.

- A compiler can translates only those source programs which have written in the language for which compiler is designed.
- A compiler can also detect & indicates the syntax errors during the compilation process but cannot able to detect logical errors.

INTERPRETER.

- An interpreter is another type of translator which is used for translating program written using high level languages.
- It takes one statement of high level language, translates into machine language & immediately executes the resulting machine language instructions.
- The main difference between compiler & interpreter is that compiler can translates the entire code but not involve in execution.

- As shown in figure that the input to an interpreter is a source program & the output is the result of an execution program.
- Interpreter translates & executes a high level language program statement-by-statement.
- A program statement is reinterpreted every time it is encountered during program execution.
- The main advantage of interpreter is that interpreter makes it easier & faster to correct programs.
- The main disadvantage is that interpreter is slower than compilers when running a finished program.

WHAT IS O PERATING SYSTEM?

- An operating system is a software program that provides an interface between user & the computer and manages thousands of applications.
- It's a collection of system software that co-ordinates between the hardware, provides a platform for software to run on.
- An operating system is an integrated set of programs that the resources (the CPU, memory, I/O devices etc) of computer system & provides an interface to the user to run the machine.
- The main two primary objective of operating system are:
    - Making a computer system convenient to use

- **Managing the resources of a computer system**

FUNCTION OF OPERATING SYSTEM

1) PROCESS MANAGEMENT

- **The process management of OS taking care about the creation & deletion of user & system process, providing mechanism for process synchronization & process communication.**

2) MEMORY MANAGEMENT

- **The memory management of OS taking care about the allocation & deallocation of memory space to the various programs in need of this resource.**

3) FILE MANAGEMENT

- **The file management of OS is taking care about the file related activities such as creation, storing, retrieving, naming, sharing & organization of files.**

4) SECURITY

- **The security model of OS protects the resources & information of a computer system against destruction & unauthorized access.**

5) COMMAND INTERPRETATION

- **This model taking care of interpreting user commands & directing the system resources to handle the requests.**
- **Provides advantages of quick response time.**
- **Offers good computing facility to small users.**

EXPLAIN TYPES OF SOFTWARE PACKAGES

- **The software is set of programs, procedure and associated documents which describe the programs and how they are used.**
- **On the base of task performed by software it can be divided in following tasks.**
- **WORD PROCESSING SOFTWARE :**
  - **It enables you to make use of computer system for creating, editing, and viewing, formatting, storing, retrieving & printing documents.**
- **SPREAD SHEET SOFTWARE:**
  - **Spreadsheet software is a numeric data analysis tool, which allows us to create kinds of computerised ledger.**
  - **Provides a predefined sheet which contains rows and columns.**
- **DATABASE SOFTWARE**
  - **A database is a collection of related data stored & treated as a unit for information retrieval purpose.**
  - **Database software is a set of one or more programs which enables us to create a database, maintain it, and organize it.**
- **GRAPHICS SOFTWARE:**
  - **Graphic software enables you to use a computer system for creating, editing, viewing, storing, retrieving and printing designs, drawings, pictures, graphs.**
- **PERSONAL ASSITANCE SOFTWARE**