Chapter 1 :

Computer Science

Class XI (As per CBSE Board)

New Syllabus 2019-20

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Introduction

A computer is an electronic device, under the control of instructions stored in its memory that can accept data (input), process the data according to specified rules(Program), produce information (output), and store the information for future use

Data vs Information

Data are raw numbers or other findings which, by themselves, are of limited value.
Information is data that has been converted into a meaningful and useful context.

Computers are being used extensively nowadays in everyday life/every field In the form of laptop, desktop, smartphone,gadgets etc.

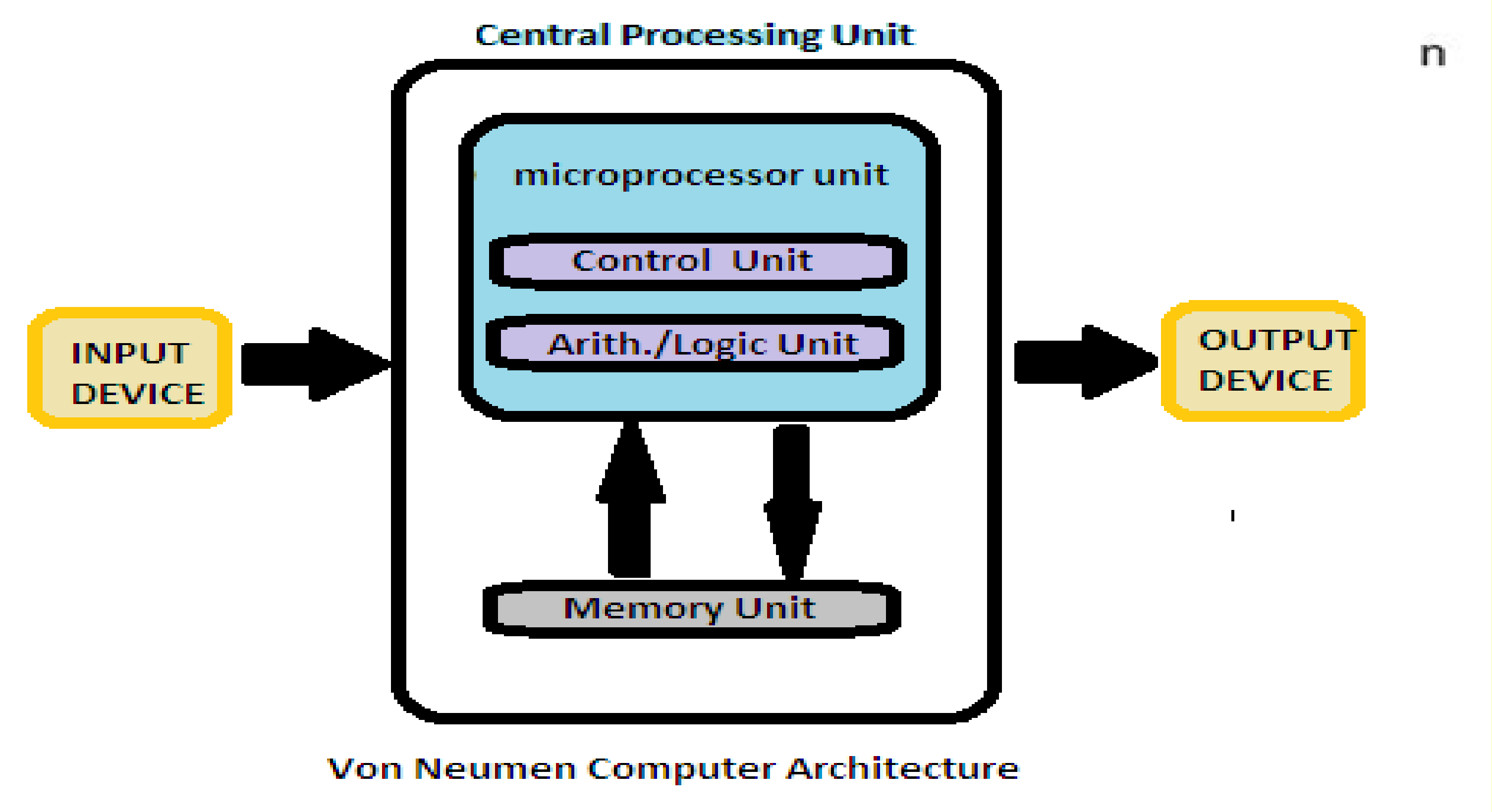
Functionalities of a computer

Any digital computer performs five functions in gross term.

1. Take data as input
2. Stores data/instructions
3. Process those stored data
4. Generate the output
5. Control all above steps

Basic Computer Organization

Functional components of a computer



Basic Computer Organization

Input/Output Units

Input Unit

A device through which data and programs from the outside world enter the computer system.

Output unit

A device through which results stored in the computer memory are made available outside the computer system.

Basic Computer Organization

Control Unit

Control unit

It organizes the computer to work computer as single unit

Arithmetic/Logic Unit

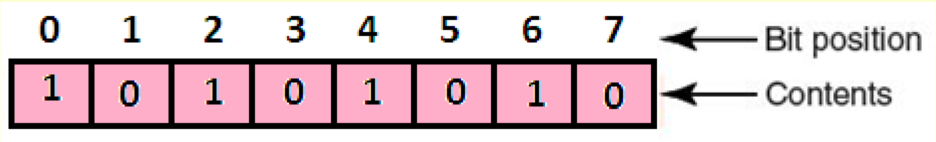
Performs basic arithmetic operations such as addition and subtraction
Performs logical operations such as AND, OR, and NOT.Most modern ALUs have a small amount of special storage units called registers that can be accessed faster than main memory.

Memory

A collection of cells, each with a unique physical address

Most computers are byte-addressable

Cell at address 11111110 contains 10101010



Basic Computer Organization

Memory Units

UNIT	STORAGE	ABBREVIATION
Bit	Binary Digit, Single 1 or 0	B
Nibble	4 bits	-
Byte/Octet	8 bits	B
Kilobyte	1024 bytes	KB
Megabyte	1024 KB	MB
Gigabyte	1024 MB	GB
Terabyte	1024 GB	TB
Petabyte	1024 TB	PB
Exabyte	1024 PB	EB
Zettabyte	1024 EB	ZB
Yottabyte	1024 ZB	YB

Basic Computer Organization

RAM and ROM

Random Access Memory (RAM)

Memory in which each location can be accessed and changed

Read Only Memory (ROM)

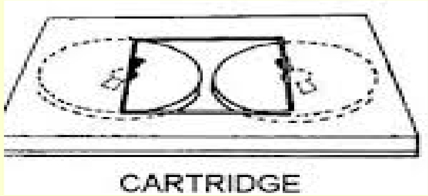
Memory in which each location can be accessed but *not* changed

RAM is volatile, ROM is not

Secondary Storage Devices

Magnetic Tape

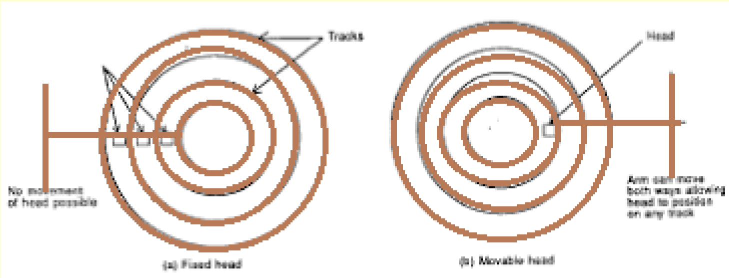
mass auxiliary storage device



Secondary Storage Devices

Hard disk

Fixed Head HDD / Movable head HDD



A hard disk is a set of stacked disks. Each disk has data recorded electromagnetically in concentric circles, or tracks, on the disk

Hard Drive Types

1. **Parallel Advanced Technology Attachment (PATA)**
2. **Serial ATA (SATA)**
3. **Small Computer System Interface (SCSI)**
4. **Solid State Drives (SSD)**

Upto 12 TB sized HDD is available in the market

Basic Computer Organization

Input Devices

Input devices can send data or information to a computer or another device.

Keyboard: It is an input device which sends data in to the computer. The data send depends on the key pressed by the user.

Mouse: A mouse is a small handheld input device which controls a cursor in a graphical user interface. It can move and select text, files, folders etc. on our computer according to the user input.

Scanner: Scanner optically reads and document, file or image and then changes it into digital signal and sends to the computer.

OMR: optical mark recognition/ reader, is used to read marks on a document and send them to computer.

OCR: OCR stands for optical character Recognition, is an input device which reads printed text and sends that to computer.

MICR: Magnetic Ink Character Reader is an input device which generally finds application is banks to process cheques.

Microphone: it receives audio generated by some input source and sends the same to a computer.

Webcam: it sends the captured images to a computer.

Graphics Tablets: This input device is used to draw using hand.

Trackballs: an upside down mouse ,encased within a socket. Is a cursor control device.

Barcode reader: It is used to read the barcode of various items and feed the same to computer.

Gamepad: Also known as joy pad is the input controller for video games.

Joystick: these input devices are used to control video games.

Basic Computer Organization

Output Devices

A device that can receive data from computer or another device and create output with that data is called output device. Examples of various output devices are as :

Monitor: A monitor is an output device that is responsible for receiving data from a computer and displaying that information as text or images for users to see.

Speakers: Receives sound signal from a computer and then plays that sound signal and thus we hear songs or music or any other audio.

Projector: Gets data from a computer and displays or projects the same information onto a screen or a wall. Projector cannot directly accept data from a user and send that data to another device.

Basic Computer Organization

Both Input / Output Devices

An input/output device is capable of receiving data from users or another devices and also sending data to another devices or computers. That means a devices which can be used as both input device and output device are called Input / Output (I/O) devices. Some examples of input/output devices are as:

USB drive: Also known as pen drive or flash stick works as both input device to computer and as an output device. USB drives receive or save data from a computer as an input and it can also send data to a computer or another device.

Facsimile: Facsimile or FAX machine has a scanner which is an input device and a small printer to provide output.

Modems: It is used to transmit and receive data from one computer to another computer or other devices using telephone lines

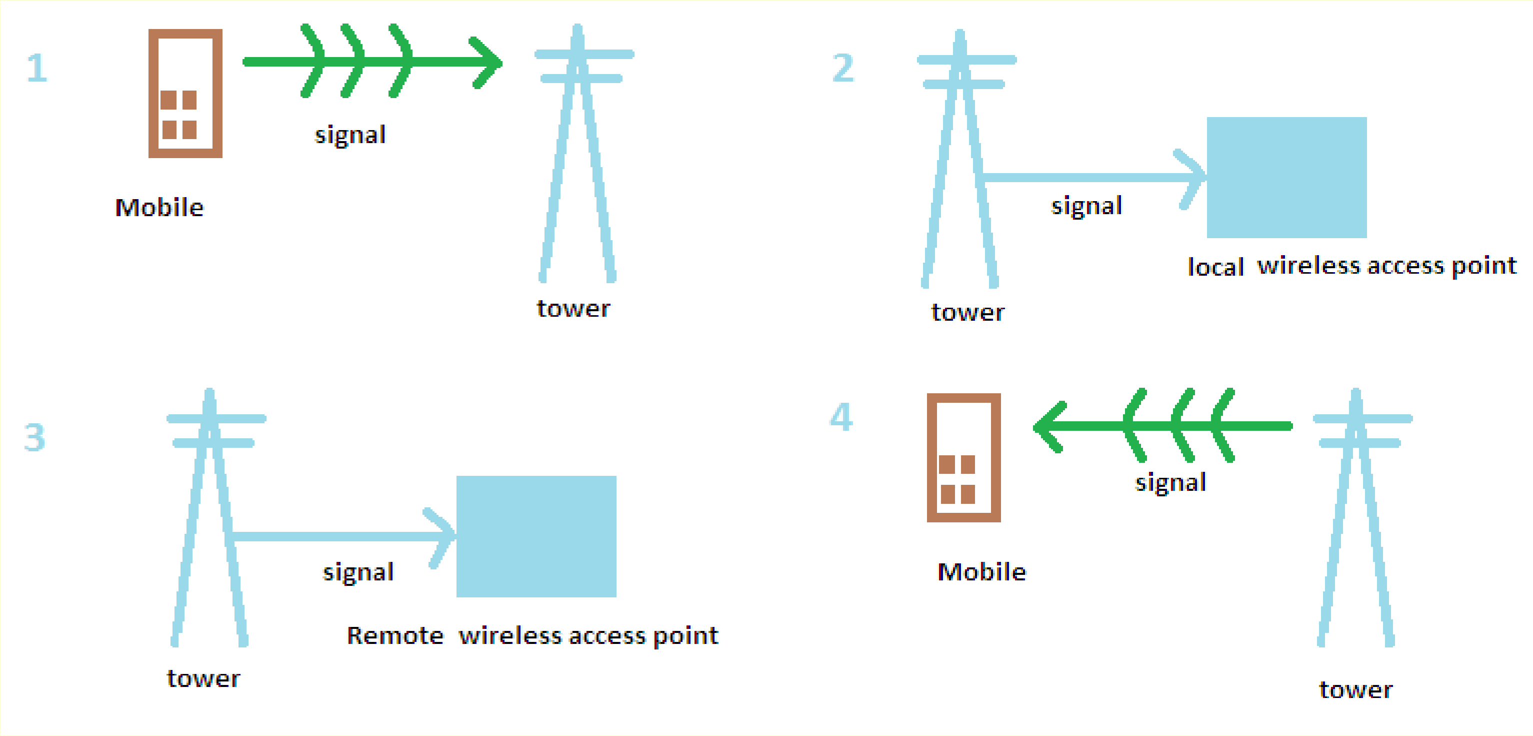
CD-RW drives and DVD-RW drives: Receives data from a computer as input to copy onto and save into writable CD or DVD. We also use CDs or DVDs to transfer data to a computer.

Touch Screen: Touch screen is both input and output device. By touching the screen input is provided and being a screen, it is used as an output device.

Headsets: Headset consists of speaker as an output device and microphone functions as an input device.

Mobile System

a **Mobile Phone** is essentially a two-way radio, consisting of a radio transmitter and a radio receiver.



Mobile System

Mobile Phone Components

1. A circuit board as brains of the phone
2. An antenna
3. A liquid crystal display (LCD)
4. A keyboard / A touch screen
5. A microphone
6. A speaker
7. A battery

Mobile System

Different types of touchscreen

1.TFT (Thin Film Transistor) LCD display is used for better image quality and high resolution. Since they are cheap to manufacture, they are found in budget phones usually.

2. IPS (In-Place Switching) LCDs are somewhat the advanced version of TFT LCDs in a way that they offer improved displays and are more battery friendly. Hence, they are found in high end phones.

3. RESISTIVE AND CAPACITIVE

There are generally two types of touchscreen LCD displays; Resistive and Capacitive. Resistive touchscreen has two layers of conductive material with a small gap between them while capacitive touchscreen consists of a layer of glass coated with transparent conductor. Capacitive screens tend to be more responsive than resistive screens and are therefore found in high end phones mostly.

4.OLED (Organic Light Emitting Diode) is a newer technology used in mobiles and monitors for display. They are better than LCDs because they offer fast response times, wider viewing angles and higher brightness. AMOLED (Active-Matrix Organic Light-Emitting Diode) and SUPER AMOLED displays are types of OLED display.
OLED types include **passive-matrix** OLEDs, **active-matrix LEDs** and **transparent** OLEDs

Mobile System

Smartphone Batteries and Their Types

Battery plays a huge role in any smartphone

Lithium Polymer batteries are the most advanced batteries available in the market right now. They are made up of plastic instead of metal, which makes them usable on a smartphone of any type.The Lithium Polymer batteries do not suffer from memory effect and offer 40 percent more battery life than others

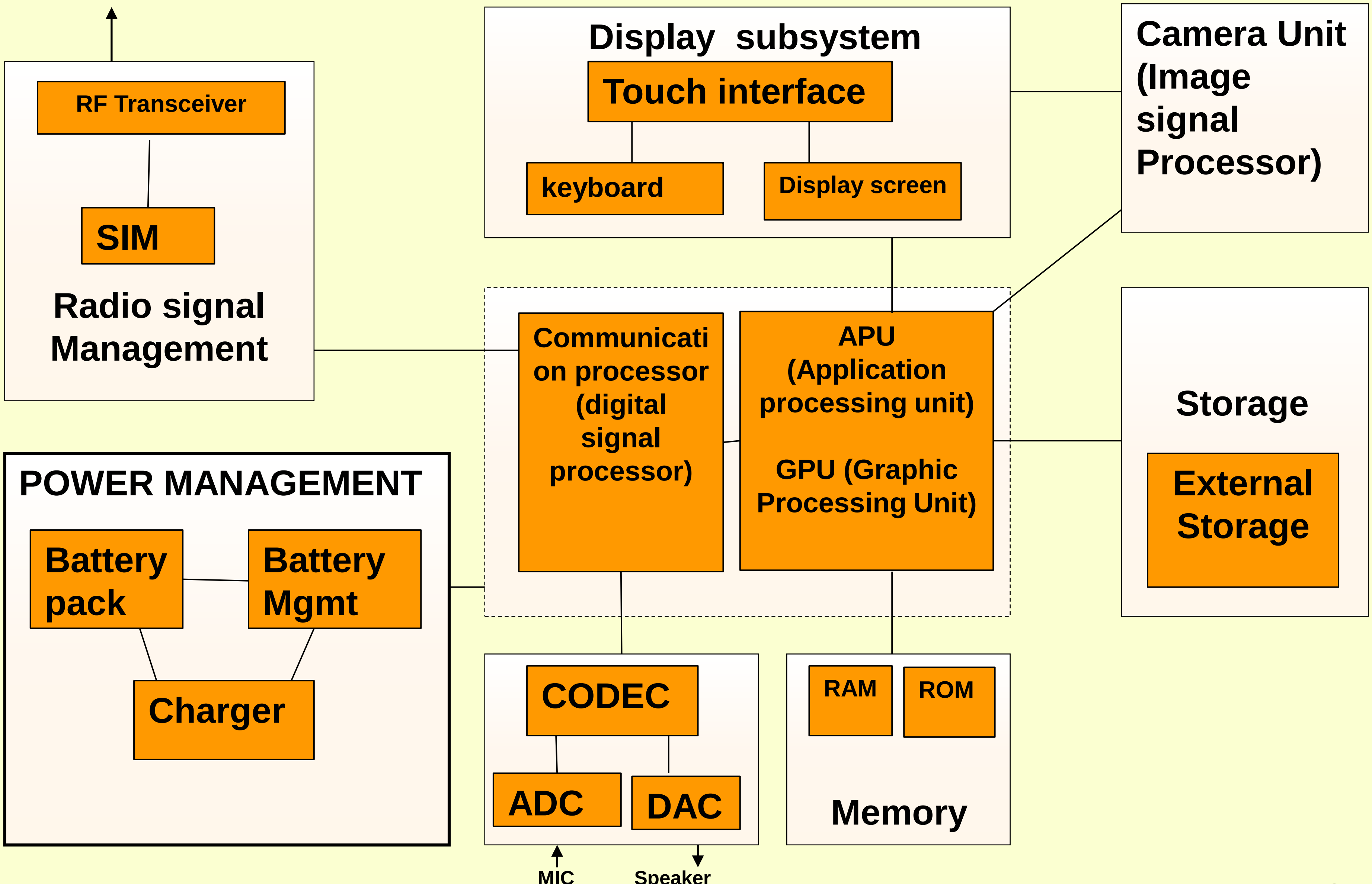
Lithium ion batteries are advanced and allow for a high charge capacity based on the size and weight of the battery. However, these these are slightly expensive. these lithium ion batteries will not remember the charge cycle, and as a result, the battery capacity will not be reduced.

Nickel Cadmium These are the cells that suffer from memory effect. And, the memory effect will result in reducing the capacity of the battery and its lifespan as well.

Nickel Metal Hydride batteries are kind of an upgrade to the Nickel Cadmium batteries, and they boast of the same size as the latter. Nickel Metal Hydride batteries offer 30 to 40 percent more battery juice than the others

Battery Size : Measured in mAh.like 2000 mAh,4000 mAh etc.

Mobile System organization



DEVELOPMENT OF COMPUTER

Abacus is known to be the first mechanical calculating device. Which was used to be performed addition and subtraction easily and speedily? This device was a first develop Ed by the Egyptians in the 10th centaury B.C, but it was given it final shape in the 12th centaury A.D. by the Chinese educationists.

NAPIER’S BONES John Napier’s of Scotland invented a calculating device, in the year 1617 called the Napier Bones. In the device, Napier’s used the bone rods of the counting purpose where some no. is printed on these rods. These rods that one can do addition, subtraction, multiplication and division easily.

Pascal's calculator In the year 1642, Blaise Pascal a French scientist invented an adding machine called Pascal’s calculator, which represents the position of digit with the help of gears in it.

Leibnz Calculator In the year 1671, a German mathematics, Gottfried Leibniz modified the Pascal calculator and he developed a machine which could perform various calculation based on multiplication and division as well.

Analytical EngineIn the year 1833, a scientist form England knows to be Charles Babbage invented such a machine. Which could keep our data safely? This device was the first mechanical computer. Charles Babbage is also known as the father of the computer.

Basic Computer Organization

GENERATION OF COMPUTER

Generatio	Year	Characteristic s
1st	1944-59	Use Valves (Vacuum tubes)
2nd	1959-64	Use transistors
3rd	1964-75	Large Scale Integrated Circuits
4th	1975-	Very Large Scale Integrated Circuits
5th	Under develop ment	"Artificial Intelligence" based computers

Software

It is an organized instructions/code written by programmers using any of various special computer languages for specific purpose.

Types of software:

(1)Application software: It handles specialized/ common tasks a user wants to perform, such as banking, hotel management,any data processing, word processing etc.

(2)System software: controls the basic functions of a computer and hides the complexity of computer system from user and application software. E.g. Operating System, Compiler, Interpret etc.

(3)Utility software: Which helps to manage, maintain and control computer resources. E.g. are antivirus software, backup software and disk tools.

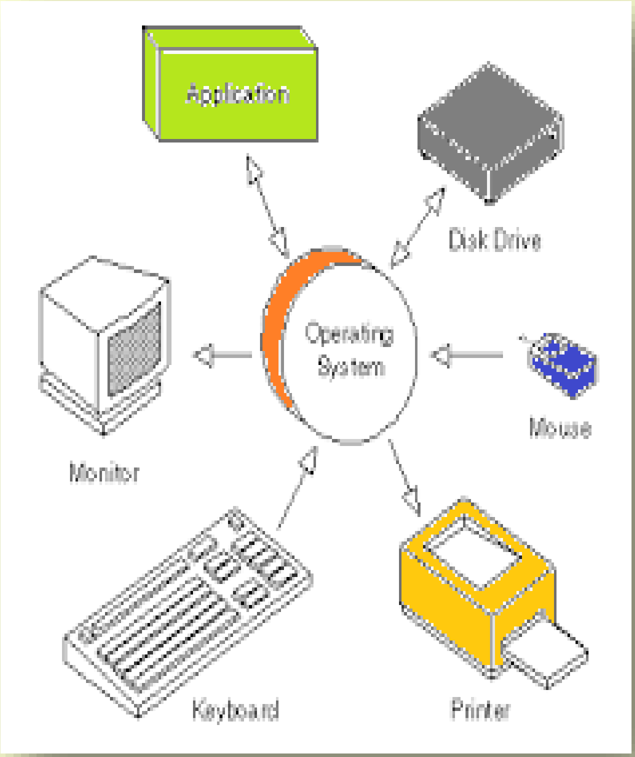
Software

(1) System software

OPERATING SYSTEM

An Operating System (OS) is a system program that controls and manages the computer resources(resource manager) so that application software can run on it.

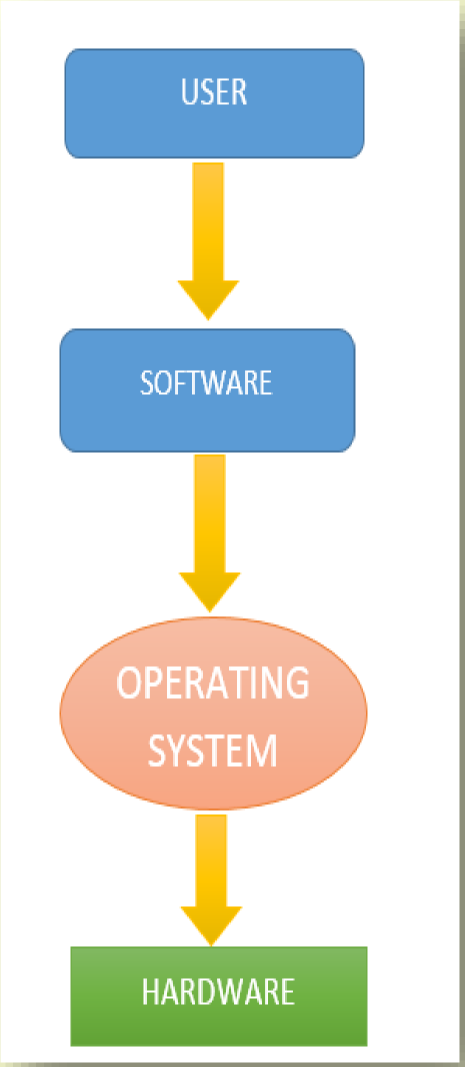
Example: Microsoft Windows, Solaris, Linux, MAC OS,Ubuntu, Apple's i-Phone OS etc.



Software

HOW OPERATING SYSTEM WORKS

In any computer or mobile device, the operating system can be termed as the back bone when it comes to software. This is because it has to be there before other programs can be run.It works as a middleman (interface) between machine and user.



At the simplest level, an operating system does two things:

- It manages the hardware resources of the computer system. These resources include such things as the processor, memory, disk space, etc.

- It provides a stable, consistent way for applications to deal with the hardware without having to know all the details of the hardware.

Software

FUNCTIONS OF OPERATING SYSTEM

- **Processor management**

Loads, schedules and execute process/programs.

- **Memory management**

Allocates /De-allocation of memory for program execution.

- **Device management**

Communicate and controls various I/O devices.

- **Storage management**

Manages and controls the storage device to provide space to program for execution & data save.

- **Application interface**

API/drivers provide a way for applications to make use of hardware subsystems

- **User interface**

structure for interaction between a user and the computer

Software

TYPE OF OPERATING SYSTEM

*** Single-User, Single Task Operating System:**

These operating systems work on single task & single user at a time.E.g. DOS

* **Single-User, Multi-Task Operating System:**

These operating systems works on more than one task and process them concurrently at a time.E.g. windows 95 or later version of windows

*** Multiuser Operating System:**

In these OS, multiple users are allowed to access the same data or information at a time via a **network**. E.g. Unix,Linux,Windows7.

*** Multiprocessing Operating System:**

Here, a single process runs on two or more processors. All the processing and their management takes place in a parallel way, hence this OS are also called as **Parallel Processing**. E.g. Linux, UNIX and Windows 7.

*** Embedded Operating System:**

These are embedded in a device, which is located in ROM.E.g. OS of microwaves,washing machine.

*** Distributed Operating System:**

In these OS, the computers work in co-operation with each other.

Software

SYSTEM SOFTWARE/PROGRAMMING SOFTWARES

Language processor/Programming Language

As the computer understand machine language(0/1) where as Humans understand High level/Human Lang.

Language Processors does the coversion task(high level to machine lang.

These are of 3 types Language processors

*** Assembler** *** Compiler** *** Interpreter**

Compilers

It convert high-level language code to machine code in one session. It takes time because it have to translate high-level code to lower-level machine language all at once and then save the executable object code to memory.

Interpreters

It translates code like a compiler but reads the code and immediately executes that code, and therefore it is initially faster than a compiler.

Assemblers

It translates an assembly language program into machine language.

Software

(2) Application software

* General Purpose application software

These are ready to use software for daily use purpose
e.g. word processor,spread sheet,presention,DBMS etc.

* Specific Purpose application software

Softwares which are designed for specific task
e.g. Payroll,Hotel Mgmt,Hospital Mgmt,Stock Mgmt etc.

(3) Utility software

that assist OS in carrying out certain specialized tasks are called utility software.

- **Antivirus** - An anti-virus scans the system for any virus and if detected, gets rid of it by deleting or isolating it.
- **Compression tools** - Compression tools are utilities that assist operating systems in shortening files so that they take less space.

Software

(3) Utility software

- **Disk Cleanup** - Disk cleanup tools assist users in freeing up disk space.
- **Disk Defragmenter** - Disk defragmenter is a disk management utility that increases file access speeds by rearranging fragmented files on contiguous locations.
- **Backup** - Backup utility enables backing up of files, folders, databases or complete disks.
- **File management tools** - Utility software providing regular file management tasks like browse, search, update, preview, etc. are called file management tools.

Memory units

What does a Computer Understands

Computers do not understand natural languages nor programming languages. They only understand the language of bits. A bit is the most basic unit in computer machine language. All instructions that the computer executes and the data that it processes is made up of a group of bits. Bits are represented in many forms either through electrical voltage, current pulses, or by the state of an electronic flip-flop circuit in form of 0 or 1.

1 Bit = Binary Digit(0 or 1)
8 Bits = 1 Byte
1024 Bytes = 1 KB (Kilo Byte)
1024 KB = 1 MB (Mega Byte)
1024 MB = 1 GB(Giga Byte)
1024 GB = 1 TB(Terra Byte)
1024 TB = 1 PB(Peta Byte)
1024 PB = 1 EB(Exa Byte)
1024 EB = 1 ZB(Zetta Byte)
1024 ZB = 1 YB (Yotta Byte)
1024 YB = 1 (Bronto Byte)
1024 Brontobyte = 1 (Geop Byte)

Boolean Logic

Boolean Logic

Because of computer understands machine language(0/1) which is binary value so every operation is done with the help of these binary value by the computer.

George Boole, **Boolean logic** is a form of **algebra** in which all values are reduced to either 1 or 1.

To understand boolean logic properly we have to understand Boolean logic rule,Truth table and logic gates

Boolean Logic

Boolean Logic rules

Boolean Algebra is the mathematics we use to analyse digital gates and circuits. We can use these "Laws of Boolean" to both reduce and simplify a complex Boolean expression in an attempt to reduce the number of logic gates required.

Boolean Expression	Boolean Algebra Law or Rule
A + 1 = 1	Annulment
A + 0 = A	Identity
A . 1 = A	Identity
A . 0 = 0	Annulment
A + A = A	Idempotent
A . A = A	Idempotent
NOT A = A	Double Negation
A + A = 1	Complement
A . A = 0	Complement
A+B = B+A	Commutative
A.B = B.A	Commutative
A+B = A.B	de Morgan's Theorem
A.B = A+B	de Morgan's Theorem

Boolean Logic

Boolean Expression

A **Boolean expression** is a logical statement that is either TRUE or FALSE .

A Boolean expression can consist of Boolean data, such as the following:

*** BOOLEAN values (YES and NO, and their synonyms, ON and OFF, and TRUE and FALSE)**

*** BOOLEAN variables or formulas**

*** Functions that yield BOOLEAN results**

- **BOOLEAN values calculated by comparison operators.**

E.g.

1. $\$F(x, y, z) = x' y' z' + x y' z + x y z' + x y z$
2. $\$F' (x, y, z) = x' y z + x' y' z + x' y z' + x y' z'$
3. $\$F(x, y, z) = (x + y + z) . (x+y+z') . (x+y'+z) . (x'+y+z)$

Boolean Logic

De Morgan's Law

The complement of the union of two sets is equal to the intersection of their complements and the complement of the intersection of two sets is equal to the union of their complements. These are called **De Morgan's laws**.

For any two finite sets A and B

(i) (A U B)' = A' ∩ B' (which is a De Morgan's law of union).

OR

(A+B)'=A'.B'

(ii) (A ∩ B)' = A' U B' (which is a De Morgan's law of intersection).

OR

(A . B)'=A'+B'

Boolean Logic

Proof of De Morgan's law: (A U B)' = A' ∩ B'
Let P = (A U B)' and Q = A' ∩ B'

Let x be an arbitrary element of P then x ∈ P ⇒ x ∈ (A U B)'
⇒ x ∉ (A U B)
⇒ x ∉ A and x ∉ B
⇒ x ∈ A' and x ∈ B'
⇒ x ∈ A' ∩ B'
⇒ x ∈ Q
Therefore, P ⊂ Q …………….. (i)
Again, let y be an arbitrary element of Q then y ∈ Q ⇒ y ∈ A' ∩ B'
⇒ y ∈ A' and y ∈ B'
⇒ y ∉ A and y ∉ B
⇒ y ∉ (A U B)
⇒ y ∈ (A U B)'
⇒ y ∈ P
Therefore, Q ⊂ P …………….. (ii)
Now combine (i) and (ii) we get; P = Q i.e. (A U B)' = A' ∩ B'

Boolean Logic

Proof of De Morgan's law: (A ∩ B)' = A' U B'
Let M = (A ∩ B)' and N = A' U B'
Let x be an arbitrary element of M then x ∈ M ⇒ x ∈ (A ∩ B)'
⇒ x ∉ (A ∩ B)
⇒ x ∉ A or x ∉ B
⇒ x ∈ A' or x ∈ B'
⇒ x ∈ A' U B'
⇒ x ∈ N
Therefore, M ⊂ N …………….. (i)
Again, let y be an arbitrary element of N then y ∈ N ⇒ y ∈ A' U B'
⇒ y ∈ A' or y ∈ B'
⇒ y ∉ A or y ∉ B
⇒ y ∉ (A ∩ B)
⇒ y ∈ (A ∩ B)'
⇒ y ∈ M
Therefore, N ⊂ M …………….. (ii)
Now combine (i) and (ii) we get; M = N i.e. (A ∩ B)' = A' U B'

Boolean Logic

Truth table

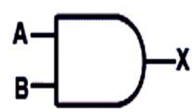
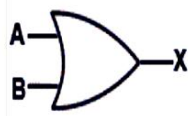
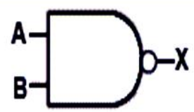
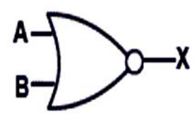
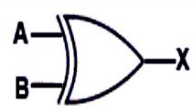
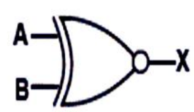
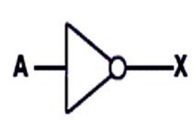
A **truth table** is a mathematical **table** used in logic.
e.g.

A	B	(A and B)	(A or B)	not(A and B)	not(A or B)
True	True	True	True	False	False
True	False	False	True	True	False
False	True	False	True	True	False
False	False	False	False	True	True

Boolean Logic

Logic Gates

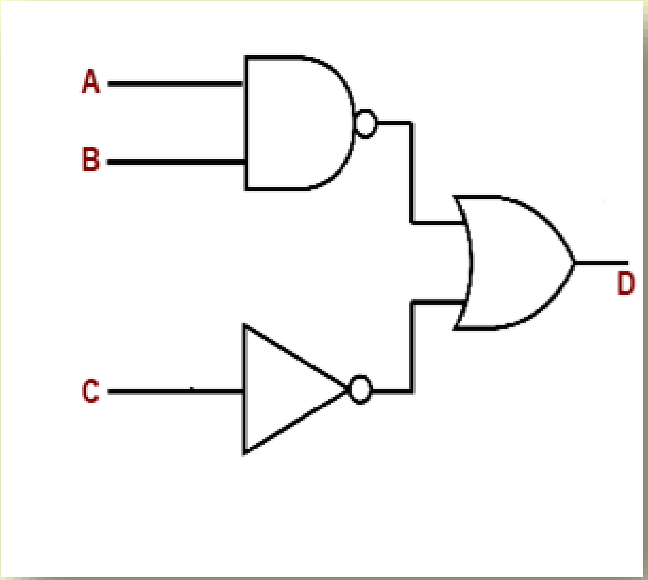
Logic gate is an idealized or physical device implementing a Boolean function. These are used to construct logic cicuit

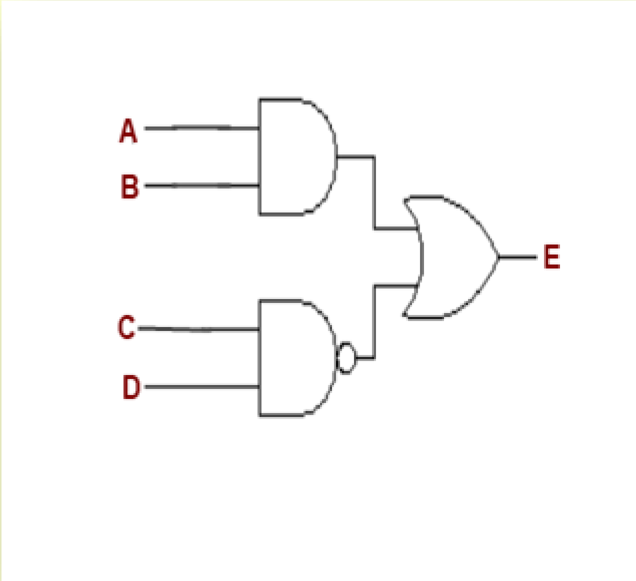
LOGIC GATE SYMBOL	DESCRIPTION	BOOLEAN OPER.
	The AND gate output is at logic 1 when, and only when all its inputs are at logic 1, otherwise the output is at logic 0.	$X = A \cdot B$
	The OR gate output is at logic 1 when one or more of its inputs are at logic 1. If all the inputs are at logic 0, the output is at logic 0.	$X = A+B$
	The NAND Gate output is at logic 0 when, and only when all its inputs are at logic 1, otherwise the output is at logic 1.	$X = \overline{A \cdot B}$
	The NOR gate output is at logic 0 when one or more of its inputs are at logic 1. If all the inputs are at logic 0, the output is at logic 1.	$X = \overline{A+B}$
	The XOR gate output is at logic 1 when one and ONLY ONE of its inputs is at logic 1. Otherwise the output is logic 0.	$X = A \oplus B$
	The XNOR gate output is at logic 0 when one and ONLY ONE of its inputs is at logic 1. Otherwise the output is logic 1. (It is similar to the XOR gate, but its output is inverted).	$X = \overline{A \oplus B}$
	The NOT gate output is at logic 0 when its only input is at logic 1, and at logic 1 when its only input is at logic 0. For this reason it is often called an INVERTER.	$X = \overline{A}$

Boolean Logic

Logic circuit

Construct a truth tables for following circuits of logic gates





Construct the logic circuit of following

1. **C + BC:**
2. **AB+BC(B+C)**

Boolean Logic

Universal gates are the logic gates which are capable of implementing any Boolean function without requiring any other type of gate.

Types of Universal Gates-

In digital electronics, there are only two universal gates which are-

1. **NAND Gate**
2. **NOR Gate**