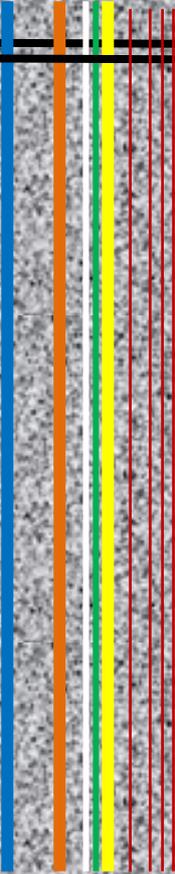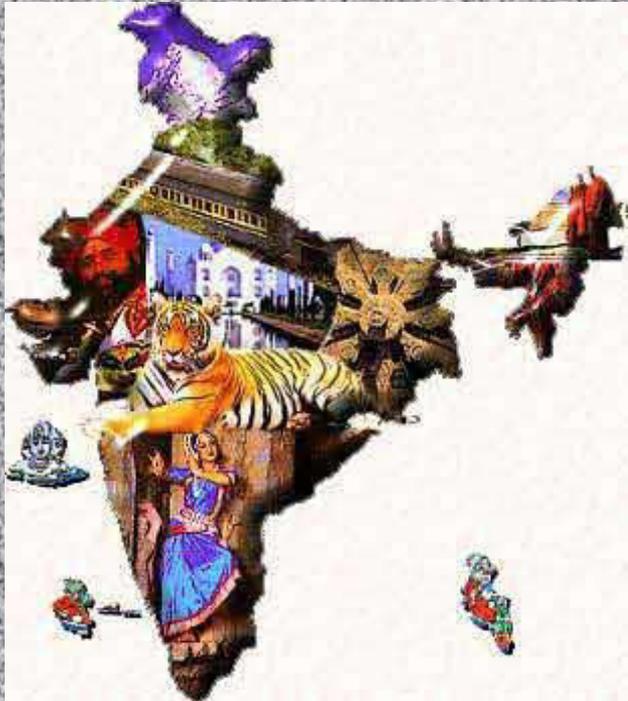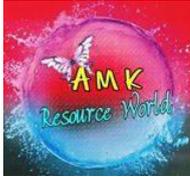# AMK

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Computer

What is Computer

Computer is an electronic device that is designed to work with Information. *The term computer is derived from the Latin term 'computare'*, this means to *calculate* or *programmable machine*. **Computer can not do anything without a Program**. It represents the decimal numbers through a string of binary digits. The Word 'Computer' usually refers to the Center Processor Unit plus Internal memory.

PERSONAL COMPUTER

A **personal computer** is a computer small and low cost, which is intended for personal use (or for use by a small group of individuals). The term "personal computer" is used to describe desktop computers (desktops). It is often shortened to the acronym PC or microcomputer, whose meaning in English is "personal computer". It is a very common type of machines.

Personal Computer (acronym PC) consists of a Processor (CPU), central processing unit (CPU) contains the arithmetic, logic, and control circuitry on an single (IC) integrated circuit; two types of memory, main memory, such as RAM, andROM, magnetic hard disks (HDD) and compact discs and various input/output devices, including a display screen, keyboard and mouse, modem, and printer.

History of Personal Computer

Prior to the Personal Computer (acronym PC), computers were designed for large organization who attached thin terminals for multiple users to a single large computer whose resources were shared among all users. The advent of the personal computer (PC),

they break up the tradition of terminals computing. By the late 1980s, technology advances made it feasible to build a small computer that an individual could own and use.

The personal computer began to be wide spread in the 1980s. The first was expensive, work late and had little capacity seen with today's eyes. History shows that they had their antecedents in particular as calculating machines. It was the development of an effective operating system and a user friendly interface which gave impetus to the development and let them be word processors.

According to the Computer History, the first "personal computer" was the Kenbak-1, launched in 1971. Had 256 bytes of memory and was advertised in Scientific American for $750, however, did not have CPU and was, like other systems of this era, designed for educational use.

Uses of Personal Computers

Personal computer (PC) is used for Work with word processing, Internet communications, and sound compositions and also for DTP. The PC is a most valued piece of technology around the world. The data processing capabilities of PC have added to their usage.

LAPTOP

A **Laptop computer** (also called *portable computer* or *notebook computer* in English) (Other terms, such as *ultrabook* or *netbook*, refer to specific *types* of laptop) is designed with portability in mind. It was developed in the late 1980s. It is briefcase style with a foldout screen with a clamshell form factor, suitable for mobile use and with a miniature keyboard. It is small enough to use in your lap. The laptop is battery or AC-powered personal computer that should be charged via a plug and socket, and when it runs out of power, it must be recharged regularly.

Laptop computer originally monochrome CRT-based, The components of a laptop are built-in **monitor; keyboard, touchpad** (which replaces the mouse), USB, graphics card and sound cards as well as high-capacity batteries that are made to keep the laptop power for a long period of time.

The laptops are more expensive because the technology to be more compact and they are more difficult to design and manufacture. If you have a limited space, it is worth considering a "portable" computer. They give you exactly the same comfort and performance of a desktop computer, but they take up less space.

How is a Laptop Different from a Desktop?

There are some important differences between laptop and desktop is its mobility as well as its compact size. The laptops computer work with the same equipment using a desktop computer thanks to its numerous I/O ports. This basically **turns your laptop computer into a desktop**, with one main difference: You can easily disconnect the equipment and take the laptop with you wherever you go. However, some laptop computer, such as **netbooks**, sacrifices some functionality in order to be **even more portable**. There are many different styles and brands of laptop and they all come with different software and programs. Laptop computer can also be used to access the Internet using a USB wireless. They can also be connected to a microphone, webcam and digital camera. The screen sizes of these computers are 12 inches to 16 inches.

You get all multimedia qualities of your laptop without response time thanks to a RAM memory of 2 GB on average and a graphics card that is just as powerful as a desktop. Thus you can easily enjoy your favorite DVDs, playing video games or edit your pictures. Your laptop can handleit all.

NOTEBOOK

A Netbook is characterized by:

CPU and Main Memory: Intel has developed a specific processor, the Atom. Its main objective, provide a processor with a very low power consumption and low cost. Few netbooks are not equipped with an Atom processor.

For the RAM, it is typically 1-2 GB, We recommend 2 GB, 1 GB, but enough to use his netbook in acceptable conditions.

The size of the screen: in fact, the largest netbooks offer a screen measuring between 7 "(17.8 cm) and 10" (25.4 cm) while laptops usually have a screen with a diagonal of 15 (38.1 cm). "These small screens are therefore limited to resolutions of 800×480 for the 7 "and 1024×600 for the 10".

Size and weight: If there is only one inch difference in the diagonal of the screen between a 9 inch netbook and 10 inches in practice increases the size of several centimeters. With a 10 inch screen, the surface of the netbook is closer to an A4 sheet of paper half an A4 ... Generally, 10-inch netbooks exceed 1 Kg "fateful" but limiting itself to a weight of 1 , 5kg up where other portable exceed 2kg. On the other hand, a larger netbook also offers a

larger and therefore more comfortable to use keyboard. Do not overlook the size of the charger that there must also be kept as small as possible.

Storage: It is imperative to identify its needs in terms of storage capacity. Netbooks with non-volatile memory (SSD or Solid State Drive) is limited to 12 GB or 20 GB as those offered with a standard hard drive offer at least 80 GB of storage. This ability is more suited to multimedia use and can store videos and music in abundance. However, the hard drive is more sensitive to shocks while being a little heavier. Some versions are now available with hard drives of 160GB.

Do not underestimate the capacity for netbooks do not sound with optical drives (CD or DVD drives).

Autonomy: Netbooks are in fact characterized by a range of over the phone. But depending on the model, this time varies from 2 hours to over 10 hours. Educate yourself before you make your purchase.

Equipment: In addition to the disk and display the characteristics of netbooks are usually very close: 3 USB ports, a VGA output, a network port, a memory card reader SDHC, WiFi and a webcam. Some models are equipped with original Bluetooth and / or WiFi 802.11n (faster than standard 802.11g). Finally, the cheapest model, the webcam is usually limited to 0.3 Mega pixels against 1.3 Mega pixels on netbooks "upscale." Given the intended use of a netbook, standard equipment is usually enough.

Please note that some models offered by telephone companies come with a 3G module (internal or external USB).

What can you do with a netbook?

Generally, netbooks can do a little of everything except 3D applications but they quickly show their limits whether in computing power, storage space or because of their small screen and small resolution.

ULTRA BOOK

In terms of capacity, ultrabooks have nothing to envy to other laptops. Indeed, although it slightly larger in width and length than a netbook, but significantly lower in height, which leaves a few millimeters. They are equipped with facilities at the forefront of technology. Thus, you will be able to find a wide variety of processor-equipped ultrabook with an Ivy Bridge technology. Graphics cards up to 1 GB, all backed by the RAM between 4 and 16 GB

The display quality is at the rendezvous with surprising resolutions for these small cars. Also, you will not be disappointed by the complete connection of ultrabooks.

Connectivity

Indeed, they are equipped with Ethernet, HDMI, USB 2.0 and 3.0 ports, WiFi, but also a Thunderbolt port. Recall that the Thunderbolt technology offers data transfer rate that is 20 times faster than the USB 2.0. In terms of storage capacity, you will delighted, because many of the machines are equipped with SSD sometimes reaching the size of 256GB or accompanied by mounted SATA hard drives with capacities from 500 GB to 1 TB The use of SSD provides an opportunity for ultrabooks be particularly fast at startup.

Autonomy

Power and battery of an ultrabook is more than obvious that these machines are not useful if they were not independent. Thus, we will be entitled to models that can run up to 11h in a row even if we say that the average range of these machines is 6:30. There are also equipped with touch screens ultrabooks which gives rise to a mid-computer combination, half tablets. To provide better handling, this type of ultrabooks running Windows 8. You will be able to find from Asus, Toshiba, Samsung, Aspire and many others. However, you should know that the major parts of ultrabooks are not equipped with CD / DVD player. You have understood, everything is done to preserve the smoothness of these machines.

BLOCK DIAGRAM OF COMPUTER
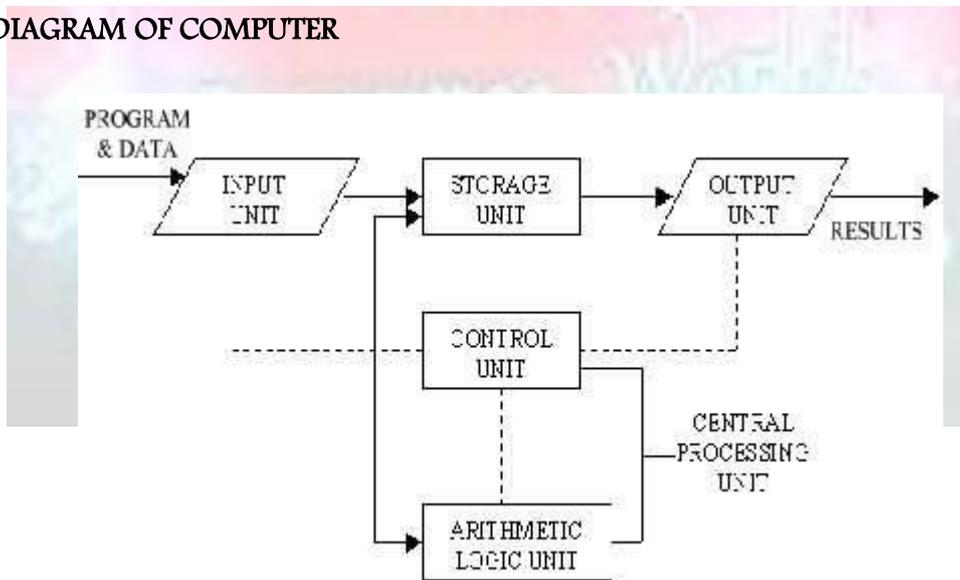
A computer can process data, pictures, sound and graphics. They can solve highly complicated problems quickly and accurately. A computer as shown in Fig. performs

basically five major computer operations or functions irrespective of their size and make. These are

1) it accepts data or instructions by way of input,

2) it stores data,

3) it can process data as required by the user,

4) it gives results in the form of output, and

5) it controls all operations inside a computer.

1. Input: This is the process of entering data and programs in to the computer system. You should know that computer is an electronic machine like any other machine which takes as inputs raw data and performs some processing giving out processed data. Therefore, the input unit takes data from us to the computer in an organized manner for processing.

2. Storage: The process of saving data and instructions permanently is known as storage. Data has to be fed into the system before the actual processing starts. It is because the processing speed of Central Processing Unit (CPU) is so fast that the data has to be provided to CPU with the same speed. Therefore the data is first stored in the storage unit for faster access and processing. This storage unit or the primary storage of the computer system is designed to do the above functionality. It provides space for storing data and instructions. The storage unit performs the following major functions:

• All data and instructions are stored here before and after processing.

• Intermediate results of processing are also stored here.

3. Processing: The task of performing operations like arithmetic and logical operations is called processing. The Central Processing Unit (CPU) takes data and instructions from the storage unit and makes all sorts of calculations based on the instructions given and the type of data provided. It is then sent back to the storage unit.

4. Output: This is the process of producing results from the data for getting useful information. Similarly the output produced by the computer after processing must also be kept somewhere inside the computer before being given to you in human readable form. Again the output is also stored inside the computer for further processing.

5. Control: The manner how instructions are executed and the above operations are performed. Controlling of all operations like input, processing and output are performed by control unit. It takes care of step by step processing of all operations inside the computer.

FUNCTIONAL UNITS

In order to carry out the operations mentioned in the previous section the computer allocates the task between its various functional units. The computer system is divided into three separate units for its operation. They are

1) arithmetic logical unit
2) control unit.
3) central processing unit.

Arithmetic Logical Unit (ALU)

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

Control Unit (CU)

The next component of computer is the Control Unit, which acts like the supervisor seeing that things are done in proper fashion. Control Unit is responsible for co ordinating various operations using time signal. The control unit determines the sequence in which computer programs and instructions are executed. Things like processing of programs stored in the main memory, interpretation of the instructions and issuing of signals for other units of the computer to execute them. It also acts as a switch board operator when several users access the computer simultaneously. Thereby it coordinates the activities of computer's peripheral equipment as they perform the input and output.

Central Processing Unit (CPU)

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

Functionalities of a computer

Any digital computer carries out five functions in gross terms:

- Takes data as input.
- Stores the data/instructions in its memory and use them when required.
- Processes the data and converts it into useful information.
- Generates the output

- Controls all the above four steps.

Following list demonstrates the advantages of computers in today's arena.

High Speed

- Computer is a very fast device.
- It is capable of performing calculation of very large amount of data.
- The computer has units of speed in microsecond, nanosecond, and even the picosecond.
- It can perform millions of calculations in a few seconds as compared to man who will spend many months for doing the same task.

Accuracy

- In addition to being very fast, computers are very accurate.
- The calculations are 100% error free.
- Computers perform all jobs with 100% accuracy provided that correct input has been given.

Storage Capability

- Memory is a very important characteristic of computers.
- A computer has much more storage capacity than human beings.
- It can store large amount of data.
- It can store any type of data such as images, videos, text, audio and many others.

Diligence

- Unlike human beings, a computer is free from monotony, tiredness and lack of concentration.
- It can work continuously without any error and boredom.
- It can do repeated work with same speed and accuracy.

Versatility

- A computer is a very versatile machine.
- A computer is very flexible in performing the jobs to be done.
- This machine can be used to solve the problems related to various fields.
- At one instance, it may be solving a complex scientific problem and the very next moment it may be playing a card game.

Reliability

- A computer is a reliable machine.
- Modern electronic components have long lives.
- Computers are designed to make maintenance easy.

Automation

- Computer is an automatic machine.
- Automation means ability to perform the given task automatically.
- Once a program is given to computer i.e., stored in computer memory, the program and instruction can control the program execution without human interaction.

Reduction in Paper Work

- The use of computers for data processing in an organization leads to reduction in paper work and results in speeding up a process.
- As data in electronic files can be retrieved as and when required, the problem of maintenance of large number of paper files gets reduced.

Reduction in Cost

- Though the initial investment for installing a computer is high but it substantially reduces the cost of each of its transaction.

Disadvantages

Following list demonstrates the disadvantages of computers in today's arena

No I.Q

- A computer is a machine that has no intelligence to perform any task.
- Each instruction has to be given to computer.
- A computer cannot take any decision on its own.

Dependency

- It functions as per a user's instruction, so it is fully dependent on human being

Environment

- The operating environment of computer should be dust free and suitable.

No Feeling

- Computers have no feelings or emotions.
- It cannot make judgement based on feeling, taste, experience, and knowledge unlike a human being.

USES OF COMPUTERS

Business

A computer has high speed of calculation, diligence, accuracy, reliability, or versatility which made it an integrated part in all business organisations.

Computer is used in business organisations for:

- Payroll calculations
- Budgeting

- Sales analysis
- Financial forecasting
- Managing employees database
- Maintenance of stocks etc.

Banking

Today banking is almost totally dependent on computer.

Banks provide following facilities:

- Banks provide online accounting facility, which includes current balances, deposits, overdrafts, interest charges, shares, and trustee records.
- ATM machines are making it even easier for customers to deal with banks

Insurance

Insurance companies are keeping all records up-to-date with the help of computers. The insurance companies, finance houses and stock broking firms are widely using computers for their concerns.

Insurance companies are maintaining a database of all clients with information showing

- procedure to continue with policies
- starting date of the policies
- next due installment of a policy
- maturity date
- interests due
- survival benefits
- bonus

Education

The computer has provided a lot of facilities in the education system.

- The computer provides a tool in the education system known as CBE (Computer Based Education).
- CBE involves control, delivery, and evaluation of learning.
- The computer education is rapidly increasing the graph of number of computer students.
- There are number of methods in which educational institutions can use computer to educate the students.
- It is used to prepare a database about performance of a student and analysis is carried out on this basis.

Marketing

In marketing, uses of computer are following:

- **Advertising** – With computers, advertising professionals create art and graphics, write and revise copy, and print and disseminate ads with the goal of selling more products.
- **At Home Shopping** – Home shopping has been made possible through use of computerised catalogues that provide access to product information and permit direct entry of orders to be filled by the customers.

Health Care

Computers have become important part in hospitals, labs, and dispensaries. The computers are being used in hospitals to keep the record of patients and medicines. It is also used in scanning and diagnosing different diseases. ECG, EEG, Ultrasounds and CT Scans etc., are also done by computerised machines.

Some major fields of health care in which computers are used are:

- **Diagnostic System** – Computers are used to collect data and identify cause of illness.
- **Lab-diagnostic System** – All tests can be done and reports are prepared by computer.
- **Patient Monitoring System** – These are used to check patient's signs for abnormality such as in Cardiac Arrest, ECG etc.
- **Pharma Information System** – Computer checks Drug-Labels, Expiry dates, harmful drug's side effects etc.
- **Surgery** : Nowadays, computers are also used in performing surgery.

Engineering Design

Computers are widely used in Engineering purpose.

One of major areas is CAD (Computer aided design). That provides creation and modification of images. Some fields are:

- **Structural Engineering** – Requires stress and strain analysis for design of Ships, Buildings, Budgets, Airplanes etc.
- **Industrial Engineering** – Computers deal with design, implementation and improvement of integrated systems of people, materials and equipments.
- **Architectural Engineering** – Computers help in planning towns, designing buildings, determining a range of buildings on a site using both 2D and 3D drawings.

Military

Computers are largely used in defence. Modern tanks, missiles, weapons etc. Military also employs computerised control systems. Some military areas where a computer has been used are:

- Missile Control
- Military Communication

- Military Operation and Planning
- Smart Weapons

Communication

Communication means to convey a message, an idea, a picture or speech that is received and understood clearly and correctly by the person for whom it is meant for. Some main areas in this category are:

- E-mail
- Chatting
- Usenet
- FTP
- Telnet
- Video-conferencing

Government

Computers play an important role in government. Some major fields in this category are:

- Budgets
- Sales tax department
- Income tax department
- Male/Female ratio
- Computerization of voters lists
- Computerization of driving licensing system
- Computerization of PAN card
- Weather forecasting

Defence:

There are many uses computers in Defence such as:

1) Controlling UAV or unmanned air-crafts an example is Predator. If you have cable I would recommend watching the shows "Future Weapons" and "Modern Marvels". The show future weapon gives an entire hour to the predator.

2) They are also used on Intercontinental Ballistic Missiles (ICBMs) that uses GPS and Computers to help the missile get to the target.

3) Computers are used to track incoming missiles and help slew weapons systems onto the incoming target to destroy them.

4) Computers are used in helping the military find out where all their assets are (Situational Awareness) and in Communications/Battle Management Systems.

5) Computers are used in the logistic and ordering functions of getting equipments to and around the battlefield.

6) Computers are used in tanks and planes and ships to target enemy forces, help run the platform and more recently to help diagnose any problems with the platforms.

7) Computers help design and test new systems.

Sports:

In today's technologically growing society, computers are being used in nearly every activity.

Recording Information

Official statistics keepers and some scouts use computers to record statistics, take notes and chat online while attending and working at a sports event.

Analyzing Movements

The best athletes pay close attention to detail. Computers can slow recorded video and allow people to study their specific movements to try to improve their tendencies and repair poor habits.

Writers

Many sportswriters attend several sporting events a week, and they take their computers with them to write during the game or shortly after while their thoughts are fresh in their mind.

Scoreboard

While some scoreboards are manually updated, most professional sports venues have very modern scoreboards that are programmed to update statistics and information immediately after the information is entered into the computer.

COMPUTER GENERATIONS

Each generation of computer is characterized by a major technological development that fundamentally changed the way computers operate, resulting in increasingly smaller, cheaper, more powerful and more efficient and reliable devices.

Generation in computer terminology is a change in technology a computer is/was being used. Initially, the generation term was used to distinguish between varying hardware technologies. But nowadays, generation includes both hardware and software, which together make up an entire computer system.

There are totally five computer generations known till date. Each generation has been discussed in detail along with their time period and characteristics. Here approximate dates against each generations have been mentioned which are normally accepted.

Following are the main five generations of computers

S.N.	Generation & Description
1	**First Generation** The period of first generation: 1946-1959. Vacuum tube based.
2	**Second Generation** The period of second generation: 1959-1965. Transistor based.
3	**Third Generation** The period of third generation: 1965-1971. Integrated Circuit based.
4	**Fourth Generation** The period of fourth generation: 1971-1980. VLSI microprocessor based.
5	**Fifth Generation** The period of fifth generation: 1980-onwards. ULSI microprocessor based

FIRST GENERATION

The period of first generation was 1946-1959. The computers of first generation used vacuum tubes as the basic components for memory and circuitry for CPU (Central Processing Unit). These tubes, like electric bulbs, produced a lot of heat and were prone to frequent fusing of the installations, therefore, were very expensive and could be afforded only by very large organisations. In this generation mainly batch processing operating system were used. Punched cards, paper tape, and magnetic tape were used as input and output devices. The computers in this generation used machine code as programming language.

Mark I : The **IBM Automatic Sequence Controlled Calculator (ASCC)**, called the Mark I by **Harvard University**, was an **electro-mechanical computer**. Mark I is the first machine to successfully perform a long services of **arithmetic and logical operation**. Mark I is the **First Generation Computer**. it was the first operating machine that could **execute long computations automatically**. *Mark I* computer which was built as a partnership between Harvard and **IBM in 1944**. This was the first programmable digital computer made in the U.S. But it was not a purely electronic computer. Instead the Mark I was constructed out of switches, relays, rotating shafts, and clutches. The machine weighed 5 tons, incorporated 500 miles of wire, was 8 feet tall and 51 feet long, and had a 50 ft rotating shaft running its length, turned by a 5 horsepower electric motor.

ENIAC: It was the **first general-purpose electronic computer** built in **1946** at **University of Pennsylvania, USA by John Mauchly and J. Presper Eckert**. The completed machine was announced to the public the evening of **February 14, 1946**. It was named **Electronic Numerical Integrator and Calculator (ENIAC)**. ENIAC contained 17,468 vacuum tubes, 7,200 crystal diodes, 1,500 relays, 70,000 resistors, 10,000 capacitors and around 5 million hand-soldered joints. It weighed more than 30 short tons (27 t), was roughly 8 by 3 by 100 feet (2.4 m × 0.9 m × 30 m), took up 1800 square feet (167 m2), and consumed 150 kW of power. Input was possible from an **IBM card reader**, and an **IBM card punch** was used for output. These cards could be used to produce printed output offline using an IBM accounting machine, such as the **IBM 405**. Today your favorite computer is many times as powerful as ENIAC, still size is very small.

EDVAC: It stands for **Electronic Discrete Variable Automatic Computer** and was developed in **1950**.it was to be a vast improvement upon ENIAC, it was **binary** rather than **decimal**, and was a stored program computer. **The concept of storing data and instructions inside the computer was introduced here.** This allowed much faster operation since the computer had rapid access to both data and instructions. The other advantage of storing instruction was that computer could do logical decision internally.

The EDVAC was a **binary serial computer** with automatic addition, subtraction, multiplication, programmed division and automatic checking with an ultrasonic serial memory. EDVAC's **addition time was 864 microseconds** and its **multiplication time was 2900**microseconds (2.9 milliseconds).

The computer had almost 6,000 vacuum tubes and 12,000 diodes, and consumed 56 kW of power. It covered 490 ft² (45.5 m²) of floor space and weighed 17,300 lb (7,850 kg).

EDSAC: It stands for **Electronic Delay Storage Automatic Computer** and was developed by **M.V. Wilkes at Cambridge University in 1949**. Two groups of individuals were working at the same time to develop the first stored-program computer. In the United States, at the University of Pennsylvania the EDVAC (Electronic Discrete Variable Automatic Computer) was being worked on. In England at Cambridge, the EDSAC (Electronic Delay Storage Automatic Computer) was also being developed. The **EDSAC** won the race as the first **stored-program computer** beating the United States' EDVAC by two months. The EDSAC performed computations in the three millisecond range. It performed arithmetic and logical operations without human intervention. The key to the success was in the **stored instructions** which it depended upon solely for its operation. **This machine marked the beginning of the computer age.** EDSAC is the first computer is used to store a program

UNIVAC-1: Ecker and Mauchly produced it in 1951 by Universal Accounting **Computer** setup. it was the **first commercial computer** produced in the United States. It was designed principally by J. Presper Eckert and John Mauchly, the inventors of the ENIAC.

The machine was 25 feet by 50 feet in length, contained 5,600 tubes, 18,000 crystal diodes, and 300 relays. It utilized serial circuitry, 2.25 MHz bit rate, and had an internal storage capacity 1,000 words or 12,000 characters.

It utilized a **Mercury delay line**, magnetic tape, and **typewriter output**. The UNIVAC was used for **general purpose computing** with large amounts of input and output.

Power consumption was about 120 kva. Its reported processing speed was 0.525 milliseconds for arithmetic functions, 2.15 milliseconds for multiplication and 3.9 Milliseconds for division.

The UNIVAC was also the first computer to come equipped with a magnetic tape unit and was the **first computer to use buffer memory**.

The main features of first generation are:

- Vacuum tube technology
- Unreliable
- Supported machine language only
- Very costly
- Generated lot of heat
- Slow input and output devices
- Huge size
- Need of A.C.
- Non-portable
- Consumed lot of electricity

Limitations of First Generation Computer

Followings are the major drawbacks of First generation computers.

1. They used valves or vacuum tubes as their main electronic component.
2. They were large in size, slow in processing and had less storage capacity.
3. They consumed lots of electricity and produced lots of heat.
4. Their computing capabilities were limited.
5. They were not so accurate and reliable.
6. They used machine level language for programming.
7. They were very expensive.

Some computers of this generation were:

- ENIAC
- EDVAC
- UNIVAC
- IBM-701
- IBM-650

SECOND GENERATION

The period of second generation was 1959-1965. In this generation transistors were used that were cheaper, consumed less power, more compact in size, more reliable and faster than the first generation machines made of vacuum tubes. In this generation, magnetic cores were used as primary memory and magnetic tape and magnetic disks as secondary storage devices. In this generation assembly language and high-level programming languages like FORTRAN, COBOL were used. The computers used batch processing and multiprogramming operating system.

The main features of second generation are:
- Use of transistors
- Reliable in comparison to first generation computers
- Smaller size as compared to first generation computers
- Generated less heat as compared to first generation computers
- Consumed less electricity as compared to first generation computers
- Faster than first generation computers
- Still very costly
- A.C. needed
- Supported machine and assembly languages

Some computers of this generation were:
- IBM 1620
- IBM 7094
- CDC 1604
- CDC 3600
- UNIVAC 1108

THIRD GENERATIONS

The period of third generation was 1965-1971. The computers of third generation used integrated circuits (IC's) in place of transistors. A single IC has many transistors, resistors and capacitors along with the associated circuitry. The IC was invented by Jack Kilby. This

development made computers smaller in size, reliable and efficient. In this generation remote processing, time-sharing, multi-programming operating system were used. High-level languages (FORTRAN-II TO IV, COBOL, PASCAL PL/1, BASIC, ALGOL-68 etc.) were used during this generation

The main features of third generation are:

- IC used
- More reliable in comparison to previous two generations
- Smaller size
- Generated less heat
- Faster
- Lesser maintenance
- Still costly
- A.C needed
- Consumed lesser electricity
- Supported high-level language

Some computers of this generation were:

- IBM-360 series
- Honeywell-6000 series
- PDP(Personal Data Processor)
- IBM-370/168
- TDC-316

FOURTH GENERATION

The period of fourth generation was 1971-1980. The computers of fourth generation used Very Large Scale Integrated (VLSI) circuits. VLSI circuits having about 5000 transistors and other circuit elements and their associated circuits on a single chip made it possible to have microcomputers of fourth generation. Fourth generation computers became more powerful, compact, reliable, and affordable. As a result, it gave rise to personal computer (PC) revolution. In this generation time sharing, real time, networks, distributed operating system were used. All the high-level languages like C, C++, DBASE etc., were used in this generation.

The main features of fourth generation are:

- VLSI technology used
- Very cheap

- Portable and reliable
- Use of PC's
- Very small size
- Pipeline processing
- No A.C. needed
- Concept of internet was introduced
- Great developments in the fields of networks
- Computers became easily available

Some computers of this generation were:

- DEC 10
- STAR 1000
- PDP 11
- CRAY-1(Super Computer)
- CRAY-X-MP(Super Computer)

FIFTH GENERATION

The period of fifth generation is 1980-till date. In the fifth generation, the VLSI technology became ULSI (Ultra Large Scale Integration) technology, resulting in the production of microprocessor chips having ten million electronic components. This generation is based on parallel processing hardware and AI (Artificial Intelligence) software. AI is an emerging branch in computer science, which interprets means and method of making computers think like human beings. All the high-level languages like C and C++, Java, .Net etc., are used in this generation.

AI includes:

- Robotics
- Neural Networks
- Game Playing
- Development of expert systems to make decisions in real life situations.
- Natural language understanding and generation

The main features of fifth generation are:

- ULSI technology
- Development of true artificial intelligence
- Development of Natural language processing
- Advancement in Parallel Processing
- Advancement in Superconductor technology

- More user friendly interfaces with multimedia features
- Availability of very powerful and compact computers at cheaper rates

Some computer types of this generation are:
- Desktop
- Laptop
- NoteBook
- UltraBook
- ChromeBook

CLASIFICATION OF COMPUTERS

Computers differ based on their data processing abilities. They are classified according to purpose, data handling and functionality. Computers can be broadly classified by their speed and computing power

.	Type	Specifications
1	PC (Personal Computer)	It is a single user computer system having moderately powerful microprocessor
2	WorkStation	It is also a single user computer system which is similar to personal computer but have more powerful microprocessor.
3	Mini Computer	It is a multi-user computer system which is capable of supporting hundreds of users simultaneously.
4	Main Frame	It is a multi-user computer system which is capable of supporting hundreds of users simultaneously. Software technology is different from minicomputer.
5	Supercomputer	It is an extremely fast computer which can execute hundreds of millions of instructions per second.

According to purpose, computers are either general purpose or specific purpose. General purpose computers are designed to perform a range of tasks.

They have the ability to store numerous programs, but lack in speed and efficiency. Specific purpose computers are designed to handle a specific problem or to perform a specific task. A set of instructions is built into the machine.

According to data handling, computers are analog, digital or hybrid. Analog computers work on the principle of measuring, in which the measurements obtained are translated into data. Modern analog computers usually employ electrical parameters, such as voltages, resistances or currents, to represent the quantities being manipulated. Such computers do

not deal directly with the numbers. They measure continuous physical magnitudes. Digital computers are those that operate with information, numerical or otherwise, represented in a digital form. Such computers process data into a digital value (in 0s and 1s). They give the results with more accuracy and at a faster rate. Hybrid computers incorporate the measuring feature of an analog computer and counting feature of a digital computer. For computational purposes, these computers use analog components and for storage, digital memories are used.

According to functionality, computers are classified as :

Analog Computer

An analog computer (spelt analogue in British English) is a form of computer that uses *continuous* physical phenomena such as electrical, mechanical, or hydraulic quantities to model the problem being solved

Digital **Computer**

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

Hybrid Computer (Analog + Digital)

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

Super Computer

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

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

Mainframe Computer

A very large and expensive computer capable of supporting hundreds, or even thousands, of users simultaneously. In the hierarchy that starts with a simple microprocessor (in watches, for example) at the bottom and moves to supercomputers at the top, mainframes

are just below supercomputers. In some ways, mainframes are more powerful than supercomputers because they support more simultaneous programs. But supercomputers can execute a single program faster than a mainframe.

Mini Computer

A midsized computer. In size and power, minicomputers lie between *workstations* and *mainframes*. In the past decade, the distinction between large minicomputers and small mainframes has blurred, however, as has the distinction between small minicomputers and workstations. But in general, a minicomputer is a multiprocessing system capable of supporting from 4 to about 200 users simultaneously.

Micro Computer or Personal Computer

• **Desktop Computer**: a personal or micro-mini computer sufficient to fit on a desk.

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

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

Workstations

Workstation is a computer used for engineering applications (CAD/CAM), desktop publishing, software development, and other such types of applications which require a moderate amount of computing power and relatively high quality graphics capabilities. Workstations generally come with a large, high-resolution graphics screen, large amount of RAM, inbuilt network support, and a graphical user interface. Most workstations also have a mass storage device such as a disk drive, but a special type of workstation, called a diskless workstation, comes without a disk drive.

Common operating systems for workstations are UNIX and Windows NT. Like PC, Workstations are also single-user computers like PC but are typically linked together to form a local-area network, although they can also be used as stand-alone systems.

Computer - Components

All types of computers follow a same basic logical structure and perform the following five basic operations for converting raw input data into information useful to their users.

	Operation	Description
1	Take Input	The process of entering data and instructions into the computer system
2	Store Data	Saving data and instructions so that they are available for processing as and when required.
3	Processing Data	Performing arithmetic, and logical operations on data in order to convert them into useful information.
4	Output Information	The process of producing useful information or results for the user, such as a printed report or visual display.
5	Control the workflow	Directs the manner and sequence in which all of the above operations are performed.

INPUT UNIT

This unit contains devices with the help of which we enter data into computer. This unit makes link between user and computer. The input devices translate the information into the form understandable by computer.

CPU (Central Processing Unit)

CPU is considered as the brain of the computer. CPU performs all types of data processing operations. It stores data, intermediate results and instructions(program). It controls the operation of all parts of computer.

CPU itself has following three components

- ALU(Arithmetic Logic Unit)
- Memory Unit
- Control Unit

Every things computer does is controlled by its **Central Processing Unit (CPU)**. The CPU is the **brains of the computer**. Sometimes referred to simply as the **central processor** or **Nerve Centre** or **heart**, but more commonly called **processor**, the CPU is where most calculations take place.

In terms of computing power, the CPU is the most important element of a computer system. It add and compare its data in cpu chip. A CPU or Processors of all computers, whether micro, mini or mainframe must have three element or parts primary storage, arithmetic logic unit (ALU), and control unit. *Control Unit* (CU) – *decodes* the *program instruction. CPU chip used in a computer is partially made out of Silica. on other words silicon chip used for data processing are called Micro Processor.*

Central processing unit (CPU) is the central component of the Pc. Sometimes it is called as processor. It is the brain that runs the show inside the Pc. All work that is done on a computer is performed directly or indirectly by the processor. Obviously, it is one of the most important components of the Pc. It is also, scientifically, not only one of the most amazing parts of the PC, but one of the most amazing devices in the world of technology. The processor plays a significant role in the following important aspects of your computer system;

Performance: The processor is probably the most important single determinant of system performance in the Pc. While other components also playa key role in determining performance, the processor's capabilities dictate the maximum performance of a system. The other devices only allow the processor to reach its full potential.

Software Support: Newer, faster processors enable the use of the latest software. In addition, new processors such as the Pentium with MMX Technology, enable the use of specialized software not usable on earlier machines.

Reliability and Stability: The quality of the processor is one factor that determines how reliably your system will run. While most processors are very dependable, some are not. This also depends to some extent on the age of the processor and how much energy it consumes.

Energy Consumption and Cooling: Originally processors consumed relatively little power compared to other system devices. Newer processors can consume a great deal of power. Power consumption has an impact on everything from cooling method selection to overall system reliability.

Motherboard Support: The processor that decides to use in your system will be a major determining factor in what sort of chipset we must use, and hence what motherboard you buy. The motherboard in turn dictates many facets of. The system's capabilities and performance.

OUTPUT UNIT

Output unit consists of devices with the help of which we get the information from computer. This unit is a link between computer and users. Output devices translate the computer's output into the form understandable by users.

Memory or Storage Unit

This unit can store instructions, data and intermediate results. This unit supplies information to the other units of the computer when needed. It is also known as internal storage unit or main memory or primary storage or Random access memory(RAM).

Its size affects speed, power and capability. Primary memory and secondary memory are two types of memories in the computer. Functions of memory unit are:

- It stores all the data and the instructions required for processing.
- It stores intermediate results of processing.
- It stores final results of processing before these results are released to an output device.
- All inputs and outputs are transmitted through main memory.

Control Unit

This unit controls the operations of all parts of computer but does not carry out any actual data processing operations.

Functions of this unit are:

- It is responsible for controlling the transfer of data and instructions among other units of a computer.
- It manages and coordinates all the units of the computer.
- It obtains the instructions from the memory, interprets them, and directs the operation of the computer.
- It communicates with Input/Output devices for transfer of data or results from storage.
- It does not process or store data.

ALU (Arithmetic Logic Unit)

This unit consists of two subsections namely

- Arithmetic section
- Logic Section

Arithmetic Section

Function of arithmetic section is to perform arithmetic operations like addition, subtraction, multiplication and division. All complex operations are done by making repetitive use of above operations.

Logic Section

Function of logic section is to perform logic operations such as comparing, selecting, matching and merging of data.

Following are few of the important input devices which are used in a computer:

- Keyboard
- Mouse

ANDROID APP ON Google Play

- Joy Stick
- Light pen
- Track Ball
- Scanner
- Graphic Tablet
- Microphone
- Magnetic Ink Card Reader(MICR)
- Optical Character Reader(OCR)
- Bar Code Reader
- Optical Mark Reader(OMR)

KEYBOARD

Keyboard is the most common and very popular input device which helps in inputting data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions.

Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

The keys on the keyboard are as follows:

	Keys	Description
1	Typing Keys	These keys include the letter keys (A–Z) and digit keys (0–9) which generally give same layout as that of typewriters.
2	Numeric Keypad	It is used to enter numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators.
3	Function Keys	The twelve function keys are present on the keyboard which are arranged in a row at the top of the keyboard. Each function key has unique meaning and is used for some specific purpose.
4	Control keys	These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc).
5	Special Purpose Keys	Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.

MOUSE

Mouse is most popular pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base which senses the movement of mouse and sends corresponding signals to CPU when the mouse buttons are pressed.

Generally it has two buttons called left and right button and a wheel is present between the buttons. Mouse can be used to control the position of cursor on screen, but it cannot be used to enter text into the computer.

Advantages

- Easy to use
- Not very expensive
- Moves the cursor faster than the arrow keys of keyboard.

JOYSTICK

Joystick is also a pointing device which is used to move cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.

The function of joystick is similar to that of a mouse. It is mainly used in Computer Aided Designing(CAD) and playing computer games.

LIGHT PEN

Light pen is a pointing device which is similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube. When the tip of a light pen is moved over the monitor screen and pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.

TRACK BALL

Track ball is an input device that is mostly used in notebook or laptop computer, instead of a mouse. This is a ball which is half inserted and by moving fingers on ball, pointer can be moved. Since the whole device is not moved, a track ball requires less space than a mouse. A track ball comes in various shapes like a ball, a button and a square.

SCANNER

Scanner is an input device which works more like a photocopy machine. It is used when some information is available on a paper and it is to be transferred to the hard disc of the computer for further manipulation. Scanner captures images from the source which are

then converted into the digital form that can be stored on the disc. These images can be edited before they are printed.

DIGITIZER

Digitizer is an input device which converts analog information into digital form. Digitizer can convert a signal from the television or camera into a series of numbers that could be stored in a computer. They can be used by the computer to create a picture of whatever the camera had been pointed at. Digitizer is also known as Tablet or Graphics Tablet because it converts graphics and pictorial data into binary inputs. A graphic tablet as digitizer is used for doing fine works of drawing and image manipulation applications.

MICROPHONE

Microphone is an input device to input sound that is then stored in digital form. The microphone is used for various applications like adding sound to a multimedia presentation or for mixing music.

MAGNETIC INK CARD READER(MICR)

MICR input device is generally used in banks because of a large number of cheques to be processed every day. The bank's code number and cheque number are printed on the cheques with a special type of ink that contains particles of magnetic material that are machine readable. This reading process is called Magnetic Ink Character Recognition (MICR). The main advantages of MICR is that it is fast and less error prone.

OPTICAL CHARACTER READER(OCR)

OCR is an input device used to read a printed text. OCR scans text optically character by character, converts them into a machine readable code and stores the text on the system memory.

BAR CODE READERS

Bar Code Reader is a device used for reading bar coded data (data in form of light and dark lines). Bar coded data is generally used in labelling goods, numbering the books etc. It may be a hand held scanner or may be embedded in a stationary scanner. Bar Code Reader scans a bar code image, converts it into an alphanumeric value which is then fed to the computer to which bar code reader is connected.

OPTICAL MARK READER(OMR)

OMR is a special type of optical scanner used to recognize the type of mark made by pen or pencil. It is used where one out of a few alternatives is to be selected and marked. It is specially used for checking the answer sheets of examinations having multiple choice questions.

Following are few of the important output devices which are used in a computer.

- Monitors
- Graphic Plotter
- Printer

MONITORS

Monitors, commonly called as Visual Display Unit (VDU), are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)
- Flat- Panel Display

Cathode-Ray Tube (CRT) Monitor

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity, or resolution. It takes more than one illuminated pixel to form whole character, such as the letter 'e' in the word help.

A finite number of characters can be displayed on a screen at once. The screen can be divided into a series of character boxes – fixed location on the screen where a standard character can be placed. Most screens are capable of displaying 80 characters of data horizontally and 25 lines vertically. There are some disadvantages of CRT:

- Large in Size
- High power consumption

Flat-Panel Display Monitor

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT. You can hang them on walls or wear them on your wrists. Current uses of flat-panel displays include calculators, video games, monitors, laptop computer, graphics display.

The flat-panel display is divided into two categories:

- **Emissive Displays** – The emissive displays are devices that convert electrical energy into light. Example are plasma panel and LED(Light-Emitting Diodes).
- **Non-Emissive Displays** – The Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. Example is LCD(Liquid-Crystal Device)

PRINTERS

Printer is an output device, which is used to print information on paper.

There are two types of printers:

- Impact Printers
- Non-Impact Printers

Impact Printers

The impact printers print the characters by striking them on the ribbon which is then pressed on the paper.

Characteristics of Impact Printers are the following:

- Very low consumable costs
- Very noisy
- Useful for bulk printing due to low cost
- There is physical contact with the paper to produce an image

These printers are of two types

- Character printers
- Line printers

Character Printers

Character printers are the printers which print one character at a time.

These are further divided into two types:

- Dot Matrix Printer(DMP)
- Daisy Wheel

DOT MATRIX PRINTER

In the market one of the most popular printers is Dot Matrix Printer. These printers are popular because of their ease of printing and economical price. Each character printed is in form of pattern of dots and head consists of a Matrix of Pins of size (5*7, 7*9, 9*7 or 9*9) which come out to form a character that is why it is called Dot Matrix Printer.

Advantages

- Inexpensive

- Widely Used
- Other language characters can be printed

Disadvantages

- Slow Speed
- Poor Quality

DAISY WHEEL

Head is lying on a wheel and pins corresponding to characters are like petals of Daisy (flower name) that is why it is called Daisy Wheel Printer. These printers are generally used for word-processing in offices which require a few letters to be sent here and there with very nice quality.

Advantages

- More reliable than DMP
- Better quality
- The fonts of character can be easily changed

Disadvantages

- Slower than DMP
- Noisy
- More expensive than DMP

Line Printers

Line printers are the printers which print one line at a time.

These are of further two types

- Drum Printer
- Chain Printer

DRUM PRINTER

This printer is like a drum in shape so it is called drum printer. The surface of drum is divided into number of tracks. Total tracks are equal to size of paper i.e. for a paper width of 132 characters, drum will have 132 tracks. A character set is embossed on track. The different character sets available in the market are 48 character set, 64 and 96 characters set. One rotation of drum prints one line. Drum printers are fast in speed and can print 300 to 2000 lines per minute.

Advantages

- Very high speed

Disadvantages

- Very expensive
- Characters fonts cannot be changed

CHAIN PRINTER

In this printer, chain of character sets are used so it is called Chain Printer. A standard character set may have 48, 64, or 96 characters.

Advantages

- Character fonts can easily be changed.
- Different languages can be used with the same printer.

Disadvantages

- Noisy

Non-impact Printers

Non-impact printers print the characters without using ribbon. These printers print a complete page at a time so they are also called as Page Printers.

These printers are of two types

- Laser Printers
- Inkjet Printers

Characteristics of Non-impact Printers

- Faster than impact printers.
- They are not noisy.
- High quality.
- Support many fonts and different character size.

Laser Printers

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.

ADVANTAGES

- Very high speed
- Very high quality output
- Give good graphics quality
- Support many fonts and different character size

DISADVANTAGES

- Expensive.
- Cannot be used to produce multiple copies of a document in a single printing.

Inkjet Printers

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers produce high quality output with presentable features.

They make less noise because no hammering is done and these have many styles of printing modes available. Colour printing is also possible. Some models of Inkjet printers can produce multiple copies of printing also.

ADVANTAGES

- High quality printing
- More reliable

DISADVANTAGES

- Expensive as cost per page is high
- Slow as compared to laser printer

VON NEUMANN ARCHITECTURE

Von Neumann Architecture also known as the *Von Neumann model*, the computer consisted of a CPU, memory and I/O devices. The program is stored in the memory. The CPU fetches an instruction from the memory at a time and executes it.

Thus, the instructions are executed sequentially which is a slow process. Neumann m/c are called control flow computer because instruction are executed sequentially as controlled by a program counter. To increase the speed, parallel processing of computer have been developed in which serial CPU's are connected in parallel to solve a problem. Even in parallel computers, the basic building blocks are Neumann processors.

The von Neumann architecture is a design model for a stored-program digital computer that uses a processing unit and a single separate storage structure to hold both instructions and data. It is named after mathematician and early computer scientist John von Neumann. Such a computer implements a universal Turing machine, and the common "referential model" of specifying sequential architectures, in contrast with parallel architectures.

One shared memory for instructions (program) and data with one data bus and one address bus between processor and memory. Instructions and data have to be fetched in sequential order (known as the Von Neuman Bottleneck), limiting the operation bandwidth. Its design is simpler than that of the Harvard architecture. It is mostly used to interface to external memory.

BIOS

A **BIOS (Basic Input/Output System)** Short for **ROM** is boot firmware program that a computer uses to successfully start operating. The BIOS is located on a chip inside of the computer and is designed in a way that protects it from disk failure.

When you turn on a PC, the BIOS first conduct a basic hardware check, called a Power-On Self Test (POST), to determine whether all of the attachments are present and working. Then

it loads the operating system into your computer's random access memory, or RAM. The BIOS also manages data flow between the computer's operating system and attached devices such as the hard disk, video card, keyboard, mouse, and printer. The BIOS stores the date, the time, and your system configuration information in a battery-powered, non-volatile memory chip, called a CMOS (Complementary Metal Oxide Semiconductor) after its manufacturing process. The main functions of the BIOS are:

(i) BIOS power on self Test (POST)

(ii) Bootstrap loader

(iii) BIOS Setup utility program

(iv) System service routines

Functions of BIOS

(i) BIOS Power on Self Test (POST): It is a built-in diagnostic program. This self test ensures that the computer has all of the necessary parts and functionality needed to successfully start itself, such as use of memory, a keyboard and other parts. Then additional tests are done during booting. If errors are detected during the test, the BIOS instruct the computer to give a code that reveals the problem. Error codes are typically a series of beeps heard shortly after startup.

The BIOS also works to give the computer basic information about how to interact with some critical components, such as drives and memory that it will need to load the operating system. Once the basic instructions have been loaded and the self-test has been passed, the computer can proceed with loading the operating system from one of the attached drives. Computer users can often make certain adjustments to the BIOS through a configuration screen on the computer. The setup screen is typically accessed with a special key sequence during the first moments of startup. This setup screen often allows users to change the order in which drives are accessed during startup and control the functionality of a number of critical devices. Features vary among individual BIOS versions. The boot sequences for Award BIOS software are;

(i) Test the CPU

(ii) Initialize support chips

(iii) Initialize the keyboard

(iv) ROM BIOS test

(v) CMOS RAM test

(vi) Memory test

(vii) Cache initialization

(viii) Initialize the vector table

(ix) CMOS RAM check sum

*(x)*Keyboard initialization

*(xi)*Video circuit test

*(xii)*Video memory test

*(xiii)*DMA Controller test

*(xiv)*PIC tests

*(xv)*EISA mode test

COMPUTER MEMORY

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in computer where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells. Each location or cell has a unique address which varies from zero to memory size minus one. For example if computer has 64k words, then this memory unit has 64 * 1024=65536 memory locations. The address of these locations varies from 0 to 65535.

Memory is primarily of three types

- Cache Memory
- Primary Memory/Main Memory
- Secondary Memory

Cache Memory

Cache memory is a very high speed semiconductor memory which can speed up CPU. It acts as a buffer between the CPU and main memory. It is used to hold those parts of data and program which are most frequently used by CPU. The parts of data and programs are transferred from disk to cache memory by operating system, from where CPU can access them.

Advantages

The advantages of cache memory are as follows:

- Cache memory is faster than main memory.
- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.

Disadvantages

The disadvantages of cache memory are as follows:

- Cache memory has limited capacity.
- It is very expensive.

Primary Memory (Main Memory)

Primary memory holds only those data and instructions on which computer is currently working. It has limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. These memories are not as fast as registers. The data and instruction required to be processed reside in main memory. It is divided into two subcategories RAM and ROM.

Characteristics of Main Memory

- These are semiconductor memories
- It is known as main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without primary memory.

Secondary Memory

This type of memory is also known as external memory or non-volatile. It is slower than main memory. These are used for storing data/Information permanently. CPU directly does not access these memories instead they are accessed via input-output routines. Contents of secondary memories are first transferred to main memory, and then CPU can access it. For example : disk, CD-ROM, DVD etc.

Characteristic of Secondary Memory

- These are magnetic and optical memories
- It is known as backup memory.
- It is non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without secondary memory.
- Slower than primary memories.

DIRECT MEMORY ACCESS

DMA stands for "**Direct Memory Access**" and is a method of transferring data from the computer's RAM to another part of the computer without processing it using the CPU. While most data that is input or output from your computer is processed by the CPU, some data does not require processing, or can be processed by another device.

In these situations, DMA can save processing time and is a more efficient way to move data from the computer's memory to other devices. In order for devices to use direct memory

access, they must be assigned to a DMA channel. Each type of port on a computer has a set of DMA channels that can be assigned to each connected device. For example, a PCI controller and a hard drive controller each have their own set of DMA channels.

For example, a sound card may need to access data stored in the computer's RAM, but since it can process the data itself, it may use DMA to bypass the CPU. Video cards that support DMA can also access the system memory and process graphics without needing the CPU. Ultra DMA hard drives use DMA to transfer data faster than previous hard drives that required the data to first be run through the CPU.

An alternative to DMA is the Programmed Input/Output (PIO) interface in which all data transmitted between devices goes through the processor. A newer protocol for the ATAIIDE interface is Ultra DMA, which provides a burst data transfer rate up to 33 mbps. Hard drives that come with Ultra DMAl33 also support PIO modes 1, 3, and 4, and multiword DMA mode 2 at 16.6 mbps.

DMA Transfer Types

Memory To Memory Transfer

In this mode block of data from one memory address is moved to another memory address. In this mode current address register of channel 0 is used to point the source address and the current address register of channel is used to point the destination address in the first transfer cycle, data byte from the source address is loaded in the temporary register of the DMA controller and in the next transfer cycle the data from the temporary register is stored in the memory pointed by destination address. After each data transfer current address registers are decremented or incremented according to current settings. The channel 1 current word count register is also decremented by 1 after each data transfer. When the word count of channel 1 goes to FFFFH, a TC is generated which activates EOP output terminating the DMA service.

Auto initialize

In this mode, during the initialization the base address and word count registers are loaded simultaneously with the current address and word count registers by the microprocessor. The address and the count in the base registers remain unchanged throughout the DMA service.

After the first block transfer i.e. after the activation of the EOP signal, the original values of the current address and current word count registers are automatically restored from the base address and base word count register of that channel. After auto initialization the channel is ready to perform another DMA service, without CPU intervention.

DMA Controller

*The co*ntroller is integrated into the processor board and manages all DMA data transfers. Transferring data between system memory and an 110 device requires two steps. Data goes from the sending device to the DMA controller and then to the receiving device. The microprocessor gives the DMA controller the location, destination, and amount of data that is to be transferred. Then the DMA controller transfers the data, allowing the microprocessor to continue with other processing tasks. When a device needs to use the Micro Channel bus to send or receive data, it competes with all the other devices that are trying to gain control of the bus. This process is known as arbitration. The DMA controller does not arbitrate for control of the BUS instead; the I/O device that is sending or receiving data (the DMA slave) participates in arbitration. It is the DMA controller, however, that takes control of the bus when the central arbitration control point grants the DMA slave's request.

RAM

RAM(Random Access Memory) is the internal memory of the CPU for storing data, program and program result. It is read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.

Access time in RAM is independent of the address that is, each storage location inside the memory is as easy to reach as other locations and takes the same amount of time. Data in the RAM can be accessed randomly but it is very expensive.

RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure. Hence a backup uninterruptible power system(UPS) is often used with computers. RAM is small, both in terms of its physical size and in the amount of data it can hold.

RAM is of two types

- Static RAM (SRAM)
- Dynamic RAM (DRAM)

Static RAM (SRAM)

The word **static** indicates that the memory retains its contents as long as power is being supplied. However, data is lost when the power gets down due to volatile nature. SRAM chips use a matrix of 6-transistors and no capacitors. Transistors do not require power to prevent leakage, so SRAM need not have to be refreshed on a regular basis.

Because of the extra space in the matrix, SRAM uses more chips than DRAM for the same amount of storage space, thus making the manufacturing costs higher. So SRAM is used as cache memory and has very fast access.

Characteristic of the Static RAM

- It has long life
- There is no need to refresh
- Faster
- Used as cache memory
- Large size
- Expensive
- High power consumption

Dynamic RAM (DRAM)

DRAM, unlike SRAM, must be continually **refreshed** in order to maintain the data. This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second. DRAM is used for most system memory because it is cheap and small. All DRAMs are made up of memory cells which are composed of one capacitor and one transistor.

Characteristics of the Dynamic RAM

- It has short data lifetime
- Need to be refreshed continuously
- Slower as compared to SRAM
- Used as RAM
- Lesser in size
- Less expensive
- Less power consumption

ROM

ROM stands for Read Only Memory. The memory from which we can only read but cannot write on it. This type of memory is non-volatile. The information is stored permanently in such memories during manufacture. A ROM, stores such instructions that are required to start a computer. This operation is referred to as bootstrap. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven
 Following are the various types of ROM

MROM (Masked ROM)

The very first ROMs were hard-wired devices that contained a pre-programmed set of data or instructions. These kind of ROMs are known as masked ROMs which are inexpensive.

PROM (Programmable Read only Memory)

PROM is read-only memory that can be modified only once by a user. The user buys a blank PROM and enters the desired contents using a PROM program. Inside the PROM chip there are small fuses which are burnt open during programming. It can be programmed only once and is not erasable.

EPROM(Erasable and Programmable Read Only Memory)

The EPROM can be erased by exposing it to ultra-violet light for a duration of up to 40 minutes. Usually, an EPROM eraser achieves this function. During programming, an electrical charge is trapped in an insulated gate region. The charge is retained for more than ten years because the charge has no leakage path. For erasing this charge, ultra-violet light is passed through a quartz crystal window(lid). This exposure to ultra-violet light dissipates the charge. During normal use the quartz lid is sealed with a sticker.

EEPROM(Electrically Erasable and Programmable Read Only Memory)

The EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (milli second). In EEPROM, any location can be selectively erased and programmed. EEPROMs can be erased one byte at a time, rather than erasing the entire chip. Hence, the process of re-programming is flexible but slow.

Advantages of ROM

The advantages of ROM are as follows:

- Non-volatile in nature
- These cannot be accidentally changed
- Cheaper than RAMs
- Easy to test
- More reliable than RAMs

- These are static and do not require refreshing
- Its contents are always known and can be verified

ISA BUS

The **Industry Standard Architecture** or **ISA** (Pronounced as separate letters or as *eye-sa*) bus began as part of IBM's revolutionary PC/XT and PC/AT released in 1981. However, it was officially recognized as "*ISA*" in 1987 when the IEEE (Institute of Electrical and Electronics Engineers) formally documented standards governing its 16-bit implementation. AT version of the bus is called the AT bus and became a de facto industry standard.

History

ISA stands for Industry standard architecture. It was the original IBM expansion bus and initially no standard was assigned to it. Its first version was the 8 bit bus and it ran at the speed of about 7 MHz.

In 1984, with the advent of PC AT (Intel 286), the bus width is increased to 16 bits and the frequency successively 6 to 8 MHz, 8.33 MHz and finally, providing a theoretical maximum of 16 MB / s (in practice only 8 MB / s as a cycle of twowas used for addressing). The second generation of PC's used 16 bit ISA expansion bus which also ran at the same speed i.e. 7 MHz initially. The later cards allow speed of 8.33 MHz for the 16 bit ISA bus. Nowadays the I/O devices are much faster than their speed but still the ISA connectors are usually included in PC's to make them is backward compatible with the slower ISA cards. Current motherboards no longer include ISA bus, PCI bus replaced by the faster and Plug & Play.

MOTHER BOARD

The motherboard serves as a single platform to connect all of the parts of a computer together. A motherboard connects CPU, memory, hard drives, optical drives, video card, sound card, and other ports and expansion cards directly or via cables. It can be considered as the backbone of a computer.

Features of Motherboard

A motherboard comes with following features:

- Motherboard varies greatly in supporting various types of components.
- Normally a motherboard supports a single type of CPU and few types of memories.
- Video Cards, Hard disks, Sound Cards have to be compatible with motherboard to function properly
- Motherboards, cases and power supplies must be compatible to work properly together.

Popular Manufacturers

- Intel
- ASUS
- AOpen
- ABIT
- Biostar
- Gigabyte
- MSI

Description of Motherboard

The motherboard is mounted inside the case and is securely attached via small screws through pre-drilled holes. Motherboard contains ports to connect all of the internal components. It provides a single socket for CPU whereas for memory, normally one or more slots are available. Motherboards provide ports to attach floppy drive, hard drive, and optical drives via ribbon cables. Motherboard carries fans and a special port designed for power supply.

There is a peripheral card slot in front of the motherboard using which video cards, sound cards and other expansion cards can be connected to motherboard.

On the left side, motherboards carry a number of ports to connect monitor, printer, mouse, keyboard, speaker, and network cables. Motherboards also provide USB ports which allow compatible devices to be connected in plug-in/plug-out fashion for example, pen drive, digital cameras etc.

Memory unit is:

- the amount of data that can be stored in the storage unit.
- that in which storage capacity is expressed in terms of Bytes.

Following are the main memory storage units:

Sr.No.	Unit	Description
1	Bit (Binary Digit)	A binary digit is logical 0 and 1 representing a passive or an active state of a component in an electric circuit.
2	Nibble	A group of 4 bits is called nibble.
3	Byte	A group of 8 bits is called byte. A byte is the smallest unit which can represent a data item or a character.
4	Word	A computer word, like a byte, is a group of fixed number of bits processed as a unit which varies from computer to computer but is fixed for each computer. The length of a computer word is called word-size or

		word length and it may be as small as 8 bits or may be as long as 96 bits. A computer stores the information in the form of computer words.

Few higher storage units are following

Sr.No.	Unit	Description
1	Kilobyte (KB)	1 KB = 1024 Bytes
2	Megabyte (MB)	1 MB = 1024 KB
3	GigaByte (GB)	1 GB = 1024 MB
4	TeraByte (TB	1 TB = 1024 GB
5	PetaByte (PB)	1 PB = 1024 TB

COMPUTER PORTS

A port:

- is a physical docking point using which an external device can be connected to the computer.
- can also be programmatic docking point through which information flows from a program to computer or over the internet.

Characteristics

A port has the following characteristics:

- External devices are connected to a computer using cables and ports.
- Ports are slots on the motherboard into which a cable of external device is plugged in.
- Examples of external devices attached via ports are mouse, keyboard, monitor, microphone, speakers etc.

Following are few important types of ports:

Serial Port

- Used for external modems and older computer mouse
- Two versions : 9 pin, 25 pin model
- Data travels at 115 kilobits per second

Parallel Port

- Used for scanners and printers
- Also called printer port
- 25 pin model
- Also known as IEEE 1284-compliant Centronics port

PS/2 Port

- Used for old computer keyboard and mouse
- Also called mouse port
- Most of the old computers provide two PS/2 port, each for mouse and keyboard
- Also known as IEEE 1284-compliant Centronics port

Universal Serial Bus (or USB) Port

- It can connect all kinds of external USB devices such as external hard disk, printer, scanner, mouse, keyboard etc.
- It was introduced in 1997.
- Most of the computers provide two USB ports as minimum.
- Data travels at 12 megabits per seconds
- USB compliant devices can get power from a USB port

VGA Port

- Connects monitor to a computer's video card.
- Has 15 holes.
- Similar to serial port connector but serial port connector has pins, it has holes.

Power Connector

- Three-pronged plug
- Connects to the computer's power cable that plugs into a power bar or wall socket

Firewire Port

- Transfers large amount of data at very fast speed.
- Connects camcorders and video equipments to the computer
- Data travels at 400 to 800 megabits per seconds
- Invented by Apple
- Three variants : 4-Pin FireWire 400 connector, 6-Pin FireWire 400 connector and 9-Pin FireWire 800 connector

Modem Port

- Connects a PC's modem to the telephone network

Ethernet Port

- Connects to a network and high speed Internet.
- Connect network cable to a computer.
- This port resides on an Ethernet Card.
- Data travels at 10 megabits to 1000 megabits per seconds depending upon the network bandwidth.

Game Port

- Connect a joystick to a PC
- Now replaced by USB.

Digital Video Interface, DVI port

- Connects Flat panel LCD monitor to the computer's high end video graphic cards.
- Very popular among video card manufacturers.

Sockets

- Connect microphone, speakers to sound card of the computer

HARDWARE

Hardware represents the physical and tangible components of a computer i.e. the components that can be seen and touched.

Examples of Hardware are following:

- **Input devices** –– keyboard, mouse etc.
- **Output devices** –– printer, monitor etc.
- **Secondary storage devices** –– Hard disk, CD, DVD etc.
- **Internal components** –– CPU, motherboard, RAM etc.

Relationship between Hardware and Software

- Hardware and software are mutually dependent on each other. Both of them must work together to make a computer produce a useful output.
- Software cannot be utilized without supporting hardware.
- Hardware without set of programs to operate upon cannot be utilized and is useless.
- To get a particular job done on the computer, relevant software should be loaded into the hardware

- Hardware is a one-time expense.
- Software development is very expensive and is a continuing expense.
- Different software applications can be loaded on a hardware to run different jobs.
- A software acts as an interface between the user and the hardware.
- If hardware is the 'heart' of a computer system, then software is its 'soul'. Both are complimentary to each other.

SOFTWARE

Software is a set of programs, which is designed to perform a well-defined function. A program is a sequence of instructions written to solve a particular problem.

There are two types of software

- System Software
- Application Software

System Software

The system software is collection of programs designed to operate, control, and extend the processing capabilities of the computer itself. System software are generally prepared by computer manufactures. These software products comprise of programs written in low-level languages which interact with the hardware at a very basic level. System software serves as the interface between hardware and the end users.

Some examples of system software are Operating System, Compilers, Interpreter, Assemblers etc.

Features of system software are as follows:

- Close to system
- Fast in speed
- Difficult to design
- Difficult to understand
- Less interactive
- Smaller in size
- Difficult to manipulate
- Generally written in low-level language

Application Software

Application software products are designed to satisfy a particular need of a particular environment. All software applications prepared in the computer lab can come under the category of Application software.

Application software may consist of a single program, such as a Microsoft's notepad for writing and editing simple text. It may also consist of a collection of programs, often called a software package, which work together to accomplish a task, such as a spreadsheet package.

Examples of Application software are following:

- Payroll Software
- Student Record Software
- Inventory Management Software
- Income Tax Software
- Railways Reservation Software
- Microsoft Office Suite Software
- Microsoft Word
- Microsoft Excel
- Microsoft Powerpoint

Features of application software are as follows:
- Close to user
- Easy to design
- More interactive
- Slow in speed
- Generally written in high-level language
- Easy to understand
- Easy to manipulate and use
- Bigger in size and requires large storage space

NUMBER SYSTEM

When we type some letters or words, the computer translates them in numbers as computers can understand only numbers. A computer can understand positional number system where there are only a few symbols called digits and these symbols represent different values depending on the position they occupy in the number.

A value of each digit in a number can be determined using

- The digit
- The position of the digit in the number
- The base of the number system (where base is defined as the total number of digits available in the number system).

Decimal Number System

The number system that we use in our day-to-day life is the decimal number system. Decimal number system has base 10 as it uses 10 digits from 0 to 9. In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands and so on.

As a computer programmer or an IT professional, you should understand the following number systems which are frequently used in computers.

S.N.	Number System and Description
1	Binary Number System Base 2. Digits used : 0, 1
2	Octal Number System Base 8. Digits used : 0 to 7
3	Hexa Decimal Number System Base 16. Digits used : 0 to 9, Letters used : A– F

Binary Number System

Characteristics of binary number system are as follows:

- Uses two digits, 0 and 1.
- Also called base 2 number system
- Each position in a binary number represents a 0 power of the base (2). Example 2^0
- Last position in a binary number represents a x power of the base (2). Example 2^x where x represents the last position – 1.

Example

Binary Number : 10101_2

Calculating Decimal Equivalent:

Step	Binary Number	Decimal Number
Step 1	10101_2	$((1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	10101_2	$(16 + 0 + 4 + 0 + 1)_{10}$
Step 3	10101_2	21_{10}

Note : 10101_2 is normally written as 10101.

Octal Number System

Characteristics of octal number system are as follows:

- Uses eight digits, 0,1,2,3,4,5,6,7.
- Also called base 8 number system
- Each position in an octal number represents a 0 power of the base (8). Example 8^0
- Last position in an octal number represents a x power of the base (8). Example 8^x where x represents the last position – 1.

Example

Octal Number : 12570_8

Calculating Decimal Equivalent:

Step	Octal Number	Decimal Number
Step 1	12570_8	$((1 \times 8^4) + (2 \times 8^3) + (5 \times 8^2) + (7 \times 8^1) + (0 \times 8^0))_{10}$
Step 2	12570_8	$(4096 + 1024 + 320 + 56 + 0)_{10}$
Step 3	12570_8	5496_{10}

Note : 12570_8 is normally written as 12570.

Hexadecimal Number System

Characteristics of hexadecimal number system are as follows:

- Uses 10 digits and 6 letters, 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F.
- Letters represents numbers starting from 10. A = 10. B = 11, C = 12, D = 13, E = 14, F = 15.
- Also called base 16 number system
- Each position in a hexadecimal number represents a 0 power of the base (16). Example 16^0
- Last position in a hexadecimal number represents a x power of the base (16). Example 16^x where x represents the last position – 1.

There are many methods or techniques which can be used to convert numbers from one base to another. We'll demonstrate here the following:

- Decimal to Other Base System
- Other Base System to Decimal
- Other Base System to Non-Decimal
- Shortcut method – Binary to Octal

- Shortcut method – Octal to Binary
- Shortcut method – Binary to Hexadecimal
- Shortcut method – Hexadecimal to Binary

Decimal to Other Base System

steps

- **Step 1** – Divide the decimal number to be converted by the value of the new base.
- **Step 2** – Get the remainder from Step 1 as the rightmost digit (least significant digit) of new base number.
- **Step 3** – Divide the quotient of the previous divide by the new base.
- **Step 4** – Record the remainder from Step 3 as the next digit (to the left) of the new base number.

Repeat Steps 3 and 4, getting remainders from right to left, until the quotient becomes zero in Step 3.

The last remainder thus obtained will be the most significant digit (MSD) of the new base number.

Other base system to Decimal System

Steps

- **Step 1** – Determine the column (positional) value of each digit (this depends on the position of the digit and the base of the number system).
- **Step 2** – Multiply the obtained column values (in Step 1) by the digits in the corresponding columns.
- **Step 3** – Sum the products calculated in Step 2. The total is the equivalent value in decimal.

Other Base System to Non-Decimal System

Steps

- **Step 1** – Convert the original number to a decimal number (base 10).
- **Step 2** – Convert the decimal number so obtained to the new base number.

Example

Octal Number : 25_8

FLOPPY DISK

The *floppy disk drive or FDD* is the primary removable storage medium for a *personal* computer. The *FDD,* once called a mini disk, is the primary medium for getting voluminous information into and out of a micro computer system. If you have two FDDs of

different storage capacities, **A:** In *DOS and Windows* the identifier used for the first *floppy disk drive;* the second floppy disk is designated as drive B:.

A **floppy disk,** often called a **diskette Drive** in the PC world, is a thin, round, flat piece of Mylar. It has an extremely thin coating of ferric oxide or magnetic oxide layer that is capable of storing magnetic fields, like thick recording tape. The *read-write head* in a *floppy disk drive* stores data on the disk by altering the magnetic particles.
The large, 5.25-inch floppy disks that most PCs use are kept in a paper envelope. The smaller, 3.5-inch floppy that all Macintoshes and some PCs use is enclosed in a rigid plastic case with a sliding metal shutter for head access.

Floppy disks retrieve information far more slowly than HDD because they rotate at lower speed (300 rpm as against 10,000+ rpm).

Data is written on to the floppy disk by the disk drive's read/write heads as the disk rotates inside the jacket.

Because floppy disks store information magnetically, any magnet can destroy the data (information) on the disk. This means you should never allow your floppy disks near a magnetic paper clip holder, the telephone, the stereo, a portable radio, or any other electronic device–and don't pin them to a filing cabinet with a magnet!

IBM Computer used 5.25" inch floppy disks can contain 360 KB, while modern 3.5" inch disks hold 1.44 Mb. Floppy disks became the main medium for software distribution during the formative years of personal computing.

In Floppy Disks, information is organized in *tracks.* Each track is subdivided into *sectors* and each sector into bytes. The smaller 3.5" Floppy Disks use 80 tracks per side, 18 sectors per track, and 512 bytes per sector, yielding a capacity of 1.44 MB. Floppy disks first appeared in the late 1960s when IBM used them in an early minicomputer.

The advantage of the floppy disk is that it is removable, and so can be used to distribute *software,* to transfer data from one computer to another, or to *back up files* from a *hard disk.* But compared to a hard disk, floppy disks are also slower, offer relatively small amounts of storage, and can be easily damaged.

What is data?

Data can be defined as a representation of facts, concepts or instructions in a formalized manner which should be suitable for communication, interpretation, or processing by human or electronic machine.

Data is represented with the help of characters like alphabets (A-Z,a-z), digits (0-9) or special characters(+,-,/,*,<,>,= etc.).

What is Information?

Information is organised or classified data which has some meaningful values for the receiver.

Information is the processed data on which decisions and actions are based.

For the decision to be meaningful, the processed data must qualify for the following characteristics:

- **Timely** – Information should be available when required.
- **Accuracy** – Information should be accurate.
- **Completeness** – Information should be complete.

Data Processing Cycle

Data processing is the re-structuring or re-ordering of data by people or machine to increase their usefulness and add values for particular purpose. Data processing consists of basic steps input, processing and output. These three steps constitute the data processing cycle.

- **Input** – In this step the input data is prepared in some convenient form for processing. The form will depend on the processing machine. For example, when electronic computers are used, the input data could be recorded on any one of several types of input medium, such as magnetic disks, tapes and so on.
- **Processing** – In this step input data is changed to produce data in a more useful form. For example, pay-checks may be calculated from the time cards, or a summary of sales for the month may be calculated from the sales orders.
- **Output** – Here the result of the proceeding processing step are collected. The particular form of the output data depends on the use of the data. For example, output data may be pay-checks for employees.

BUS

Bus: The electrically conducting path along which data is transmitted inside any digital electronic device. A bus consists of a set of parallel conductors, which may be conventional wires, copper tracks on a PRINTED CIRCUIT BOARD, or microscopic aluminum trails on the surface of a silicon chip. Each wire carries just one bit,

so the number of wires determines the largest data WORD the bus can transmit: a bus with eight wires can carry only 8-bit data words, and hence defines the device as an 8-bit device. A bus normally has a single word memory circuit called a LATCH attached to either end, which briefly stores the word being transmitted and ensures that each bit has settled to its intended state before its value is transmitted.

The bus helps the various parts of the PC communicate. If there was no bus, you would have an unwieldy number of wires connecting every part to every other part. It would be like having separate wiring for every light bulb and socket in your house. There are a variety of buses found inside the computer. The data bus allows data to travel back and forth between the microprocessor (CPU) and memory (RAM). The address bus carries information about the location of data in memory.

The control bus carries the control signals that make sure everything is flowing smoothly from place to place. If your computer has *expansion slots,* there's an **expansion bus.** Messages and information pass between your computer and the *add-in boards* you plug in over the expansion bus. Although this is a bit confusing, these different buses are sometimes together called simply "the bus."

A user can think of the computer's "bus" as one unit made up of three parts: data, address, and control, even though the three electrical pathways do not run along each other (and therefore don't really form a single "unit") within the computer.

There are different sizes, or widths of data buses found in computers today. A data bus' width is measured by the number of bits that can travel on it at once. The speed at which its bus can transmit words, that is, its bus BANDWIDTH, crucially determines the speed of any digital device.

One way to make a bus faster is to increase its width; for example a 16-bit bus can transmit two 8-bit words at once, 'side-by-side', and so carries 8-bit data twice as fast as an 8-bit

bus can. A computer's CPU will typically contain several buses, often of differing widths, that connect its various subunits.

It is common for modern CPUs to use on-chip buses that are wider than the bus they use to communicate with external devices such as memory, and the speed difference between on- and off-chip operations must then be bridged by keeping a reservoir of temporary data in a CACHE. For example many of the Pentium class of processors use 256 bits for their fastest on-chip buses, but only 64 bits for external links.

An 8-bit bus carries data along 8 parallel lines. A 16-bit bus, also called ISA (Industry Standard Architecture), carries data along 16 lines. A 32-bit bus, classified as EISA (Enhanced Industry Standard Architecture) or MCA (Micro Channel Architecture), can carry data along 32 lines.

The speed at which buses conduct signals is measured in megahertz (Mhz). Typical PCs today run at speeds between 20 and 65Mhz. Also see CPU, Expansion Card, Memory, Motherboard, RAM, ROM, and System Unit.

How Does It Work?

A bus transfers electrical signals from one place to another. An actual bus appears as an endless amount of etched copper circuits on the motherboard's surface. The bus is connected to the CPU through the Bus Interface Unit.

Data travels between the CPU and memory along the data bus. The location (address) of that data is carried along the address bus. A clock signal which keeps everything in synch travels along the control bus.

The clock acts like a traffic light for all the PC's components; the "green light" goes on with each clock tick. A PC's clock can "tick" anywhere from 20 to 65 million times per second, which makes it seem like a computer is really fast. But since each task (such as saving a file) is made up of several programmed instructions, and each of those instructions takes several clock cycles to carry out, a person sometimes has to sit and wait for the computer to catch up.

What is a Computer Network?

A computer network is a system in which multiple computers are connected to each other to share information and resources.

Characteristics of a computer network

- Share Resources from one computer to another
- Create files and store them in one computer, access those files from the other computer(s) connected over the network
- Connect a printer, scanner, or a fax machine to one computer within the network and let other computers of the network use the machines available over network.

Following is the list of hardware's required to setup a computer network.

- Network Cables
- Distributors
- Routers
- Internal Network Cards
- External Network Cards

Network Cables

Network cables are used to connect computers. The most commonly used cable is Category 5 cable RJ-45.

Distributors

A computer can be connected to another one via a serial port but if we need to connect many computers to produce a network, this serial connection will not work. The solution is to use a central body to which other computers, printers, scanners etc. can be connected and then this body will manage or distribute network traffic.

Router

A router is a type of device which acts as the central point among computers and other devices that are part of a network. A router is equipped with holes called ports and computers and other devices are connected to a router using network cables. Now-a-days router comes in wireless modes using which computers can be connected without any physical cable.

Network Card

Network card is a necessary component of a computer without which a computer cannot be connected over a network. It is also known as network adapter or Network Interface Card (NIC). Most branded computers have network card pre-installed. Network cards are of two types : Internal and External Network Cards.

INTERNAL NETWORK CARDS

Motherboard has a slot for internal network card where it is to be inserted. Internal network cards are of two types in which first type uses Peripheral Component Interconnect (PCI) connection while the second type uses Industry Standard Architecture (ISA). Network cables are required to provide network access.

EXTERNAL NETWORK CARDS

External network cards come in two flavours : Wireless and USB based. Wireless network card need to be inserted into the motherboard but no network cable is required to connect to network

Universal Serial Bus (USB)

USB card are easy to use and connect via USB port. Computers automatically detect USB card and can install the drivers required to support the USB network card automatically

OPERATING SYSTEM

It is a program with following features:
- An operating system is a program that acts as an interface between the software and the computer hardware.
- It is an integrated set of specialised programs that are used to manage overall resources and operations of the computer.
- It is specialised software that controls and monitors the execution of all other programs that reside in the computer, including application programs and other system software.

Objectives of Operating System
- To make a computer system convenient to use in an efficient manner
- To hide the details of the hardware resources from the users
- To provide users a convenient interface to use the computer system
- To act as an intermediary between the hardware and its users and making it easier for the users to access and use other resources
- To manage the resources of a computer system

- To keep track of who is using which resource, granting resource requests, according for resource using and mediating conflicting requests from different programs and users
- To provide efficient and fair sharing of resources among users and programs

Characteristics of Operating System

- **Memory Management** –– keeps tracks of primary memory i.e. what part of it is in use by whom, what part is not in use etc. and allocates the memory when a process or program requests it.
- **Processor Management** –– allocates the processor(CPU) to a process and deallocates processor when it is no longer required.
- **Device Management** –– keeps track of all devices. This is also called I/O controller that decides which process gets the device, when, and for how much time.
- **File Management** –– allocates and de-allocates the resources and decides who gets the resources.
- **Security** –– prevents unauthorized access to programs and data by means of passwords and similar other techniques.
- **Job accounting** –– keeps track of time and resources used by various jobs and/or users.
- **Control over system performance** –– records delays between request for a service and from the system.
- **Interaction with the operators** –– The interaction may take place via the console of the computer in the form of instructions. Operating System acknowledges the same, does the corresponding action and informs the operation by a display screen.
- **Error-detecting aids** –– Production of dumps, traces, error messages and other debugging and error-detecting methods.
- **Coordination between other software and users** –– Coordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.

WHAT IS 32bit?

The word *"bit"* attached to a number can refer to several things, depending on the context. The term 32-bit is often applied to the following:

1. 32-bit refer how much information stored in the "registers" of thecomputer's *central processing unit,* which is an indication of speed and performance.

2. 32-bit refer the size of data *bus* through which the processor sends out the information. 32-bit bus can address 4,294,967,296 words (232), which would correspond to 4 gigabytes. The larger data bus enables faster transfer of data to and from storage. Most personal computers today use a 32-bit bus,

3. It can refer to how much information in *memory* a computer can use.

4. It can refer to the depth of the pixels on the monitor, which creates the color and the resolution of the images, 32-bit Color (so-called TRUE COLOUR).

5. It can refer to the program that uses the 32-bit internal registers and large memory capacity.

6. It can refer to the Operating System; Windows 2000 are true 32-bit operating systems,

7. It can refer to FAT file system, FAT32 allows each disk to be divided into a larger number of clusters (allocation units);

8. It can refer to binary address.

9. It can refer to 32-bit chip.

A *bit* is a tiny electronic signal. In any context, the bigger the bit number, the more powerful, faster, or more colorful the feature.

Internet

It is a worldwide system which has the following characteristics:

- Internet is a world-wide / global system of interconnected computer networks.
- Internet uses the standard Internet Protocol (TCP/IP)
- Every computer in internet is identified by a unique IP address.
- IP Address is a unique set of numbers (such as 110.22.33.114) which identifies a computer's location.
- A special computer DNS (Domain Name Server) is used to give name to the IP Address so that user can locate a computer by a name.
- For example, a DNS server will resolve a name http://www.tutorialspoint.com to a particular IP address to uniquely identify the computer on which this website is hosted.
- Internet is accessible to every user all over the world.

INTRANET

- Intranet is system in which multiple PCs are connected to each other.
- PCs in intranet are not available to the world outside the intranet.
- Usually each company or organization has their own Intranet network and members/employees of that company can access the computers in their intranet.

- Each computer in Intranet is also identified by an IP Address which is unique among the computers in that Intranet.

Similarities in Internet and Intranet

- Intranet uses the internet protocols such as TCP/IP and FTP.
- Intranet sites are accessible via web browser in similar way as websites in internet. But only members of Intranet network can access intranet hosted sites.
- In Intranet, own instant messengers can be used as similar to yahoo messenger/ gtalk over the internet.

Differences in Internet and Intranet

- Internet is general to PCs all over the world whereas Intranet is specific to few PCs.
- Internet has wider access and provides a better access to websites to large population whereas Intranet is restricted.
- Internet is not as safe as Intranet as Intranet can be safely privatized as per the need.

What is an application?

An **app** is a type of software that allows you to **perform specific tasks**. Applications for desktop or laptop computers are sometimes called **desktop applications**, and those for mobile devices are called **mobile apps**. When you open an application, it runs inside the **operating system** until you close it. Most of the time, you will have more than one application open at the same time, and this is known as **multitasking**.

Types of desktop applications

There are countless desktop applications out there, and they fall into many different categories. Some are more**full-featured** (like **Microsoft Word**), while others may only do **one or two things** (like **gadgets**). Below are just a few types of applications you might use:

- **Word processors:** A word processor allows you to write a letter, design a flyer, and create many other types of documents. The most well-known word processor is **Microsoft Word**.
- **Personal finance:** Personal finance software, such as **Quicken**, allows you to keep track of your income and expenses and create a budget, among other tasks. Most personal finance programs can automatically download information from your bank so you don't have to manually type in all of your transactions.

- **Web browsers:** A **web browser** is the tool you use to access the **Internet**. Most computers come with a web browser **pre-installed**, but you can also download a different one if you prefer. Examples of browsers include **Internet Explorer**, **Firefox**, **Google Chrome**, and **Safari**.
- **Games:** There are many different games you can play on your computer. They range from card games such as **Solitaire** to action games like **Halo 2**. Many action games require a lot of **computing power**, so they may not work unless you have a newer computer.
- **Media players:** If you want to listen to **MP3s** or watch **movies** you've downloaded, you'll need to use a **media player**. **Windows Media Player** and **iTunes** are popular media players.
- **Gadgets:** Sometimes called **widgets**, these are simple applications you can place on your desktop (or on the **Dashboard** if you're using a Mac). There are many different types of gadgets, and they include **calendars**, **calculators**, **maps**, and **news headlines**.

Installing applications

In order to work, an application usually has to be **installed** on your computer. Typically, installation is as simple as inserting the **installation disc** and following the instructions on the screen. For software **downloaded from the Internet**, you can usually **double-click** it after it is finished downloading and then follow the instructions on the screen. Many applications include a **readme** file (for example, **readme.txt**), which includes installation instructions and other information

Files and applications

Each application on your computer has a group of **file types**—or **formats**—it is able to open. You generally won't have to figure out which application will open your files. When you **double-click** a file, your computer will automatically use the correct application to open it, as long as the application is installed on your computer.

If you don't have the correct application installed, you may not be able to open the file. However, in some cases you can open the file with a **web application** that runs in your browser. For example, if you don't have Microsoft Word, you can open Word documents with **Google Docs**

MICROSOFT WINDOWS

Microsoft created the **Windows** operating system in the mid-1980s. Over the years, there have been many different versions of Windows, but the most recent ones

are **Windows 8** (released in 2012), **Windows 7** (2009), and **Windows Vista** (2007). Windows comes **preloaded** on most new PCs, which helps to make it the **most popular operating system** in the world.

If you're buying a new computer or are upgrading to a newer version of Windows, you can choose from several different **editions** of Windows, such as **Home Premium**, **Professional**, and **Ultimate**

Mac OS X

Mac OS is a line of operating systems created by Apple. It comes preloaded on all new Macintosh computers, or Macs. All of the recent versions are known as **OS X** (pronounced O-S Ten), and the specific versions include **Yosemite** (released in 2014), **Mavericks** (2013), **Mountain** **Lion** (2012), **Lion** (2011), and **Snow Leopard**(2009). Apple also offers a version called **Mac OS X Server**, which is designed to be run on servers.

According to **StatCounter Global Stats**, Mac OS X users account for **9.5%** of the operating systems market as of September 2014—much lower than the percentage of Windows users (almost **90%**). One reason for this is that Apple computers tend to be more expensive. However, many people prefer the look and feel of Mac OS X.

Linux

Linux (pronounced **LINN-ux**) is a family of **open-source** operating systems, which means they can be modified and distributed by anyone around the world. This is different from **proprietary software** like Windows, which can only be modified by the company that owns it (Microsoft). The advantages of Linux are that it is **free**, and there are many different **distributions**—or versions—you can choose from. Each distribution has a different look and feel, and the most popular ones include **Ubuntu**, **Mint**, and **Fedora**.

Linux is named after **Linus Torvalds**, who created the **Linux kernel** in 1991. The **kernel** is the computer code that is the central part of an operating system

Operating systems for mobile devices

The operating systems we've been talking about were designed to run on **desktop** or **laptop** computers. **Mobile devices** such as **phones**, **tablet computers**, and **MP3 players** are different from desktop and laptop computers, so they run operating systems that are designed specifically for mobile devices. Examples of

mobile operating systems include **Apple iOS**, **Windows Phone**, and **Google Android**. In the screenshot below, you can see Apple iOS running on an iPad.

Types of Magnetic Disks

Hard Disks

A **hard disk** consists of 1 or more metal platters which are sealed inside a case. The metal is one which is magnetic. The hard disk is usually installed inside the computer's case, though there are removable and cartridge types, also.

Technically the **hard drive** is what controls the motion of the **hard disks** which contain the data. But most people use "hard disk" and "hard drive" interchangeably. They don't make that mistake for floppy disks and floppy drives, described below. It is clearer with floppies that the drive and the disk are separate things.

Diskette / Floppy Disk (extinct?)

Both sizes are seem to be extinct in work places. The only remaining flocks of such disks are hiding among the dust balls in back storage closets, waiting for someone to decide what to do with them.

Sizes:

5¼"
(really ancient stuff)

3½"
(just horribly old)

Both sizes are made of mylar with an oxide coating. The oxide provides the magnetic quality for the disk. The "floppy" part is what is inside the diskette covers – a very floppy piece of plastic (i.e. the mylar).

Other Removable Magnetic Media

Several other kinds of removable magnetic media are in use, such as the Zip disk. All of these have a much higher capacity than floppy disks.

Each type of media requires its own drive. The drives and disks are much more expensive than floppy drives and disks, but then, you are getting much larger capacities.

Capacity of Disks

5¼" floppy	– 360 KB or 1.2 MB
3½" floppy	– 720 KB or 1.44 MB

Hard disk

early ones	= 20 MB
currently	up to 3 TB Internal hard drive where **1 TB** = 1 **terabyte** = 1000 GB

Word Processing

Word processing is the *most used computer application*!

It has replaced the typewriter as the main way words are put on paper. Documents can be revised and corrected before they are ever printed. An existing document can be used as a **template**, or pattern, for a new one. So the user doesn't have to recreate standard documents from scratch each time. This is a major time-saver and helps keep things consistent.

Purpose:	•	To produce documents
Main advantage:	•	Can easily change what has been done
	•	Can reuse existing documents as a template

Steps to produce a document

- Create
- Edit
- Format
- Print
- Save

Create

You **create** a document when you open a blank document and enter text.

Features/Terms:

Word wrap – Automatically wrapping the text to the next line so it all fits within the screen's width.

Change the size of the screen and the text moves to fit in the space.

Cursor – Symbol for where text will appear like: I

Enter text– Type new text

Scrolling – Moving document around within window

Select – Highlight text, usually by dragging. Commands and keystroke combinations will apply to the selected material.

Edit – Make changes

Cut – Remove selection from document and store temporarily on the **Clipboard**, which is a section of computer memory. The Windows Clipboard can hold only one thing at a time. The Office Clipboard from Office XP and later versions can hold many items.

Copy – Duplicate selection onto Clipboard

Paste – Place contents of the Clipboard at cursor location

Undo – Reverses whatever change you just made
Some programs will only "undo" the last change.
Others keep a list and can undo more, depending on how many changes the program tracks.

Insert – Add text at location without overwriting existing text

Overwrite – Typing overwrites existing text, replacing whatever characters were there already

Delete – Remove text (not saved anywhere)

Search – Look for specific word(s) or character(s) in the document

Replace – Can replace specific word(s) or character(s) with stated text

Template – Document that serves as a pattern for a new document

Thesaurus – Looks for synonyms for selected word

Spelling check – Looks for spelling errors

Grammar check – Looks for grammar/style errors (of limited help)

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