Computer: Introduction

- Computer is an
  - Electronic Device
  - Calculating and Data Processing Machine
- Performs task in 3 steps
  - Input >> Process > >Output

Input, Process, Output

Input : Data and instructions given to the computer

Input Unit: Device that feeds input to computer. E.g. Keyboard
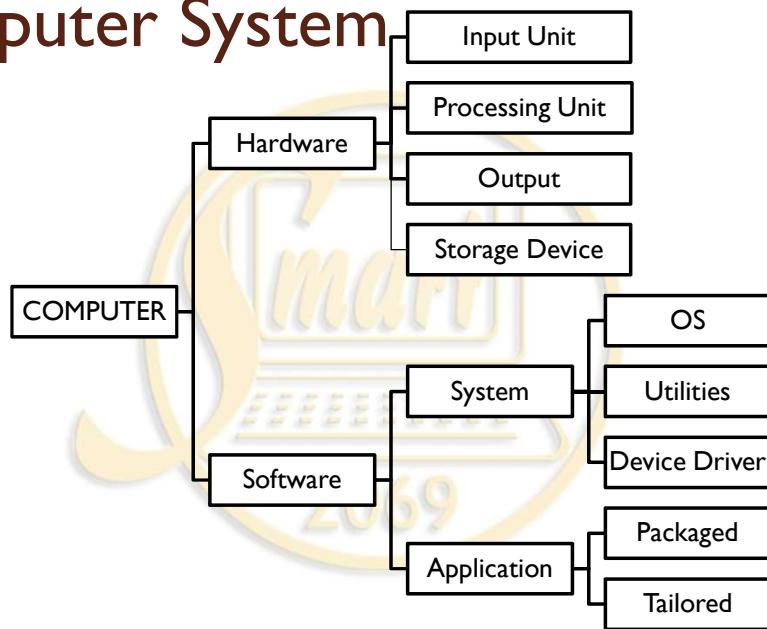
Process: Actual execution of task

Processing Unit : CPU (Central Processing Unit) known as Processor, Attached on motherboard

Output: Result obtained after processing

Output Unit : Device that gives output. E.g. Printer

Computer System

		Input Unit
		Processing Unit
	Hardware	Output
		Storage Device
COMPUTER		
		OS
	System	Utilities
		Device Driver
	Software	
		Packaged
	Application	Tailored

Hardware

All the physical parts of computer

Input Unit	Processing Unit	Output Unit	Storage Unit
Keyboard	CPU/Processor	Printer	Hard Disk
Mouse		Monitor	CD/DVD
Joystick		Speaker	
Scanner		Projector	Pen Drive
Touch Screen		Plotter	Memory Card

Software

Set of Instructions → Program

Set of Programs → Software

Application Software

Software to perform specific task

a) Packaged Software:

- Readymade Software

- Developed for Public Use

- Eg. Graphic Designing, Multimedia

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Software

Set of Instructions → Program

Set of Programs → Software

Application Software

Software to perform specific task

b) Tailored Software:

- Customized Software

- Developed for Personal/Private Use

- Billing Software, School Management Soft

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Software

System Software

Designed to run computer hardware and application

a) Operating System Software:

- Operates Computer

- Provides Platform for other application

- Mediator between user and hardware

- Monitors all computer activities

- E.g. DOS, Windows, MAC, Android, IOS

Software

System Software

Designed to run computer hardware and application

b) Utilities :

- Helps to analyze, maintain, optimize, configure

- Takes care of computer

- E.g. Antivirus, Cleanup, Disk Defragmenter

Characteristics/Features of Computer
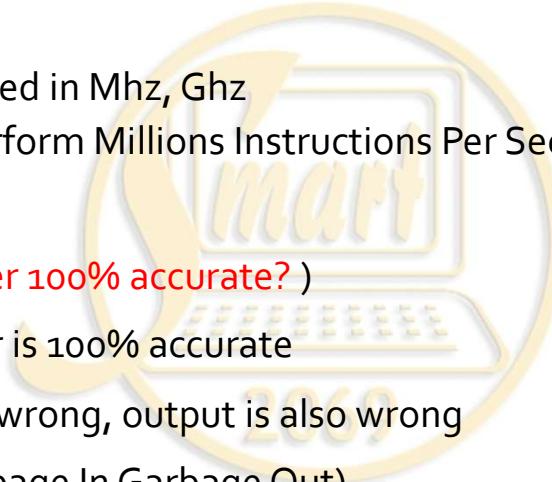
Speed
- Measured in Mhz, Ghz
- Can perform Millions Instructions Per Second
- Accuracy

(Is Computer 100% accurate?)

- Computer is 100% accurate

- If input is wrong, output is also wrong

(GIGO: Garbage In Garbage Out)

Characteristics/Features of Computer

Storage

0 or 1 = bit

4 bits = 1 nibble

8 bits = 1 byte/ 2 nibbles

1024 bytes= 1 KB (Kilobyte)

1024 KB = 1 MB (Megabyte)

Characteristics/Features of Computer

Storage

1024 MB = 1 GB (Gigabyte)
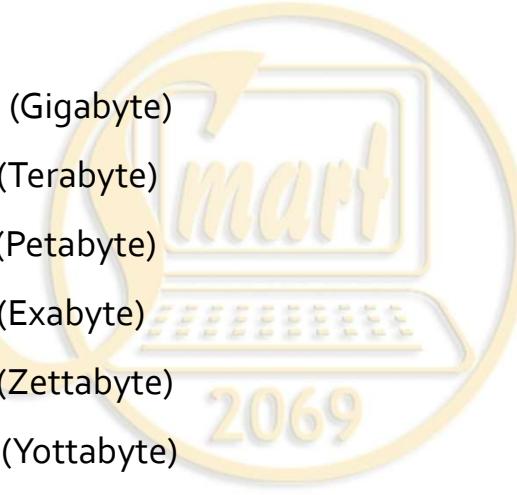
1024 GB = 1 TB (Terabyte)

1024 TB = 1 PB (Petabyte)

1024 PB = 1 EB (Exabyte)

1024 EB = 1 ZB (Zettabyte)

1024 ZB = 1 YB (Yottabyte)

Characteristics/Features of Computer

Storage

Symbol	Power of 10 (in bytes)	Power of 2 (in bytes)
KB	10^3	2^{10}
MB	10^6	2^{20}
GB	10^9	2^{30}
TB	10^{12}	2^{40}
PB	10^{15}	2^{50}
EB	10^{18}	2^{60}
ZB	10^{21}	2^{70}
YB	10^{24}	2^{80}

Characteristics/Features of Computer

Reliability

Automation (Automatic)

Versatility

    Can perform various tasks, can be used in different fields

Diligence (Tirelessness)
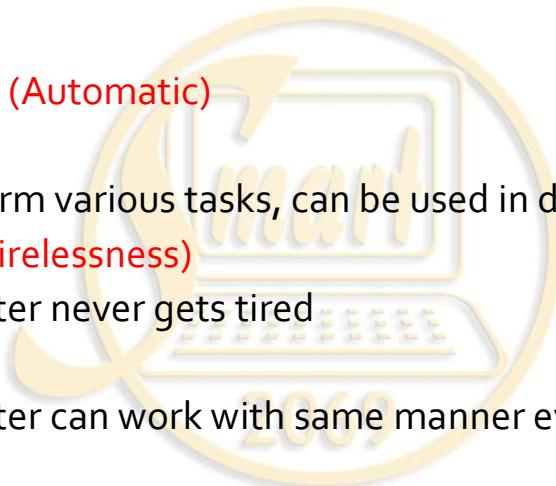
    - Computer never gets tired

Consistency

    - Computer can work with same manner every time
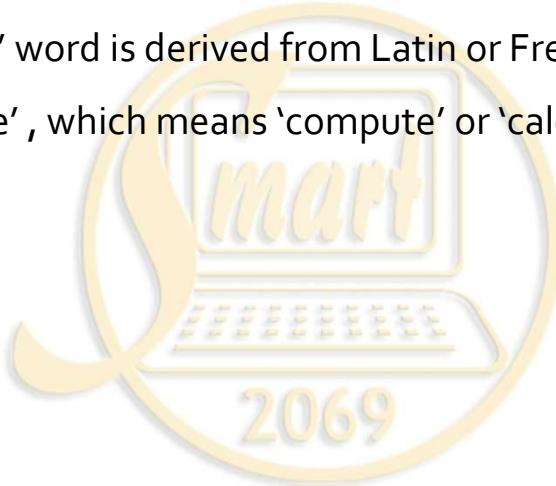
Precision

    - In Calculation, computer can maintain the level of accuracy

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History of Computer

- 'Computer' word is derived from Latin or French word

    'computare' , which means 'compute' or 'calculate'

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History of Computer

What

- ABACUS

Who

- Chinese People
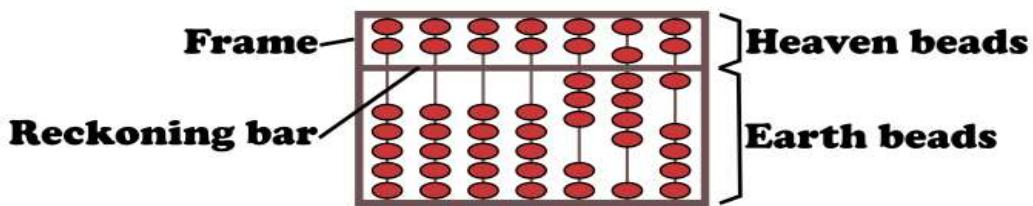
When

- 2500-3000 BC

ABACUS

- First calculating machine

- Made up of with wooden frame with beads

History of Computer

What
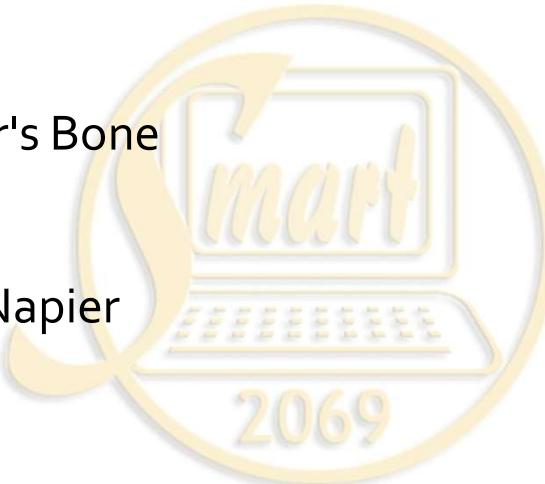
- Napier's Bone

Who

- John Napier

When

- 1617

Napier's Bone

- Multiplying Machine
- Made up of ivory bones engraved with multiplication table
- Also used for division and taking square root

History of Computer

What

- Slide Rule

Who

- William Oughtred
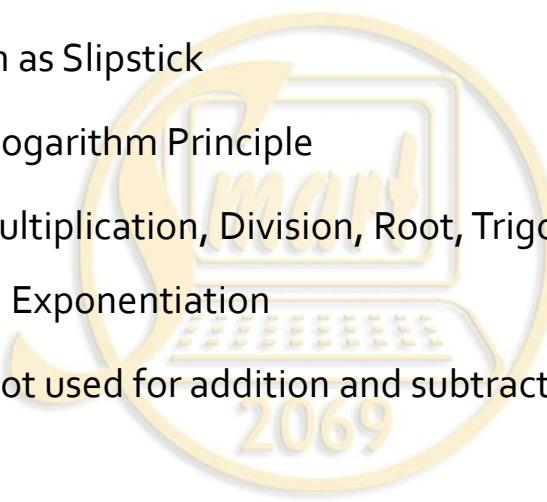
When

- 1622

Slide Rule

- Also known as Slipstick

- Works on Logarithm Principle

- Used for Multiplication, Division, Root, Trigonometry, Logarithm, Exponentiation

- Normally not used for addition and subtraction

History of Computer

What

- Pascaline

Who

- Blaise Pascal

When

- 1642

Pascaline

- Also known as Pascal's Calculator or Arithmetic Machine
- First Mechanical Calculator
- Capable for addition and subtraction
- Have toothed metal wheels having number 0 to 9

History of Computer

What
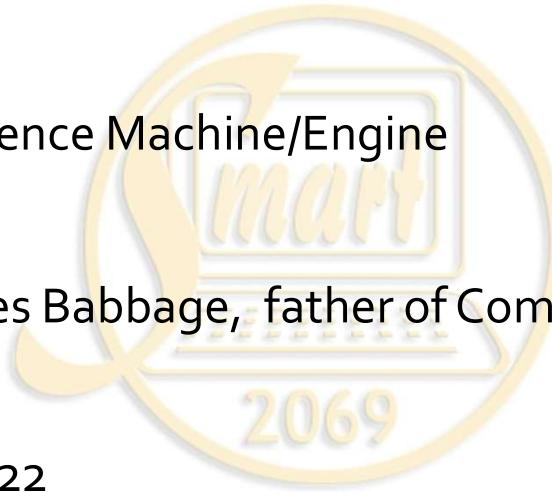
- Difference Machine/Engine

Who

- Charles Babbage, father of Computer
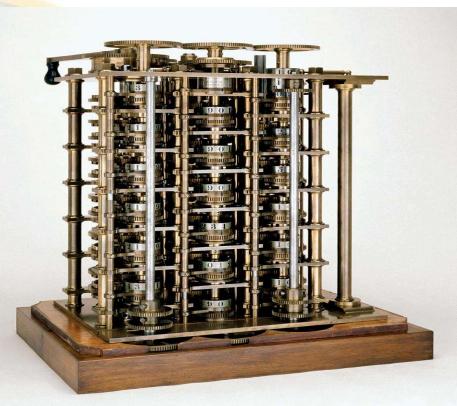
When

- 1821-22

Difference Machine/Engine

- Decimal Digital Machine

- Could perform complex mathematical calculation

- Upto 31 digits of precision

- Used to solve polynomial equations

History of Computer

What

- Analytical Engine

Who

- Charles Babbage
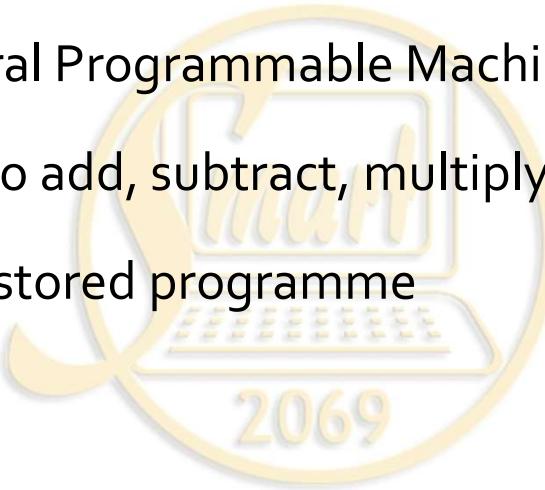
When

- 1837

Analytical Engine

- General Programmable Machine

- Able to add, subtract, multiply, divide

- Used stored programme

Some Important Inventions

Atanasoff Berry Computer (ABC): First automatic <u>electronic digital</u> computer

Hardvard Mark-I: Automatic Sequence Controlled Calculator (ASCC), First automatic <u>electromechanical</u> computer

Colossus: First electronics digital programmable computing device.

ENIAC (Electronic Numerical Integrator and Calculator) : First <u>general purpose electronic digital</u> computer

Some Important Inventions

EDVAC (Electronic Discrete Variable Automatic Computer)-First stored program computer

EDSAC (Electronic Delay Storage Automatic Computer) -First <u>practical stored-program</u> electronic

UNIVAC (Universal Automatic Computer)-First <u>Commercial</u> Computer

Cray-1: First Super Computer

UNIVAC-1: First Mainframe Computer

Some Important Inventions

PDP-1: First Mini Computer

Altair-8800: First Micro Computer

Father of Computer: Charles Babbage

Father of Modern Computer: Charles Babbage

Father of Computer Science: Alan Turing

Father of Artificial Intelligence: John McCarthy

First Computer Programmer: Lady Augusta Ada

Generation Computer

- Classification of computer in different time frame on the basis of their technological development

- 5 Generations till now
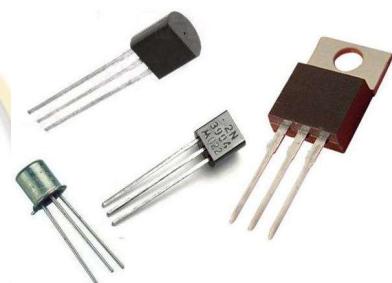
First Generation

- 1940s-1950s

- Electronic Device used: Vacuum Tube and Valves

- Large and Bulky in size

- Slow (speed: millisecond range) = 10^{-3} second

- Consume lots of electricity

- E.g., ENIAC, EDSAC, EDVAC, IBM-650, 702

Second Generation

- 1950s-1960s

- Electronic Device used: Transistor

- Smaller and faster than 1st gen.

   (speed: microsecond range) = 10^{-6}

  second

- E.g. IBM 7000, ATLAS, Honeywell-200

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Third Generation

- 1960s-1970s

- Used IC (Integrated Circuits) Chips

- Smaller and faster than 2nd gen.
   (speed: nanosecond range) = 10^{-9}
   second

- Used Operating System

- E.g. IBM 360 ICL 2900

Fourth Generation

- 1970s-1990s

- Used Microprocessor

- Use of Keyboard, Mouse, Scanner

- Smaller and faster than 3rd gen.
   (speed: picosecond range) = 10^{-12}
   second

- E.g. Pentium Series, IBM System/370

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Fifth Generation

-Future Generation

- Will be based on biochips

- Will have artificial Intelligence (AI)

- Ability to solve problems

- Will recognize voice, image etc

- Still in developing stage

- Very fast (speed: femtosecond range) = 10^{-15} second

[Artificial Intelligence: Capability of computer to perform task as human beings]

History of Computer in Nepal
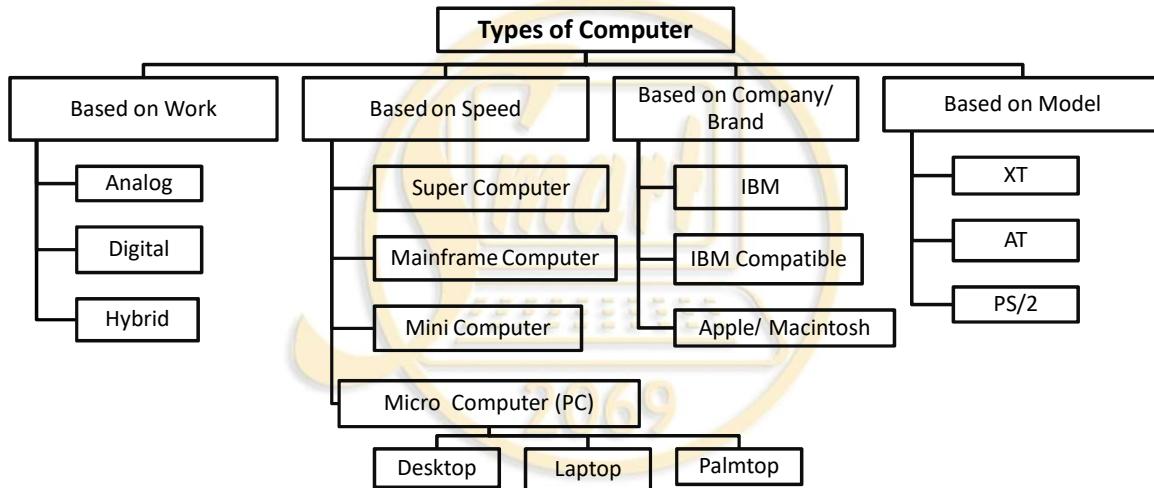
2018 B.S: Electronic Calculator FACIT

2028 B.S: IBM 1401- Mainframe Computer

2031 B.S: NCC (National Computer Center) was established

2038 B.S: ICL-2950/10- Mainframe Computer

Types of Computer

Based on Work
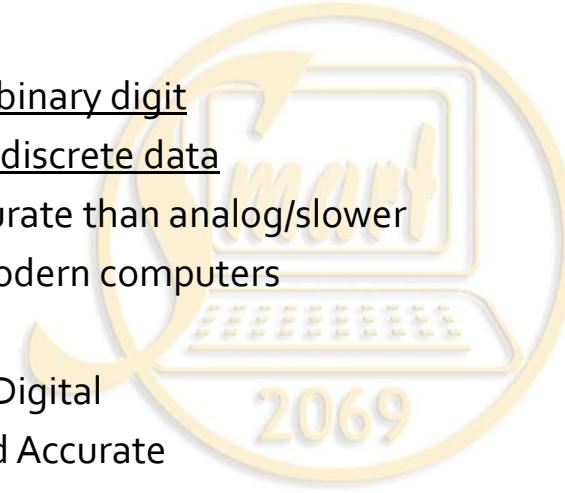
1) Analog

- Measures <u>physical quantities</u> (temperature, pressure, speed etc)

- Words on <u>Continuous variable data</u>

- Faster than digital/Less accurate

- E.g of analog devices: speedometer, thermometer

Based on Work

2) Digital
- Based on <u>binary digit</u>
- Words on <u>discrete data</u>
- More accurate than analog/slower
- E.g. All modern computers

3) Hybrid
- Analog + Digital
- Faster and Accurate
- E.g. ECG, CT Scan

Based on Size and Speed

1) Micro Computer
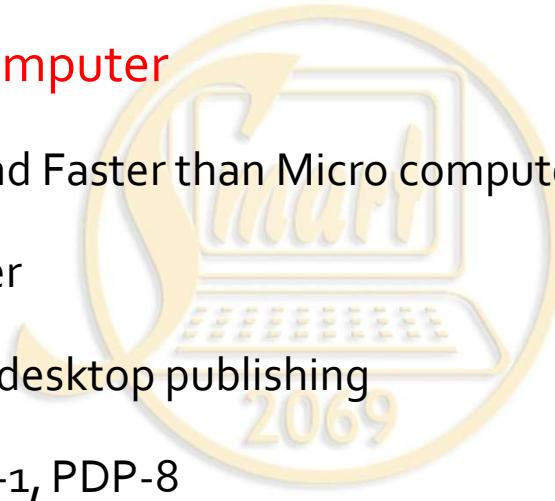
- Smallest and Limited Speed

- Personal Computer (PC)

- Single User

- Used at home, office

- Desktop, Laptop

Based on Size and Speed

2) Mini Computer
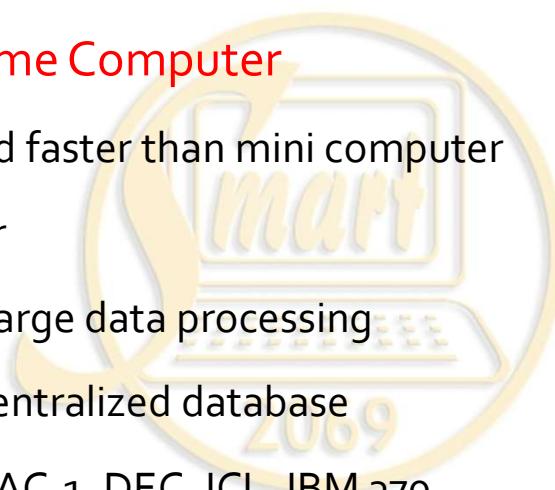
- Larger and Faster than Micro computer

- Multi User

- Used for desktop publishing

- E.g. PDP-1, PDP-8

Based on Size and Speed

3) Mainframe Computer
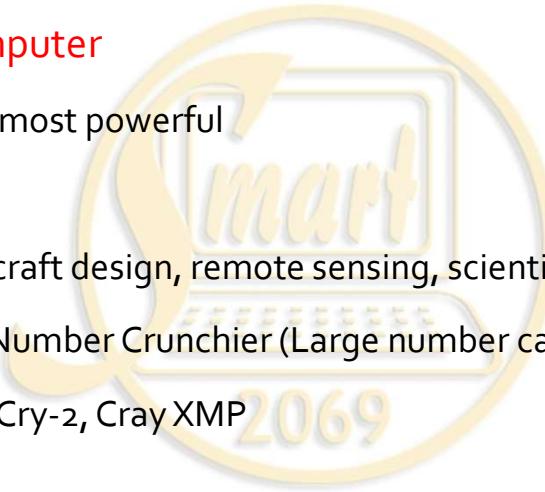
- Larger and faster than mini computer
- Multi User
- Used for large data processing
- Used in Centralized database
- E.g. UNIVAC-1, DEC, ICL, IBM 370

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Based on Size and Speed

4) Super Computer

- Fastest and most powerful
- Multi User
- Used for aircraft design, remote sensing, scientific research etc
- Also called Number Crunchier (Large number calculation)
- E.g. Cray-1, Cry-2, Cray XMP

Based on Brand/Company
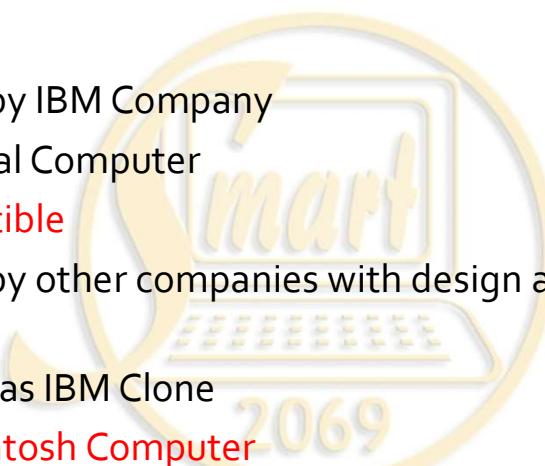
1) IBM PC
- Developed by IBM Company
- First Personal Computer

2) IBM Compatible
- Developed by other companies with design and architecture of IBM
- Also known as IBM Clone

3) Apple/Macintosh Computer
- Developed by Apple Company with own design and architecture

Based on Model

1) XT Computer (Extended Technology)
- Does not support GUI based OS
- Processing speed 4.77 Mhz
- E.g. Intel 8080, 8086, 8088
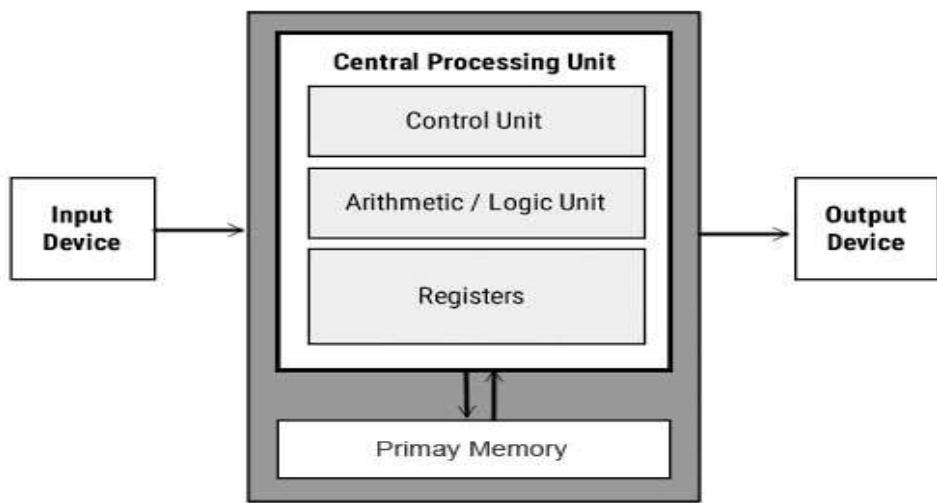
2) AT Computer (Advanced Technology)
- Supports GUI based OS
- Processing speed 2 Ghz
- E.g. Intel Pentium series

3) PS/2 Computer (Personal System/2)
- Advanced of AT Computer
- Mostly used in laptops
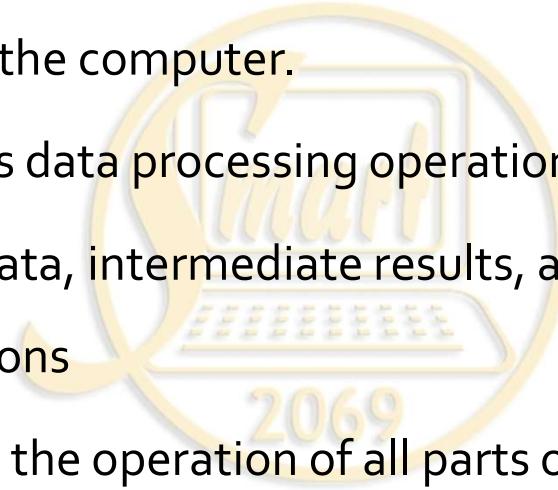
Architecture of Computer

Central Processing Unit

- Control Unit
- Arithmetic / Logic Unit
- Registers

Input Device → Output Device

Primay Memory

Von Neumann Architecture by John Von Neumann
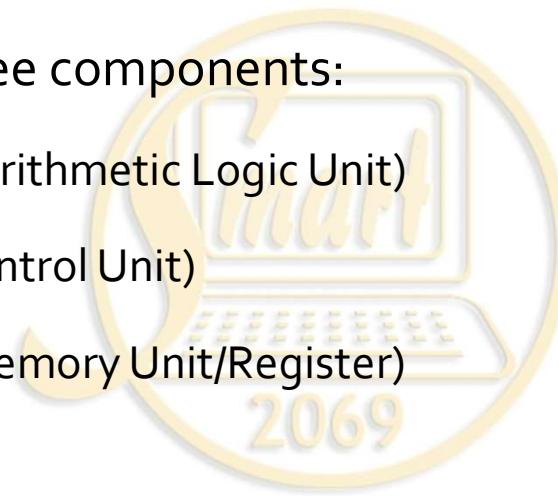
CPU (Processor)

- Brain of the computer.

- Performs data processing operations.

- Stores data, intermediate results, and instructions

- Controls the operation of all parts of computer.

CPU (Processor)

- Has three components:
  - ALU (Arithmetic Logic Unit)
  - CU (Control Unit)
  - MU (Memory Unit/Register)

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Arithmetic Logic Unit

- Consists of two sections:
  - ◦ Arithmetic Section
    - Performs arithmetic operations and complex operations
    - Actual processing unit
  - ◦ Logic Section
    - Performs logical operations like comparison, selection, matching and merging of data

Control Unit

- Nerve System of computer

- Controls overall operations of computer

- Controls the flow/transfer of data

- Performs <u>fetch, decode and execute</u> operation

- Does not process or store data

Register (Memory Unit)

- Temporarily stores data currently being processed

- Stores intermediate result of processing

- Stores result before transferring to output device

- Accept, store and transfer data very fast

Types of Register

- MAR
- PC
- AC
- MDR

- Index
- MBR
- Data
- Link

MAR (Memory Address Register)

- Holds the <u>memory addresses of data</u> and instructions currently being processed

AC Register (Accumulator)

- Stores the <u>Results</u> those are produced by the System

MDR (Memory Data Register)

- Holds the data obtained from MAR <u>before it goes to the decoder</u>

PC (Program Counter)

- Also called instruction pointer register/ instruction address register

- Holds the address of the memory <u>location of the next instruction</u>

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MBR (Memory Buffer Register)

- Holds the contents of data or instruction being transferred to, from memory

Index Register

- Holds a number that can be added to (or, in some cases, subtracted from) the address used for modifying operand addresses

Data Register
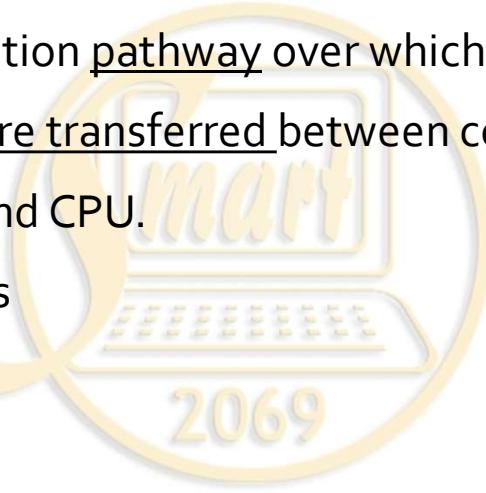
- Stores data being transmitted to or from a peripheral device

Link Register

- Stores computation value like carry over
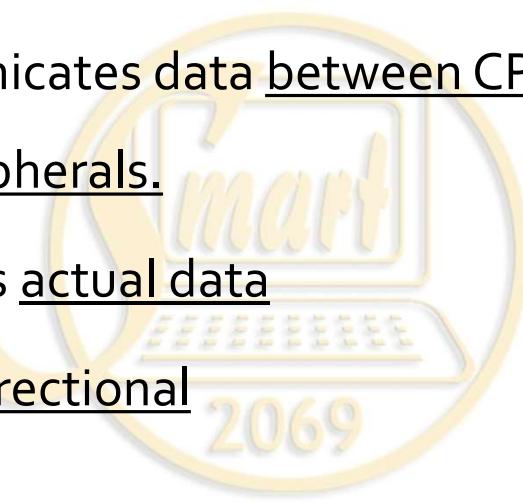
System BUS

- Communication <u>pathway</u> over which information and <u>signal are transferred</u> between components of computer and CPU.
- Types of Bus
  - Data Bus
  - Control Bus
  - Address Bus
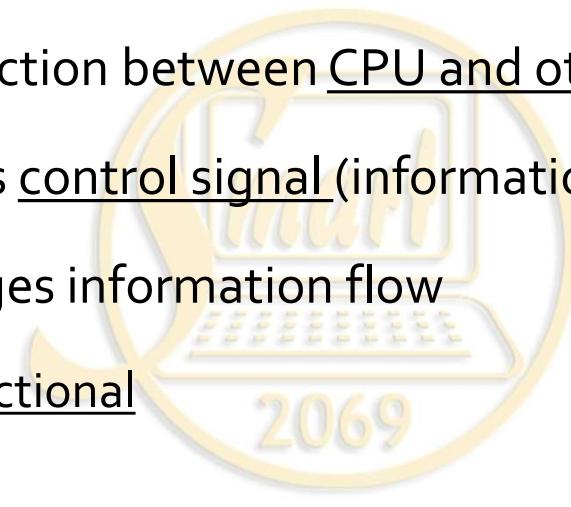
Data Bus

- Communicates data <u>between CPU, memory, and peripherals.</u>

- Transfers <u>actual data</u>

- It is <u>bi-directional</u>
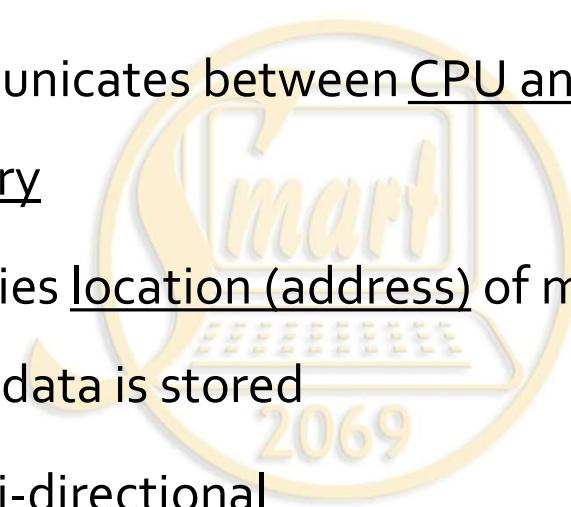
Control Bus

- Connection between CPU and other devices

- Carries control signal (information)

- Manages information flow

- Bi-directional

Address Bus

- Communicates between CPU and Main Memory

- Identifies location (address) of main memory where data is stored

- It is uni-directional

CPU Machine Cycle

- **Fetch**: get an <u>instructions</u> from <u>main memory</u>

- **Decode**: <u>translate</u> it into computer commands

- **Execute**: <u>actually process</u> the commands

- **Store**: write the <u>result to main memory</u>

Affecting factors of CPU Speed

- System Clock Rate

- Bus width

- Word size (Length)

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Clock Rate (Clock Speed/Frequency)

- Number of cycles CPU executes per second

- Known as processor speed

- Measured in Mhz (Megahertz), GHz

  (gigahertz)

  (1 Mhz= 1million cycles per second)

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Bus Width/ Bus size

- Amount of <u>data</u> that can be <u>transferred at a time</u> to

  memory and to input and output devices

- Measured in <u>bits</u>

- Bus width can be 8, 16, 32, 64, 128 and so far.

  (An 8-bit bus moves 8 bits of data at a time)

Word Length/ Word Size

- Amount of <u>data</u> that can be <u>processed at a time</u>

- Measured in <u>bits</u>

- Can be 8, 16, 32, 64, 128 and so far.

  (An 8-bit process can processs 8 bits of data at a time)

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Integrated Circuit (IC)

- Also called **microelectronic circuit, microchip, or chip**

- Made up of **Silicon**

- An **assembly** of electronic components (like collection of electronic components -- resistors, transistors, capacitors, etc) fabricated as a **single unit**

- Each Electronic Circuit in IC is known as a **bit cell**

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Scale of Integration

(Based on **Density of Components)**

- SSI (Small Scale Integration): contains less than **100**
- MSI (Medium Scale Integration): less than **500** components
- LSI (Large Scale Integration): **500 to 300000** components.
- VLSI (Very Large Scale Integration): contains more than **300000** components
- ULSI (Ultra Large Scale Integration): **more than 3 millions** of components.

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Computer Memory
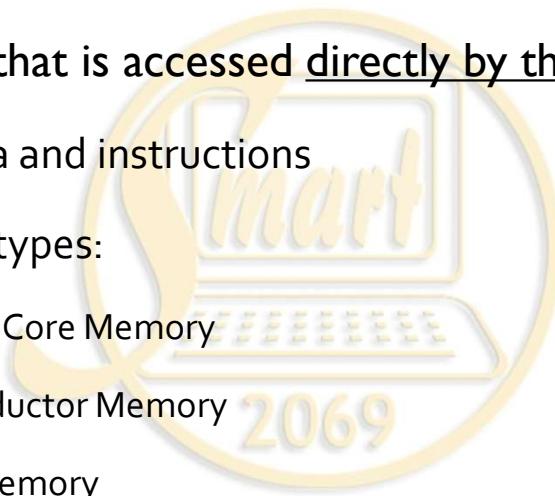
- Storage location where data /instruction or information are stored either temporarily or permanently

Types

- Primary Memory/ Main Memory / Internal Memory
- Secondary Memory/ Auxiliary Memory/ External Memory

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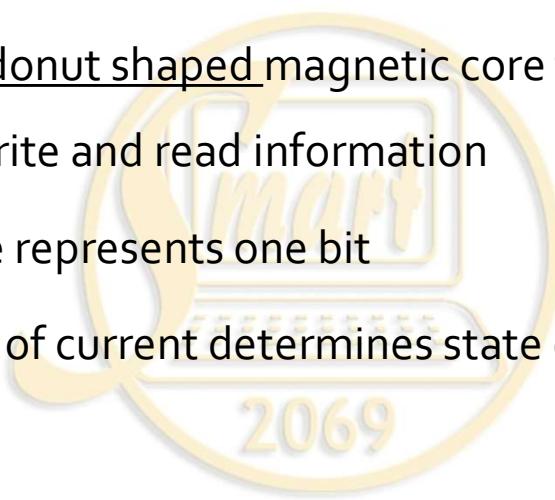
Primary Memory

- Memory that is accessed <u>directly by the CPU</u>

- Holds data and instructions

- Common types:
  - Magnetic Core Memory
  - Semiconductor Memory
  - Bubble Memory
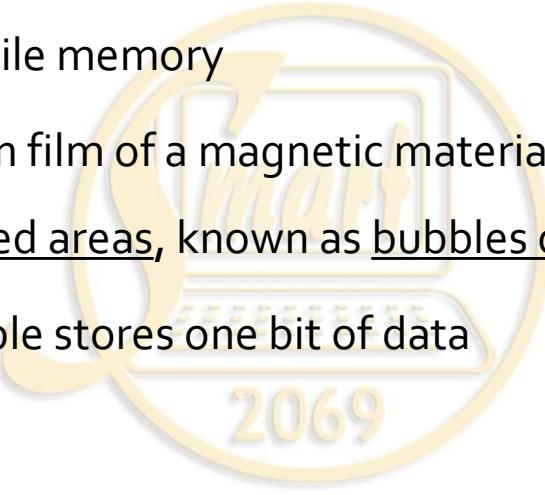
Magnetic Core Memory

- Use tiny <u>donut shaped</u> magnetic core <u>threaded with wire</u> to write and read information

- Each core represents one bit

- Direction of current determines state of each core (0 or 1).
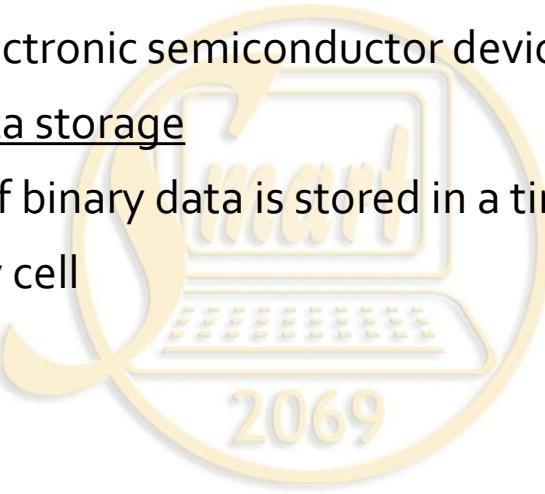
Bubble Memory

- Non-volatile memory

- Uses a thin film of a magnetic material to hold small magnetized areas, known as bubbles or domains

- Each bubble stores one bit of data
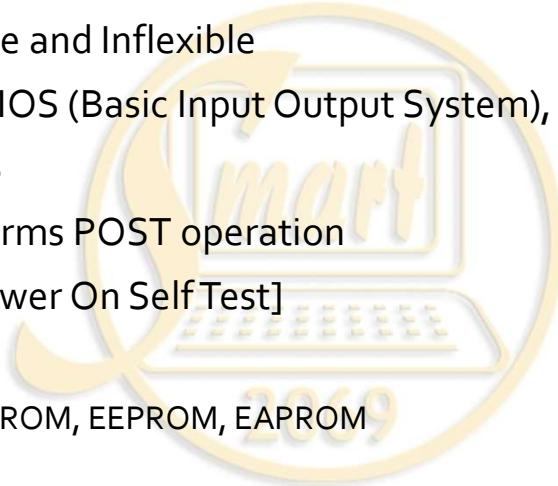
Semiconductor Memory

- Digital electronic semiconductor device used for digital data storage

- Each bit of binary data is stored in a tiny circuit called a memory cell

- Types
  - ROM
  - RAM
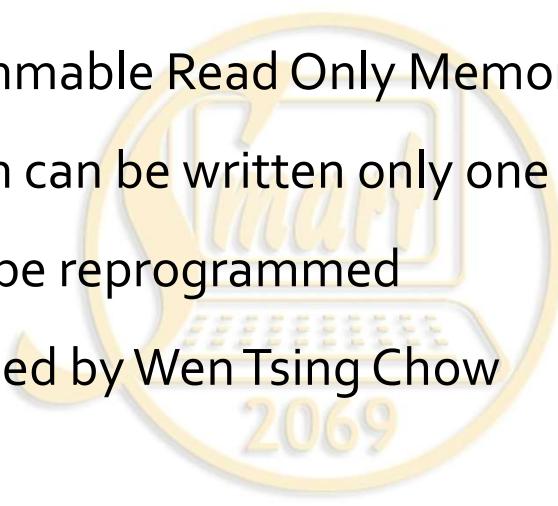
ROM (Read Only Memory)

- Non Volatile and Inflexible
- Contains BIOS (Basic Input Output System), also known as ROM-BIOS
- BIOS performs POST operation
  [POST= Power On Self Test]
- Types
  - PROM, EPROM, EEPROM, EAPROM

PROM

- Programmable Read Only Memory

- Program can be written only one time

- Cannot be reprogrammed

- Developed by Wen Tsing Chow

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EPROM

- Erasable Programmable Read Only Memory
- Can be erased by Ultra Violet Ray
- Can be reprogrammed
- Developed by Dov Frohman

EEPROM

- Electrically Erasable Programmable Read Only Memory
- Can be erased by Electric Charge
- Can be reprogrammed
- Developed by George Perlegos

EAPROM

- Electrically Alterable Programmable Read Only Memory
- Contents of selected memory locations can be changed by applying suitable electric signals
- Can be reprogrammed

RAM (Random Access Memory)

- Volatile Memory
  - All data get lost if power supply is off
- Temporary Memory
- Read/Write Memory
- User Memory
- Working Memory
- Types: SRAM (Static RAM), DRAM (Dynamic RAM)

SRAM vs DRAM

SRAM	DRAM
• No need to refresh periodically	• Needs to refresh periodically
• Faster than DRAM	• Slower than SRAM
• Uses Transistor	• Uses capacitor
• Uses less power	• Uses more power
• Can store less data	• Can store more data
• Used in Cache Memory	• Used in Main Memory

Secondary Memory

- Storage Devices

- Permanent, Stable, Persistent, Non Volatile

- Program and data are stored for future use

- Not directly accessed by CPU

- Slower and cheaper than Primary Memory
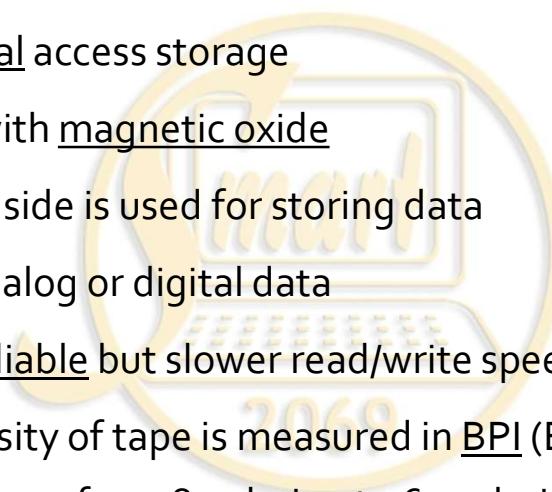
Secondary Memory

- Magnetic Media
  - Magnetic Drum, Magnetic Tape, Floppy Disk, Hard Disk, Zip disk
- Optical Disk
  - CD, DVD,

Magnetic Tape

- Sequential access storage
- Coated with magnetic oxide
- Only one side is used for storing data
- Stores analog or digital data
- Highly reliable but slower read/write speed
- Data density of tape is measured in BPI (Bits per Inch) which ranges from 800 bpi upto 6250 bpi

Magnetic Drum

- <u>Random access storage</u>

- Metal cylinder coated with magnetic iron-oxide (ferromagnetic) material

- Single drum can have up to 200 tracks

- Drum rotates at a speed of up to 3,000 rpm

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Floppy Disk

- Called diskette

- Developed by IBM Company

- Information is recorded in circular tracks

- The capacity of commonly used floppy disk is 1.44 MB

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Floppy Details

Size and Type	Speed	Track	Sector	Capacity
5.25" (Double Density)	300 rpm	40	9	360 KB
5.25" (High Density)	360 rpm	80	15	1.2 MB
3.5" (Double Density)	300 rpm	80	9	720 KB
3.5" (High Density)	300 rpm	80	18	1.44 MB
3.5" (Extra HD)	300 rpm	80	36	2.88 MB
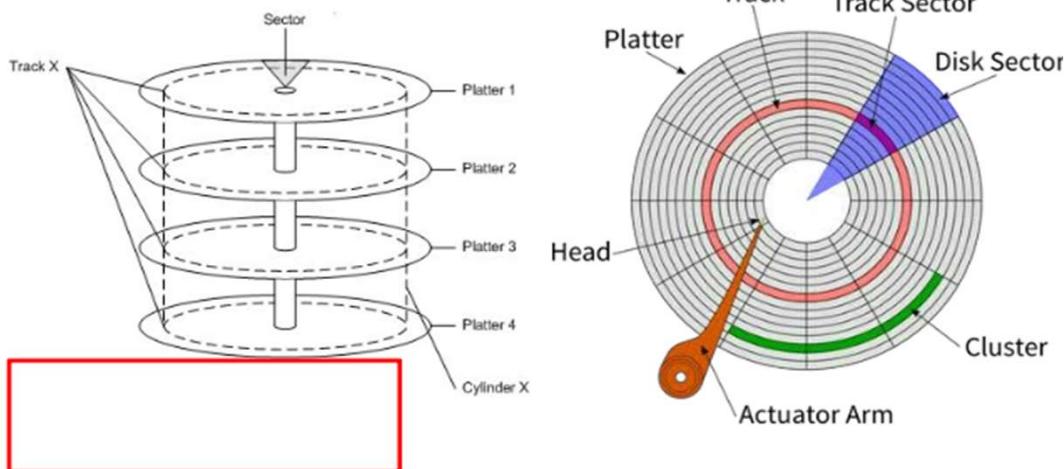
- Size of flopply disk: 8", 5.25", 3.5"

Hard Disk

- Random storage device
- Electro-mechanical data storage device
- connected to the motherboard using an ATA, SCSI, or SATA cable
- Divided into track, sector, cylinder and cluster
- Rotation speed 3600, 7000 or above RPM
- Invented by Reynold Johnson (IBM)

Elements of magnetic disk

Elements of magnetic disk

- **Track**: Circular ring on one side of the disk. Each track has a unique number.
- **Sectors**: A disk sector is a wedge-shape piece of the disk. Each sector is numbered.
- **Clusters**: A cluster is a set of track sectors, ranging from 2 to 32 or more.
- **Cylinder**: Set of matched tracks.

Factors affecting disk performance

- **Seek time:** Time taken by read/write head to <u>position</u> over particular data track
- **Latency:** Time elapses between the moment when the read/write head settles over the desired data track and the moment when the first byte of the required data appears under the head.
- **Access time:** Sum of Seek Time and Latency

CD (Compact Disk)

- Random Access Storage Optical Media
- Invented by James Russell
- Types
  - CD-R: CD Recordable
  - CD ROM: CD Read Only Memory (standard size: 650 MB)
  - CD RW: CD Rewritable
  - DVD: Digital Versatile Disk (Standard size: 4.7 GB, upto 17GB)

Types of Memory on different base

- Based on Data Access
- Based on Technology
- Based on Handling
- Based on Volume

Based on Data Access

- **Sequential Access Media**: Data can be read in sequence, also called serial device. E.g. Cassette Tape, Magnetic Tape
- **Random Access Media**: Data can be accessed directly without passing through intervening points, E.g. Floppy Disk, Hard Disk, Zip Disk, CD/DVD, RAM etc.

Based on Data Technology
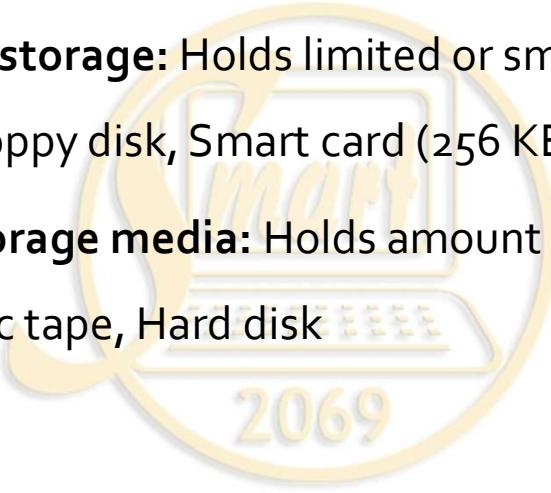
- **Paper Technology**: Paper Tape, Punch Card
- **Magnetic Technology**: Magnetic Disk, Magnetic Tape, Magnetic Core
- **Optical Technology**: Optical Disk (CD, DVD)
- **Magneto-Optical** Technology: MO Disk
- **Semiconductor Technology**: Pen drive, Flash card, RAM etc.

Based on Data Handling

- **Fixed Disk**: Attached in computer

  ◦ Hard Disk, RAM

- **Removable Disk:** Can easily be removed from computer

  ◦ Floppy disk, pen drive, CD
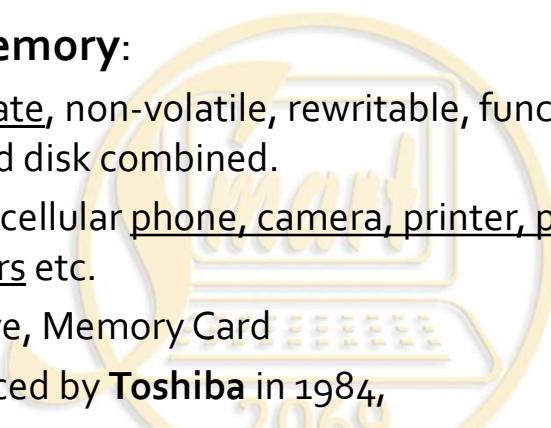
Based on Data Volume

- **Limited storage:** Holds limited or small amount of data- Floppy disk, Smart card (256 KB)

- **Mass storage media:** Holds amount of data- Magnetic tape, Hard disk

Other Memories
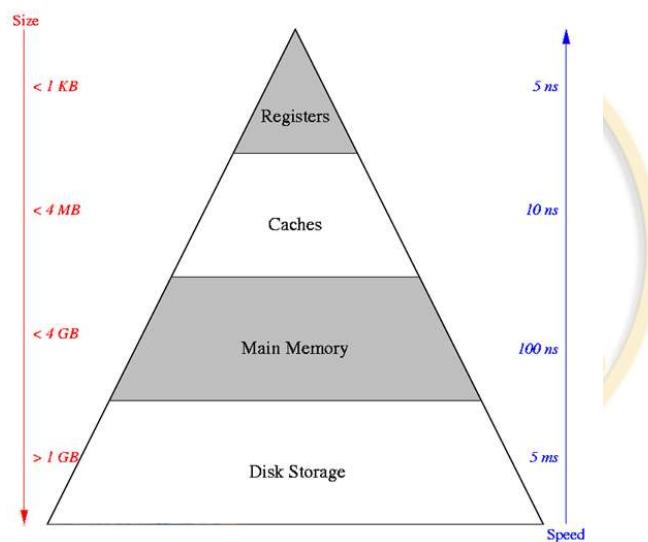
- **Flash Memory**:
  - Solid state, non-volatile, rewritable, functions like RAM and hard disk combined.
  - Used in cellular phone, camera, printer, pager, audio recorders etc.
  - Pen drive, Memory Card
  - Introduced by **Toshiba** in 1984,
  - Flash memory was developed from EEPROM (electrically erasable programmable read-only memory).

Other Memories

- **Cache Memory**:
  - Very high-speed memory
  - Also known buffer memory
  - Placed between processor and main memory to manage their speed difference
  - There are 5 to 6 levels of cache

Memory Hierarchy

Virtual Memory

- <u>Memory management technique</u> where secondary memory can be used as if it were a part of Primary Memory

- Also known as Swap file or page file

- Managed by Operating System

Memory Management

- Base Memory or Conventional Memory

- Upper Memory Area (UMA)

- High Memory Area (HMA)

- Extended Memory (EXT)

Base Memory or Conventional Memory
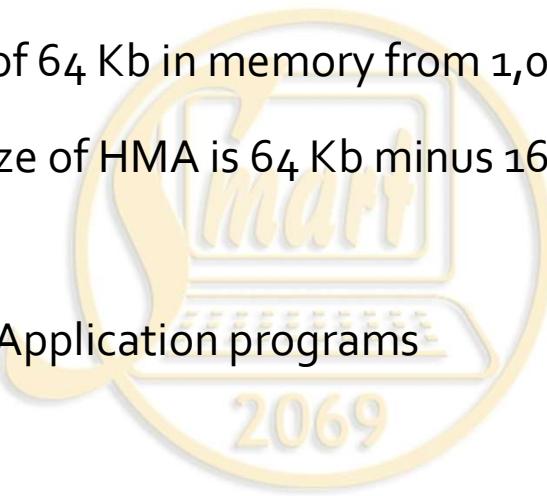
- Also called Lower Memory

- Area where old DOS operating system and application are loaded

- From 0 to 640 Kb, making it 655,360 bytes in size

- In older systems the size of Conventional Memory could be limited to 512 or even 256 K

UMA (Upper Memory Area)- 384 KB

- Area is reserved for System Hardware like video memory, ROM and device driver

- From 640 to 1,024 KB
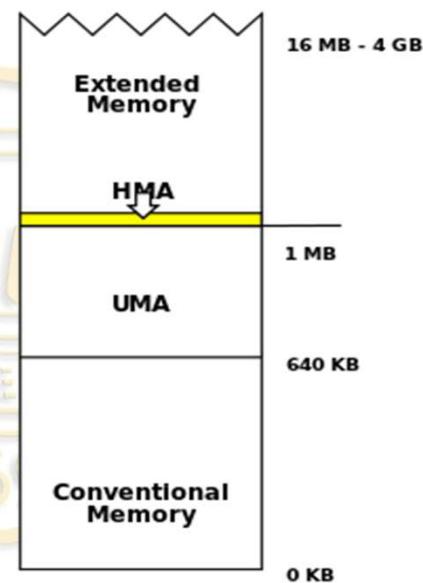
HMA (High Memory Area)-64 KB

- An area of 64 Kb in memory from 1,024 to 1,088 Kb

- Actual size of HMA is 64 Kb minus 16 bytes or 65,516 bytes

- Used by Application programs

Extended Memory

- Memory above 1,024 Kb

Input Device

Input : Data and instructions given to the

 computer

Input Device

Device that feeds input to computer.

Keyboard

Keys on keyboard

- Functional Keys (F1- F12)
- Alphabetical Keys (a-z and A-Z)
- Numeric Keys (0-9)
- Special Keys (Ctrl, Shift, Alt, Enter...)
- Cursor Movement Keys (Up/Down/Left/Right arrows)
- Symbolic Keys ($, @, !, ...)

Types of keyboard (Based on model)

QWERTY: The most commonly used layout of keyboard.

- 83 keys- XT Keyboard

- 84 keys- AT Keyboard

- 101 keys- Enhanced Keyboard

- 104 keys- Enhanced Windows Keyboard (Standard Keyboard)

Types of keyboard (Based on model)

Ergonomic Keyboard

- A keyboard that separates the keys into two halves shaped like a wide "V".

- Puts less stress on the hands and wrist

Dvorak Keyboard

- Alternative to QWERTY

- Has most common letters in Home Row
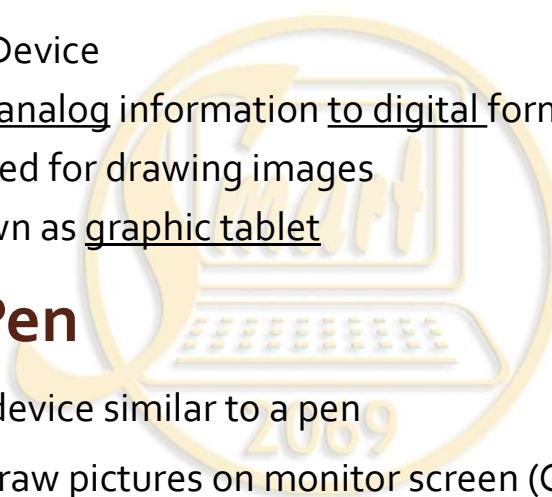
Mouse

- Pointing Device
- Types:
  - Mechanical Mouse
  - Scroll Mouse
  - Optical Mouse
  - Wireless Mouse

Scroll

Graphic Digitizer

- Pointing Device
- Converts underline analog information to digital form
- Can be used for drawing images
- Also known as graphic tablet
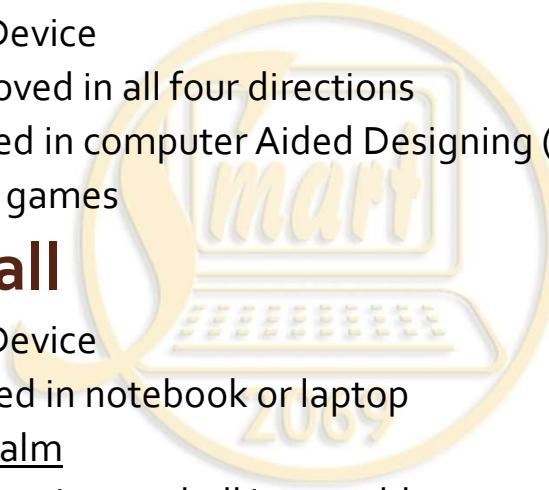
Light Pen

- Pointing device similar to a pen
- Used to draw pictures on monitor screen (CRT screen)

Joystick

- Pointing Device
- Can be moved in all four directions
- Mainly used in computer Aided Designing (CAD) and playing computer games

Trackball

- Pointing Device
- Mostly used in notebook or laptop
- Used by palm
- Device is stationery, ball is movable

BCR (Bar Code Reader)

- Used for reading bar coded data (data in the form of light and dark lines)
- Used in labeling goods, numbering the books
- Also called point of sale (POS) scanner

Smart InfoTech

OCR
- Optical <u>Character</u> Reader/ Recognition
- Reads character or <u>printed text</u>

OMR
- Optical <u>Mark</u> Recognition/Reader
- Recognizes mark made by pen or pencil
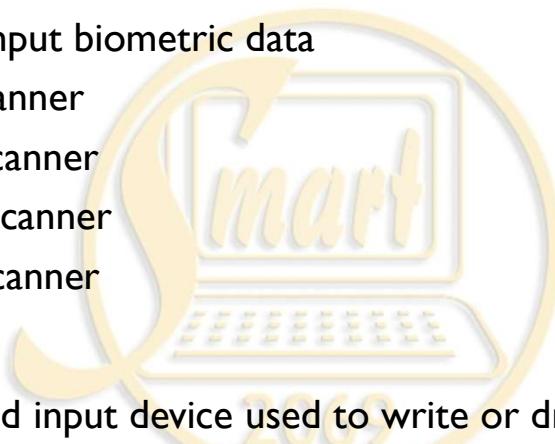
MICR
- Magnetic Ink Character Recognition/Reader
- Recognizes letter printed with special ink (magnetic ink)
- Used in bank to read cheque

Smart InfoTech

Scanner

- Captures image and converts image to digital form

- Works like a photocopy machine
  - **Flatbed Scanner**: Uses <u>flat surface</u> to scan document.
  - **Sheet Fed Scanner**: Paper is fed into the scanner.
  - **Handheld Scanner:** Scanner is dragged over the page
  - **Card Scanner**: Scans business cards

Biometric Devices

- Used to input biometric data
  - Face scanner
  - Hand scanner
  - Finger scanner
  - Voice scanner
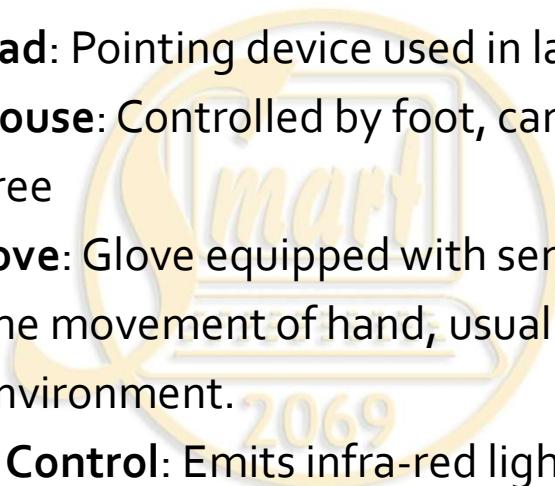
Stylus

- pen-shaped input device used to write or draw on the screen of a graphic tablet or device
- replacement for the user's fingers

Other input devices

- **Touch Pad**: Pointing device used in laptop.
- **Pedal Mouse**: Controlled by foot, can be moved 360 degree
- **Data Glove**: Glove equipped with sensors that senses the movement of hand, usually used in virtual environment.
- **Remote Control**: Emits infra-red light rays to control TVs, VCRs etc.

Other input devices

- **Webcam**: To capture image
- **Space Mouse**: Having X, Y and Z axes, used in 3D environment.
- **Microphone**: To record audio
- **VR** : Virtual Reality
- **Light Gun**: To shoot target on screen

Other input devices

- **Sensors**: Used in car, washing machine, heading control
- **Digital Camera**: to take photo
- **Voice (Speech Recognition) Recognition**: System to recognize digitally record speech. 90% accurate

Pointing Input Devices

- Mouse
- Trackball
- Touchpad/Trackpad
- Pointing Stick
- Graphics Tablet

- Touchscreen
- Light Pen
- Joystick
- Stylus

Scanning Input Devices

- Scanner
- OCR
- OMR
- MICR
- BCR
- Biometric Devices

Direct and indirect input devices

Direct Entry Devices

- No need to convert data
- No or less human interaction
- E.g. All scanning devices, like: OCR, OMR, MICR, BCR, light pen

Indirect Entry Devices

- Data need to be converted
- Human interaction is needed
- E.g. Keyboard, Mouse, Joystick

Output Devices

- Output : Result obtained after processing
- Output Device: Device that provides output

Types of Output Devices

- Softcopy Output Device
  - Gives temporary output, digital output or electronic output, e.g. Monitor, Speaker
- Hardcopy Output Devices
  - Give permanent output or output in printed form (for future use),e.g. Printer, Plotter

Impact and Non Impact Printer

Impact Printer	Non impact Printer
Printing mechanism and paper touches each other	Printing mechanism and paper does not touches
Noisy	Less Noisy
Low Quality	High Quality
Slower	Faster
E.g. Dot Matrix, Daisy Wheel, Drum	E.g. Laser, Inkjet

Dot Matrix Printer

- Uses pins impacting an ink ribbon to print
- Used for printing multiple carbon copies
- Similar to the printing mechanism of typewriters

Daisy Wheel Printer
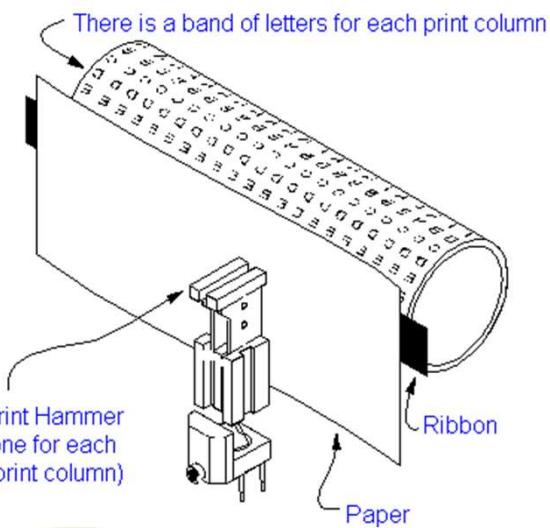
- Uses a metal or plastic disk containing each of the letters, numbers, and other characters
- Can't print graphics
- Also known as Golf Ball printer

Daisy Wheel Printer

Drum Printer

- Used formed character images around a cylindrical drum as its printing mechanism

There is a band of letters for each print column

Print Hammer (one for each print column)

Ribbon
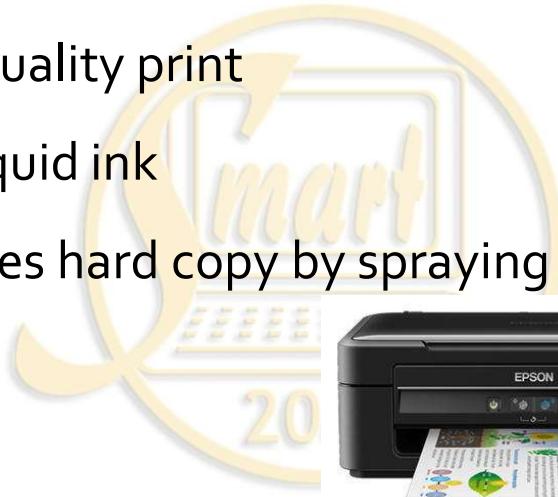
Paper

Laser Printer

- Uses photocopier technology
- Uses a laser and electrical charge model
- Consists of Cartridge and Toner
- Uses dry powder ink
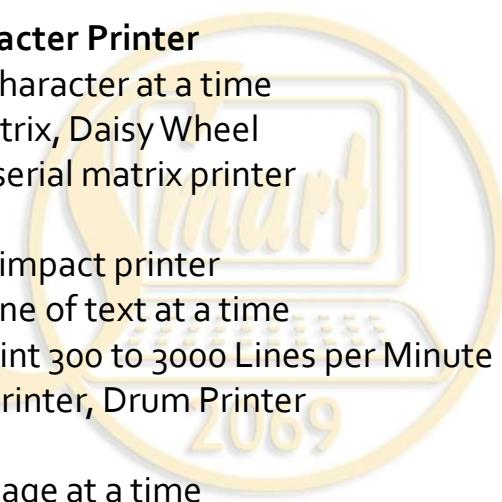
Inkjet Printer

- Gives quality print

- Uses liquid ink

- Produces hard copy by spraying ink onto

  paper
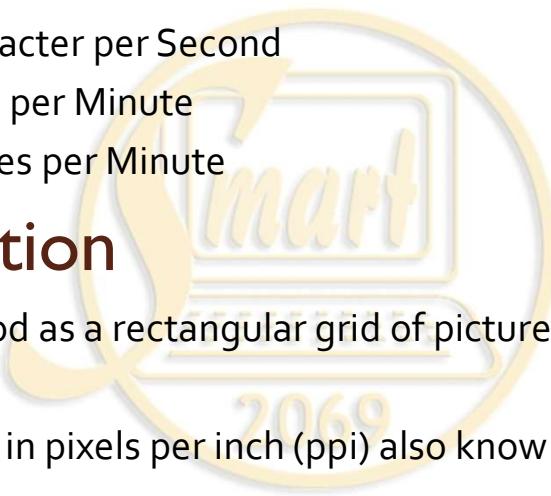
Types of printers based on speed

- **Serial or Character Printer**
  - Prints one character at a time
  - E.g. Dot Matrix, Daisy Wheel
  - Also called serial matrix printer
- **Line Printer**
  - High speed impact printer
  - Prints one line of text at a time
  - Can print print 300 to 3000 Lines per Minute
  - E.g. Chain Printer, Drum Printer
- **Page Printer**
  - Prints one page at a time
  - E.g. Laser Printer, Inkjet Printer

Speed of Printer

- **CPS**: Character per Second
- **LPM**: Line per Minute
- **PPM**: Pages per Minute
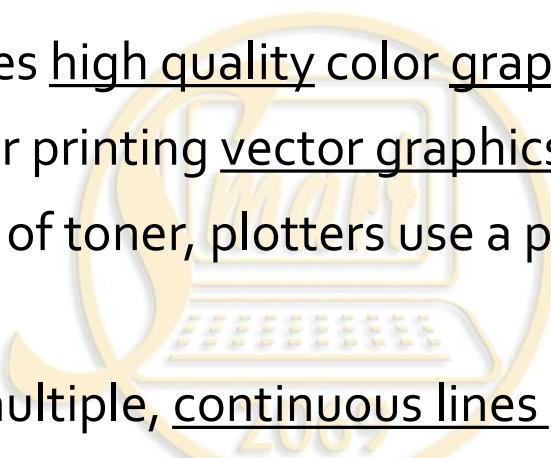
Resolution

- Understood as a rectangular grid of picture elements (pixels).
- Measured in pixels per inch (ppi) also know as dots per inch (dpi)

Plotter

- Produces high quality color graphics
- Used for printing vector graphics
- Instead of toner, plotters use a pen, pencil, marker,
- Draw multiple, continuous lines onto paper rather than a series of dots

Types of Plotter

- **Drum Plotter**: Plotter is mounted on the surface of drum
- **Flatbed Plotter**: Plots on papers that are spread and fixed over a rectangular flatbed surface
- **Electrostatic Plotter**: use electrostatic charges to create images out of very small dots
- **Inkjet Plotter**: Pushes beads of ink directly onto the surface of whatever you are printing on

Monitor

- Also known as VDU (Visual Display Unit)

- Converts the electronic signals from computer into a visual display.

Types of Monitor

- CRT (Cathode Ray Tube)

- LCD (Liquid Crystal Display)

- LED (Light Emitting Diode)

- PDP (Plasma Display Panel)

- Touch Screen Monitor
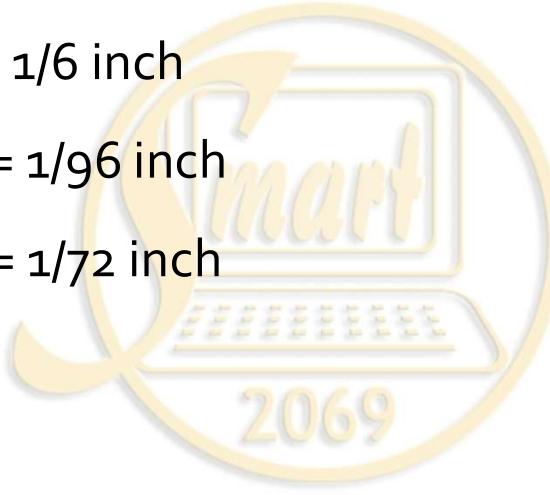
Resolution of monitor

- Number of dots on the screen or pixel

- Expressed as pair of numbers that give the number of dots on a line (horizontal) and the number of lines (vertical)
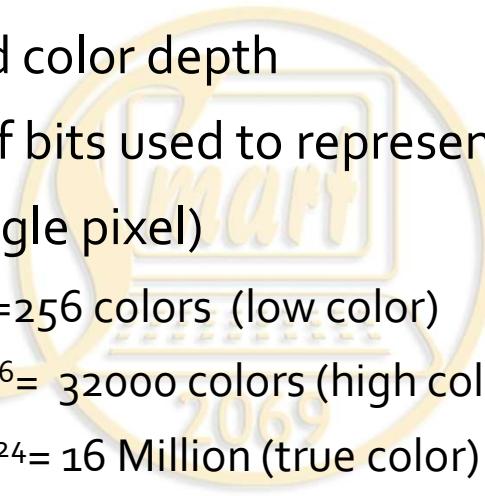
Pixel, Pica and Point

- 1 pica = 1/6 inch

- 1 pixel = 1/96 inch

- 1 point= 1/72 inch

Bit Depth

- Also called color depth
- Number of bits used to represent color of an image (single pixel)
  - 8 bits =2^8=256 colors (low color)
  - 16 bits=2^{16}= 32000 colors (high color)
  - 24 bits =2^{24}= 16 Million (true color)

Refresh Rate

- Number of times your monitor updates with new images each second
- Speed of monitor to paint the dots on the screen

Dot pitch

- Measurement that defines the sharpness of a display.
- Distance between the dots used to display the image on the screen.
- Also called Dot pitch, or "pixel pitch,"

Other output devices

- **Machine Tool**: Computer Aided Manufacturing (CAM) tool used in manufacturing products
- **Voice Synthesis**: Produces robotic sound in VAB (Voice Answer Back)
- **COM (Computer Output Microfilm):** process for transferring data from electronic media stored on computers to 16mm microfilm or microfiche.

Other output devices

- Projector
- Robot Machine
- Speaker
- Video Card
- Braille Reader
- TV

I/O Devices

- Modem (Modulator/Demodulator)
- Sound Card
- Headset/Earphone
- NIC (Network Interface Card)
- Storage Devices like Hard Disk
- Fax Machine
- Touchscreen
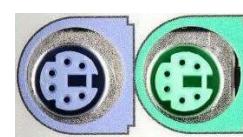
Computer Ports
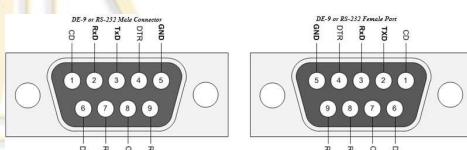
- Point of attachment, where the cable from the peripheral can be plugged in

Types of Ports

- **PS/2**
  ◦ Developed by IBM for connecting mouse and keyboard
  ◦ 6 pins
- **Serial Port**
  ◦ Used for mouse, keyboard
  ◦ 9 pins
- **Parallel Port**
  ◦ Used for Scanner, Printer
  ◦ 36 pins

Types of Ports

- **Audio Port:** Connects Speaker

- **VGA Port**

  ◦ Connects Monitor

  ◦ 15 pins in 3 rows

- **USB (Universal Serial Bus):** Supports 127

  devices

Types of Ports
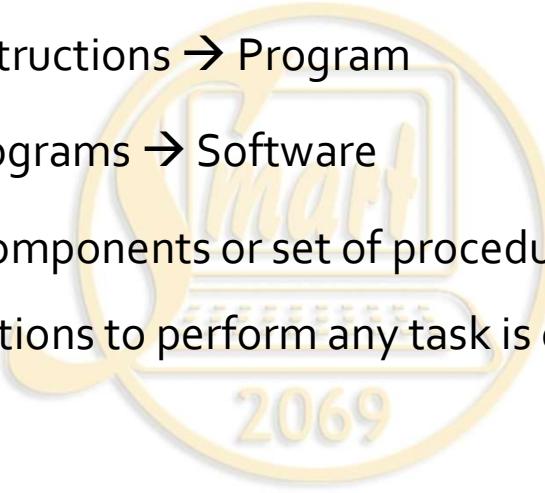
- **SCSI (**Small Computer System Interface**)**

- **DVI (Digital Video Interface):** Connects Monitor

- **HDMI (High Definition Media Interface)**

- **RJ-45:** Registered Jack-45**,** Used in Network **,** 8 pins

- **RJ-11:** Used in Telephone**,** 4 or 6 pins

Software

Set of Instructions → Program

Set of Programs → Software

Logical components or set of procedures or routines or instructions to perform any task is called software.
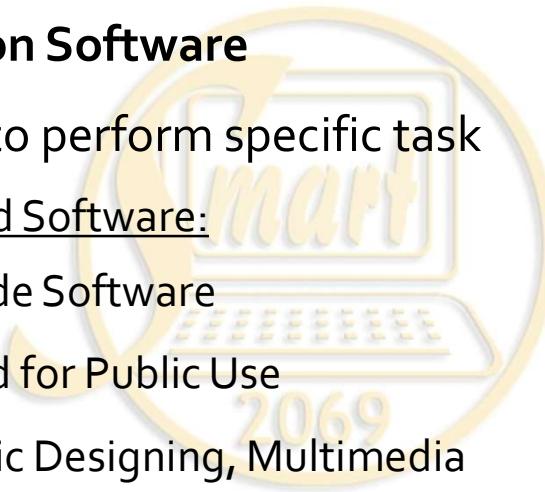
Software

Application Software

Software to perform specific task

a) Packaged Software:

- Readymade Software

- Developed for Public Use

- Eg. Graphic Designing, Multimedia

Smart InfoTech

Software

Application Software

Software to perform specific task

b) Tailored Software:

- Customized Software

- Developed for Personal/Private Use

- Billing Software, School Management Soft

Software

System Software

Designed to run computer hardware and application

a) Operating System Software:

- Operates Computer
- Provides Platform for other application
- Mediator between user and hardware
- Monitors all computer activities
- E.g. DOS, Windows, MAC, Android, IOS

Software

System Software

Designed to run computer hardware and application

a) Operating System Software:
Types of OS(Based on Interface):
CLI (Command Line Interface): Work with commands
GUI (Graphic User Interface): Windows with graphic
Types (Based on User):
Single User: Windows   • Multiuser: Unix, Linux
Types (Based on operation)
Single Task: DOS   • Multitask: Windows

Software

System Software

Designed to run computer hardware and application

b) Utilities :

- Helps to analyze, maintain, optimize, configure

- Takes care of computer

- E.g. Antivirus, Cleanup, Disk Defragmenter

Software

System Software

Designed to run computer hardware and application

c) Device Driver :

- Software that enables one or

more hardware devices to communicate with the

computer's operating system

Programming Language

- Low Level Language
  - **Machine Language**: 1st Generation Language Uses only 0 and 1.
  - **Assembly Language**: 2nd Generation Language, Uses mnemonic (symbols)
- High Level Language:
  - 3rd Generation Language, uses English Word and phrases.

HLL vs LLL

HLL

- User-friendly
- Easy to understand
- Simple to <u>debug</u>
- Portable
- Machine independent

LLL

- Machine-friendly
- Hard to understand
- Complex to debug
- Non portable
- Machine dependent

Generation of Programming Language

- 1st Generation: Machine Language

- 2nd Generation: Assembly Language

- 3rd Generation: High Level Language

- 4th Generation: Very High Level Language

- 5th Generation: Natural Language

3rd Generation Language

- Procedural Language
- <u>Earlier</u>:
  - FORTRAN (Formula Translation)
  - COBOL (Common Business Oriented Language)
  - ALGOL (Algorithmic Language)
- <u>Modern</u>
  - BASIC (Beginners All-Purpose Symbolic Instruction Code)
  - C, C++, C#, PASCAL, ADA, JAVA

4th Generation Language

- Non Procedural Language
- PHP (Hypertext Preprocessor), Ruby, FoxPro, SPSS (Statistical Package For The Social Sciences)
- Types:
  - Query languages
  - Report generators.
  - Applications generators.
  - Decision support systems

5th Generation Language

- Used in artificial intelligence

- Prolog (Programming in Logic)

- OPS5 (Official Production System)

- Mercury

Language Processor

- Language translator or converter to convert high level or assembly language to low level language

Types of Language Processor

- **Assembler**: Converts program written in <u>assembly language</u> into Machine language
- **Interpreter**: Converts program written in High Level Language into Machine Language <u>line by line</u>
- **Compiler**: Converts <u>whole program</u> written in High Level language into Machine Language. The process is called compilation

Interpreter vs Compiler
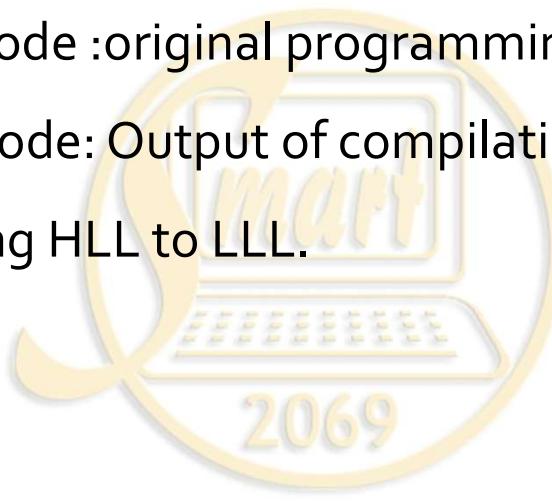
Interpreter	Compiler
Converts one statement at a time	Converts whole program
Slower	Faster
Error detection easier	Error detection difficult
Requires less memory	Required more memory
Does not generate object code	Generates object code
E.g. BASIC, PHP use it	E.g. C, C++, C#, Java use it

Source Code and Object Code

- Source Code :original programming code
- Object Code: Output of compilation after converting HLL to LLL.

Some terminologies

- **Firmware**: Software stored in computer's ROM or computer's circuitry
- **Peopleware (human ware)**: users and persons related to computer.
- **Liveware**: Persons working in computer online
- **Shareware**: programs available for trial
- **Freeware**: programs available completely free
- **Netware**: Networking software
- **Open Source**: Software code available freely

Multimedia Application

Multimedia is a form of communication combining with different media and they may include text, audio, music, images, animation and video.

Multimedia System

- System capable of processing multimedia data and applications.
- The proper combination of different multimedia **tools** which work together to create, edit, store and publish the multimedia content.
- E.g of multimedia tools: computer, multimedia software, sound card, microphone, camera etc.)

Different Multimedia Elements / Components

- Text
- Graphic
- Audio
- Video
- Animation

Text

- Combination of letters, digits and special characters.
- File formats:
  ◦ txt, rtf (rich text format, doc, pdf (portable document format)
- Application
  ◦ Notepad, Wordpad, MS Word, Adobe Reader

Graphic

- Still images and graphics
- File formats
  ◦ jpg/jpeg (Joint Photographic Experts Group), bmp (bitmap) , png (Portable Network Graphic), tiff(Tagged Image File Format), gif(Graphics Interchange Format)
- Application
  ◦ Picasa, Photoshop, Paint, Corel Draw
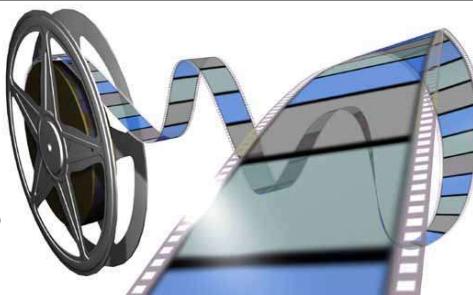
Audio

- Sound files
- File formats:
  ◦ wav (Windows Audio Video), wma (Windows Media Audio), mp3 (Media Player layer 3), midi (Musical Instrument Digital Interface), amr (Adaptive Muti-Rate)
- Application
  ◦ Winamp, Sound Forge, Adobe Audition, Switch

Video

- Motion picture or live images
- File formats
  ◦ mp4 (Media Player Layer 3), mpg/mpeg (Motion Picture Expert Group), WMV (Windows Media Video), AVI (Audio Video Interleave)
- Application
  ◦ Windows Media Player, VLC Player, Adobe Premier, PowerDVD
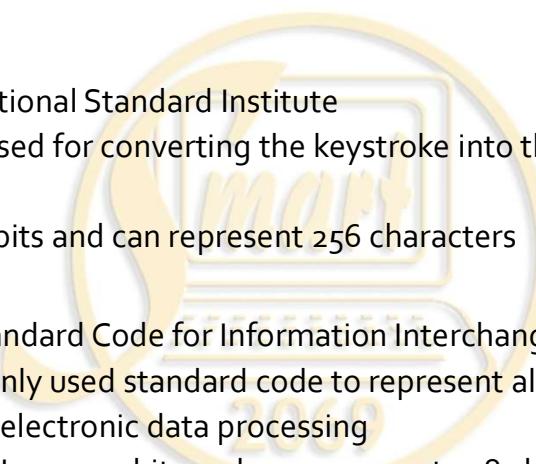
Animation

- Simulation of series of pictures in frame is called animation.
- File formats
  ◦ swf (Short Wave File), gif (Graphic Interchange   Format)
- Application
  ◦ Flash, swish, 3D Studio, MAYA, ImageReady

Some encoding scheme

- **ANSI**:
  ◦ American National Standard Institute
  ◦ Standard is used for converting the keystroke into the corresponding bits
  ◦ consists of 8 bits and can represent 256 characters
- **ASCII**:
  ◦ American Standard Code for Information Interchang
  ◦ Most commonly used standard code to represent alphanumeric characters in electronic data processing
  ◦ Original ASCII-7 uses 7 bits and can represent 128 characters
  ◦ ASCII-8 can uses 8 bits and can represent 256 characters

Some encoding scheme

- **ASCII Value:**
  - A-Z: 65-90,   41h- 5Ah
  - a-z: 97-122   61h-7Ah
  - 0-9: 48-57   30h-39h
  - Space: 32
  - Enter: 13
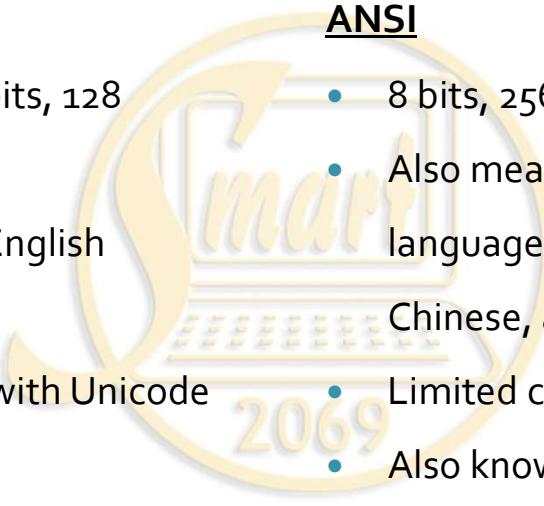
Some encoding scheme

ASCII

- Originally 7 bits, 128 characters
- Created for English language
- Compatible with Unicode

ANSI

- 8 bits, 256 characters
- Also meant for other languages like Japanese, Chinese, and many others
- Limited compatibility
- Also known as extended ASCII

Some encoding scheme

- **EBCDIC**:
  ◦ Extended Binary Coded Decimal Interchange Code
  ◦ 8-bit alphanumeric code used in IBM main frame computer, supports 256 symbols
- **BCD**:
  ◦ Binary Coded Decimal
  ◦ Also known as packet decimal
  ◦ Each decimal digit is represented by a fixed number of bits, usually four bits
- **Excess-3 or Stibitz code**:
  ◦ Numbers are represented as decimal digits, and each digit is represented by four bits as the digit value plus 3

Some encoding scheme

- **Unicode**
  ◦ The Unicode Standard is a character coding system designed to support the worldwide languages
  ◦ The latest version contains a repertoire of 136,755 characters
- **Gray Code**
  ◦ The reflected binary code (RBC) or Gray code
  ◦ Differs from leading and following number by a single bit.
- **Baudot Code**
  ◦ Invented by Emile Baudot, Used in Teleprinter
  ◦ Also called International Teleprinter Code
  ◦ Has 5 bits with 32 characters