**UNIT 1 Introduction to computers:**

A computer is an electronic device, which accept data and process it and gives us information with set of instructions called program.i.e A computer is a programmable machine, multiuse machine. The word computer is derived from the latin word “computare”.The computer as a system which is a combination of hardware and software joined together.so it has the ability to:

a) accept data

b)input,store and execute instructions.

c)perform mathematical and logical operation on data.

d)output results.

Functions of computer:

There are various function of computer. The main functions are of five types. They are as follows:

1) Inputting-The process which enter data inside computer system with the help of input devices is called inputting.or In others words the process of entering data and instruction is called inputting.

2) Processing:

The process which performs different mathematical operations and logical operations (<,≤, ≥, ≠, >) is called processing.   
The computer performs all processing by "calculating," and "comparing” the data stored in its memory (RAM). It is done in two ways. They are as follows:

a) Mathematical operation  
The computer can perform any mathematical operation on data by adding, subtracting, multiplying and dividing(+,-,\*,/) one set with another.

b)Logical operation  
The computer can analyze and evaluate data by matching it with sets of known data that are included in the program or called in from storage i.e it compares two or more data either it is greater than, smaller than, greater or equal to, smaller or equal to and equals to((<, ≤, ≥, ≠, >).

3) Outputting:

The process of giving information or results after processing and storing is called outputting. It is shown by output devices such as monitor. i.eThe process which display result to the user is called outputting.

4) Storing: The process which helps to store data and information is called storing. The computer is able to store (save) data and programs permanently and retrieve it when required. A system's size is based on how much disk storage it has. The more disks, the more data are immediately available

5) Controlling: The CPU of a computer is responsible for controlling devices attached with computer.i.e Controlling is the function of controlling all the input and output devices, application programmes and memory units.

Data:

The raw facts, measurements, or materials are called data which are collected from different areas to get information. These are also observations, old records. Data is plural form of Datum. For example:

A 40

50 B

30

C 80 D

Fig1: Data

In above fig.A,50,B,40……. Are data. when you simply look at figure, it does not give any meaning, so data are raw facts.

Information:

The proceeded data which are in meaningful form are called information. Data are regarded the most fundamental forms of information. Data are arranged and processed to get information.

|  |  |
| --- | --- |
| Section | No of Students |
| A  B  C  D | 50  40  80  30 |

Fig: Information

When the data of fig 1 are arranged as in fig 2 it gives information since it shows that in section A, there are 50 students and in section B ,there are 40 students and so on.

Hardware:

The physical components which can be seen, touched, feel are called hardware which are resources of a computer .The hardware consist of following components.

Input Device:

These devices are used to input data and instruction into computer .eg: keyboard, mouse etc.

Memories:

These devices are used to store the data and instructions temporarily or permanently.

CPU(central processing unit): It is a processing device ,which is used to perform different mathematical operations and execute instruction.

Output Devices:

Those devices are used to display result to the user. Monitor, printer etc.

Advantages of computer:

1. The result given by computer100% accurate and it is reliable than other devices and human beings.
2. Computer works in fast speed than human beings.
3. Computer is versatile machine as it can do many types of jobs once at a time.
4. Computer has higher storage space to store data and information.

Disadvantages: of computer

1. Computer is expensive and poor people can not afford but day by day it is becoming cheaper.
2. It is totally dependent on electricity and if there is no electricity computer cannot do anything and also the electric shock cause danger.
3. Although it is reliable, sometimes the failures of devices and programs can produce unreliable result.

d).People are becoming too much dependent on computers.

Instruction:

Instructions are the commands which give the way or path to perform different operations inside computer with the help of different devices.

Program:

Collections of set of instructions are called programs. Which are used to run and perform different operations inside computer. Each collection of program parts called software.

Characteristics of computer

All computers have certain common characteristics irrespective their type and size. Computers are not just adding machines; they are capable of doing complex activities and operations. Computers are what they are because of following characteristics.

a)speed:

Computers can calculate at very high speeds. As the power of computer increases, the speed also increases. The smallest unit of time in the human experience is realistically the second. We do not think of doing something in less than a second. But a computer performs operations at an incredible speed. It can process information within Pico second. The computers can process data at an extremely fast rate. i.e. in tune of million of instructions per seconds(MIPS). For example A microcomputer can execute a million of instruction per second. We will use the following terms to describe the processing capability of computer

Millisecond :one thousand of second=1/1000

Microsecond :One million of second=1/1000,000

Nanosecond :One billionth of a second=1/100,000,000

Picoseconds :One trillionth of a second=1/1000,000,000,000

b)Storage:

A computer can store large amount of data. i.e the storage capacity of computer is high. The data can be stored and retrieved according to the need of the user. In fact it takes very less time to retrieve desired information from a huge amount of data stored inside a computer memory. So the capability of storing and retrieving huge amount of data in fast and efficient manner is one of the important characteristics of computer.

c) Accuracy:

In addition to being fast, computers are very accurate which means that the accuracy of computer is very high. The accuracy of a computer is consistently high and the degree of a accuracy of a computer depends upon its design. Every calculation is performed with the same accuracy.

d)Diligence:

A computer can perform repetitive task without being bored, tired and losing concentration. It can continuously work for several hours without human intervention after the data and programs are fed to it. They can handle complicated and complex tasks. Diligence means being constant and earnest in effort and application.

e)Versatility:

Computers are very versatile machines. They can perform activities ranging from simple calculations to complex operations. They can perform different tasks depending upon different programs fed to them. For each task to be performed there is one program associated with it.

f) Word length:

A digital computer operate on binary digits-0 and 1’s.It can understand information in terms of 0s and 1s.A binary digit is called a bit. A group of 8 bits is called a byte. Thus the number of bits that a computer can process at a time in parallel is called its word length .commonly used word length are 8,16,32 or 64 bits. Word length is the measure of the computing power of a computer .The longer word length ,the more powerful the computer is. When we talk about 32-bit computer, it means that its word length is 32 bits.

g) Automation: The automation characteristics of a computer is

that it finishes any task automatically. computers can be programmed to perform a series of complex tasks involving multiple programs.

Limitations of computer( What computer can not do?)

a)No Intellegent:Computer are the machine which can not think.They do not show any intelligence of their own.It can not take its own decision.so their I.Q(Intelligence Quotient) is zero.

b) No Intution: Computer can not draw conclusion with out going through itself.i.e they do not have intuition.Computer can only do a job,which can be expressed in a finite number of steps.The computer is useless without correct program.

c) No Feeling: Computer has no emotions because they are machine.

Types of computer:

Computers are classified according to their application, work, size, capacity, speed, brand which are described as follows:

**Analog**

**computer**

**COMPUTER**

**On the basis**

**Of Brand**

**On the Basis**

**Of Size**

**on the Basis**

**of Work**

Hybrid computer

Digital computer

Micro

computer

Mini computer

Mainframe

computer

IBM/PC

IBM compatible

Apple/Macintosh

Super Computer

**Fig: Classification of computers**

* 1. Classification of computers Based on work:

A. Digital computer

B. Analog Computer

C. Hybrid Computer

A. Digital Computer

A computer which uses binary digits 0s and 1s are called digital computer. They convert the data into binary digits (0s and 1s) and all operations are carried out on these digits at extremely fast rate. A digital computer basically knows how to count the digit and add the digits. Digital computers are much faster than analog computers and far more accurate. Digital computers have high storage or memory. They works upon discontinuous data. Digital computers are multipurpose and programmable and hence used for general purpose( can be used in many different application). Example: Digital Clock, personal computer (PC) etc.

B. Analog Computer

The computer which is used to measure physical magnitudes(such as-voltage , temperature, current and pressure) is called analog computer. Analog computers works with the natural or physical values. i.e these computers works with continuous data. The accuracy of analog computer is low and there is very low or do not have storage or memory. Analog computer operates by measuring rather than counting. Analog computers are mostly used in scientific and engineering applications .E.g:- speedometer, voltmeter etc.

c. Hybrid computers:

A hybrid computer is a combination of both analog and digital computers. i. e it can perform the functions of both a digital and analog computer. or example in an intensive care unit of hospital, analog devices measure the patients heart function, temperature, or other vital signs. These measures are then converted into numbers or digits and supplied to a digital component that monitors the patients vital signs. Hybrid computers are used in weather forecasting. E.g-Hybrid watch.

Difference Between Analog and Digital Computer

|  |  |
| --- | --- |
| Analog computer | Digital computer |
| * Analog computers works with the natural or physical values. * These computer works with * Continuous data. * Accuracy of analog computer is low. * There is very low or do not have storage or memory in analog computer. * Analog computers are used for special purpose only. * Cost of analog computer is low. * Analog computers can’t be re-programmed or if needed to be re-programmed then whole circuit system and hardware parts are to be replaced with new ones. * E.g:Thermometer,Barometer etc * The wave of Analog signals are shown below:   Analog Signal | -Digital computer works with binary digits (0s and 1s).  -These computer works with discontinuous data.  -Accuracy of digital computer is high.  -Digital computers have high storage or memory,  -Digital computer is multipurpose and programmable and hence used for general purpose.  These computers are totally flexible and can be re-programmed.   * PC, Digital camera, digital clock etc. * The wave of Analog signals are shown below:   Digital Signal |

Classification of Digital Computer based on Size:

Now day's computers are available in different sizes and with different capabilities. on the basis of storage capacity of speed of processing information computers are classified into:

A. Micro computers(PC):

The smallest general-purpose computers are called micro computers. Which consists of a single small CPU(central processing units),normally called a microprocessor. Now a days microcomputers are being smaller and smaller but more powerful. Micro computers are known as PC(personal computer) or home computers. These computers are used in Business, engineering, schools, Bank, Entertainment etc. for example: IBM PC(International Business machine),IBM XT(Extended Techonology), laptop,notebooks,PDA(personal digital assistant) etc

B. Minicomputer

Minicomputers are more powerful,high processing speed and having more storage capacity than micro computer.The cost of minicomputer is high than micro computer. These are multi-user( means more than one user can use the computer ) and multiprocessor( Having more than one processor in a single system). They have high processing’s speed, capabilities, large storage space than micro computers. E.g: VAX 50,IBM360.

C. Mainframe Computers:

Main frame computer large machines ,made of several units connected together. Mainframe computers are more powerful,high processing speed and having more storage capacity than minicomputer. Mainframe computers are generally used in big organizations and government departments for large-scale data processing.For example: IBM 3090,VAX 8842 etc.

D. super computers

The largest computer in the world is called super computer.Which is more powerful , more expensive computers and they have extremely large storage capacities and processing speed is at least 10 times faster than other computers. so they are big machines. Inside super computers, there are several smaller computers ,each of which can work on different parts of a work simultaneously. They can be handled and maintained by computer engineers only. super computers are used in weather forecasting, medicine and for creating computer graphics. Some of the super computers are CRAY,NEC super SXII,CYBER 205.

-Workstation computer:

This is a powerful, single computer. A workstation is like a personal computer, but it has a more powerful microprocessor and a storage device for storing data. These are more expensive computer which are used by Engineers, scientist and other professionals who processed a lot of data. People who use complex program use this types of computers. It has better quality display and others. The powerful workstations are called supermicro. For example: Workstations computer made by Sun,Applo,NeXT,IBM.

Portable Computers:

The computer which can be easily carried from one place to other place around is called portable computer.These are smaller computer and yet powerful.For example: laptops or Notebook PCs,PDA(personal Digital Assistant) etc.

Network Computers:

Network Computers are computers with minimal memory, disk storage and processor power designed to connect to a network, especially the internet. The idea behind network computers is that many users who are connected to a network do not need all the computer power they get from typical personal computer. Instead they can rely on the power of the network servers. These types of computer minimize the amount of disk storage, and processor.

Classification Based on Brand:

Computers are classified in terms of brand also. Many companies are involved in manufacturing of computer throughout the world .Many brands of computers are available in the market. On the basis of brand the following three categories are available:

1. IBM PC
2. IBM compatible
3. APPLE/Macintosh
4. IBM PC(International Business Machine personal computer)

IBM is one the leading companies of the world in manufacturing computers, which established in 1924 in USA.In the beginning IBM manufactured main frame computers followed by mini and micro computers. The computers manufactured by IBM are called as IBM computers or IBM brand computers. personal computer(PC) is the most important type of microcomputer, the microcomputers manufactured by IBM company are called as IBM PC.These computers are more reliable, durable and have better quality and the cost originally was very high but now a days the cost has gone down.

1. IBM Compatible

A computer that has the same functional characteristic and the principles of IBM computers are called as IBM compatibles. The basic architecture is similar to IBM PC excepting few technologies. All the software and programs, which run in IBM computers can equally run in IBM compatibles. IBM compatible computers are cheaper and their parts are easily available in the market. Therefore they are popular in the world. Most of the microcomputers used in Nepal are IBM compatibles.

c)Apple/Macintosh

The computer manufactured by Apple company with different architecture is called as Apple or Macintosh computer. This company was established in USA in 1970s.The Apple computers have their own software and hardware. Apple company manufactured new brand of computer popularly known as Macintosh. In Nepal most of the Desktop publishing houses use Apple/Macintosh because they are very easy to handle and the graphic print that we get is of better quality.

#Homework-2

* 1. Differentiate between microcomputer and supercomputer.
  2. Write short note:- Workstation computer, personal computer(PC)

Types of Computer on the basis of model:

1. XT (Extended Technology)

The computer which uses 8086 or 8088 microprocessor types are called XT computers. These types of computer have processing speed 4.77 MHz and they are comparatively slower in speed. They can not run advanced form of software programs.

b) AT(Advanced Technology ) Computer:

The computer which uses 80286 microprocessor is called AT computers. These computers are faster than XT computers. The memory capacity is also higher than XT computers and can run advanced form of software programs. For example desktop pc, home pc etc

c)PS/2 Computer

The PS/2 computers are called personal system computers, which are smaller than AT computer and having more storage capacity than XT computers. These types of computer are known as portable computers so that they can easily carry from one place to another place. For example,laptop,notebook,mobile pc etc.

Personal computer (PC)

Personal computer (PC) is any general-purpose computer whose size, capabilities, and original sales price make it useful for individuals.

A personal computer may be a desktop computer, a laptop, tablet PC or a handheld PC (also called palmtop). The most common hardware components are CPU,RAM,Motherboard, [keyboard](http://en.wikipedia.org/wiki/Computer_keyboard) and [pointing device](http://en.wikipedia.org/wiki/Pointing_device) ,Hard Disk etc

Software applications for personal computers include word processing, spreadsheets, databases, Web browsers and e-mail clients, games, and myriad personal productivity and special-purpose software. Modern personal computers often have high-speed or dial-up connections to the Internet, allowing access to the World Wide Web and a wide range of other resources.

A PC may be used at home, or may be found in an office. Personal computers can be connected to a local area network (LAN) either by a cable or wirelessly.

a. Workstation

A workstation is a high-end personal computer designed for technical or scientific applications. Intended primarily to be used by one person at a time, they are commonly connected to a [local area network](http://en.wikipedia.org/wiki/Local_area_network) and run multi-user [operating systems](http://en.wikipedia.org/wiki/Operating_system).

b. Desktop computer

Desktop PCs can fit on a [desk](http://en.wikipedia.org/wiki/Desk) was considered remarkably small than workstation PC. Today the phrase usually indicates a particular style of [computer case](http://en.wikipedia.org/wiki/Computer_case). Desktop computers come in a variety of styles ranging from large vertical [tower cases](http://en.wikipedia.org/wiki/Tower_case) to [small form factor](http://en.wikipedia.org/wiki/Small_form_factor) models that can be tucked behind an [LCD monitor](http://en.wikipedia.org/wiki/LCD_monitor). In this sense, the term 'desktop' refers specifically to a horizontally-oriented case, usually intended to have the display screen placed on top to save space on the desk top. Most modern desktop computers have separate screens and keyboards.

c. Single unit

Single unit PCs (also known as all-in-one PCs) is a subtype of desktop computers, which combine the monitor and case of the computer within a single unit. The monitor almost always utilizes a [touch screen](http://en.wikipedia.org/wiki/Touchscreen) as an optional method of user input; however detached keyboards and mice are normally still included. The inner components of the PC are often located directly behind the monitor.

d. Laptop

A laptop computer or simply [laptop](http://en.wikipedia.org/wiki/Laptop), also called a notebook computer or sometimes a notebook, is a small personal computer designed for portability.Laptops contains high capacity [batteries](http://en.wikipedia.org/wiki/Battery_(electricity)) that can power the device for extensive periods of time, enhancing portability. Once the battery charge is depleted, it will have to be recharged through a power outlet. In the interest of saving power, weight and space, they usually share RAM with the video channel, slowing their performance compared to an equivalent desktop machine.

One main drawback of the laptop is that, due to the size and configuration of components, relatively little can be done to upgrade the overall computer from its original design. Some devices can be attached externally through ports (including via USB), however internal upgrades are not recommended or in some cases impossible, making the desktop PC more modular.

e. Notebook:

Notebooks are small portable computers in a "clamshell" design that are designed specifically for wireless communication and access to the Internet. They are generally much lighter and cheaper than subnotebooks, and have a smaller display, between 7" and 9", with a screen resolution between 800x600 and 1024x768 but newer models feature higher resolution at up to 1280x768.

f.Tablet PC

A tablet PC is a [notebook](http://en.wikipedia.org/wiki/Notebook) or slate-shaped [mobile computer](http://en.wikipedia.org/wiki/Mobile_computer), first introduced by [Pen computing](http://en.wikipedia.org/wiki/Pen_computing) in the early 90s. Its [touch screen](http://en.wikipedia.org/wiki/Touchscreen) or [graphics tablet/screen hybrid](http://en.wikipedia.org/wiki/Graphics_tablet/screen_hybrid) technology allows the user to operate the [computer](http://en.wikipedia.org/wiki/Computer) with a [stylus](http://en.wikipedia.org/wiki/Stylus_(computing)) or digital pen, or a fingertip, instead of a [keyboard](http://en.wikipedia.org/wiki/Computer_keyboard) or [mouse](http://en.wikipedia.org/wiki/Mouse_(computing)). The form factor offers a more mobile way to interact with a computer. Tablet PCs are often used where normal notebooks.

g.Home theater PC

A home theater PC (HTPC) is a convergence device that combines the functions of a personal computer and a [digital video recorder](http://en.wikipedia.org/wiki/Digital_video_recorder). It is connected to a [television](http://en.wikipedia.org/wiki/Television) or a television-sized [computer display](http://en.wikipedia.org/wiki/Computer_display) and is often used as a digital photo, music, video player, TV receiver and digital video recorder. Home theater PCs are also referred to as [media center](http://en.wikipedia.org/wiki/Media_center) systems or [media servers](http://en.wikipedia.org/wiki/Media_server). The general goal in a HTPC is usually to combine many or all components of a [home theater](http://en.wikipedia.org/wiki/Home_theater) setup into one box. They can be purchased pre-configured with the required hardware and software needed to add television programming to the PC, or can be cobbled together out of discrete components as is commonly done with [MythTV](http://en.wikipedia.org/wiki/MythTV), [Windows Media Center](http://en.wikipedia.org/wiki/Windows_Media_Center), [GB-PVR](http://en.wikipedia.org/wiki/GB-PVR), [SageTV](http://en.wikipedia.org/wiki/SageTV), Famulent or [LinuxMCE](http://en.wikipedia.org/wiki/LinuxMCE).

**History of computers**

The history of computer development is often referred to in reference to the different generations of computing devices. 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.

History of computer starts from time when there were no any number systems discovered and no any device for calculation.

First people counted on their fingers, then they cut the notched of sticks, counted stones and even tied knots in rope.

The development of computer is described in three parts:

I) **Mechanical calculation era**:

In this part we will discuss the development of mechanical calculating device.

i. ***Abacus***:

 It was the earliest counting device. It was believed to be discovered in china about 3000 BC. But it actually evolved in different culture at about the same time.

It used beads to represent digits and wire to hold places.   
It was used only to add and subtract.   
It has two parts heaven and earth.

ii. ***Napier’s Bone***:

Invented by English mathematician ***John Napier*** in 1614 AD. (*Napier was the founder of modern logarithms*).

This mechanical device was used for multiplication and division.

It consists of nine pieces of rectangular cards; each divided horizontally into nine

Square.

Each square is divided diagonally from the right hand corner to bottom left hand corner. In each card multiplication tables from 1 to 9 was written. He places ten above diagonal and unit below the diagonal of square.

iii. ***Slide Rule***:

This device was developed by an English mathematician ***William Ought Red*** in

1920.   
It was based on the principle of logarithms1.   
It was made up of three parts:

a.The body (ruler) .

b. The slide with scale marked on it.   
c.The transparent cursor marked with sharp lines as indicator.

 It was very easy to use; the results of the calculation were obtained by just moving the slide along the body.

iv. ***Pascaline (Pascal’s calculator)***:

 French mathematician, Blaise Pascal, developed Pascaline in 1642.

It was the first mechanical calculator, and limited to performing only addition

and subtraction. And calculation was possible up to 8 digits.

It used a mechanical gear to add and subtract. And had simple monitor to see the results. Multiplication was performed by repeated addition and division by repeated subtraction.

v. ***Stepped Recknor***:

In 1971, a German mathematician Gothfried Von Leibnitz modified the Pascaline machine and invented the calculating machine called ***stepped Recknor***.

It could perform addition, subtraction, multiplication, division and could find out square root also.

1 Logarithm: one of a series of arithmetic exponents tabulated to simplify computation by making it possible to use addition and subtraction instead of multiplication and division.

vi. ***Jacquard’s loom***:

 In 1802 AD, Frenchman Joseph Marie Jacquard, a textile manufacturer discovered a mechanism for automated weaving of clothes. [I.e*. he developed a loom that could be programmed, used large card with holes punched in them to activate rod that raised and lowered threads in a weaving machine*.]

It was based on principle of present and absent of some holes, in which principle ***punch cards*** were developed afterwards.

So he is called the father of punch cards concepts.

vii. **Difference and analytical engine**:

In 1822 AD, a British mathematician Charles Babbage develop mechanical device called Difference engine. It was designed specially to compute polynomials (expression of more than two algebraic terms).

In 1833, Babbage designed analytical engine which was general purpose computer that solve any arithmetic problems.

Not only these calculators, he invented working principle of computer, on which modern computers are also based. So, he is called the ‘*father of the computer’*.

viii.***Lady Augusta Ada***:

She was the disciple of Charles Babbage. She carried forward the works of Babbage.

She made the first program to be used in Babbage Machine. So she is called the ‘***first programmer’***.

To honor her work, a programming language called ‘***Ada Prog’*** was named after her and used in US defense department for long time.

ix.***Gorge Boole***:

Gorge Boole an English mathematician discovers a mathematical logic called “**Boolean Algebra**” in 19th century.

Boole reduced the logic to two valued binary notation in which two digits 0s and 1s can be used to represent any form of data.

The mathematical system of 0s and 1s provided theoretical foundation for switching electronic devices in modern digital computers.

x. ***Dr. Herman Hollerith***:

***Dr***. Herman Hollerith was a census statistician, who was remembered in the history of computer for following contributions:

1. a. He invented a machine called Tabulating machine (Tabulator) in 1886 AD which could process on punch cards and performs census calculation faster than ever before.
2. b. He was the first person to use punch card practically.
3. c. He was the founder of IBM (international Business machine), which he founded in 1923 AD. II) **Age of electromechanical computers:**

i.***Mark‐I***:

In **1937 Prof. Howard Aiken** developed an electromechanical computer called

Mark‐I.

 It was also called automatic sequence controlled calculator (ASCC).

 It was very large computer of dimension 51ft\*8ft\*3ft.

 It consumed a lot of electricity and generates lot of heat.

 It used 18,000 vacuum tubes as memory device.

 In 1944 AD, Aiken modified Mark‐I and invented Mark‐II which used 19,000

vacuum tubes. (*note: Mark‐I is also called first computer)*

ii. **ABC (Atanasoff Berry computer)**:

It was also called first electronic digital computer.

It was invented by Dr. John V. Atanasoff and Clifford Berry in 1942 AD.

It used 18,000 vacuum tubes and other 45 valves for internal logic and capacitor for storage of electrical charges.

It used punch card as secondary storage.

III)**Age of electronic computers**:

1. **ENIAC (Electronic Numerical Integrator and calculator)** :

 It was developed by Dr John W. Mauchly and J. Presper Eckert in 1946.

It was developed for U.S army to compute new trajectory table for use in world war‐II. But it was too late to made use of in the war.

It was built from 17,468 vacuum tubes

It could perform 5000 addition and 300 multiplications per second.

It was extremely large and occupied a space of 1500 sq. feet.

It was the first and last computer to use decimal number system.

It was used still 1955 in US army.

ENIAC has some disadvantages such as:

1. It generates a lot of heat

2. Small storage capacity

|  |  |  |  |
| --- | --- | --- | --- |
| ii. **John Von Neumann**: | | | He developed the principle of stored program in 1945 AD. So he is called the father of stored program. |
|  | | | Before his principle, the program required for computer were integrated and written permanently in machine, so modification of program was not possible. |
|  | | | But after stored program concept, we stored programs inside computer in some storage media. |
|  | | | |
| iii. | **EDSAC (Electronic delay Storage Automatic Computer)**: | | |
|  |  | | It was invented by Maurice Wilkes in 1949. |
|  |  | | It also used vacuum tubes. |
|  |  | | It was the first stored program computer. |
| iv. | **EDVAC (Electronic Discrete Variable Automatic computer)**: | | |
|  |  | It was developed by J.P. Eckert and John Mauchly in 1952. Although started | |
|  | before, it was completed after EDSAC. | | |
|  |  | It also used vacuum tubes and some internal storage. | |
| v. | **UNIVAC (Universal automatic computer)** : | | |
|  |  | It was also developed by john Mauchly and J.P. Eckert in 1961 AD. | |
|  |  | It was the first computer manufactured for commercial use and is a general | |
|  | purpose digital computer. | | |
|  |  | Before this all the computer were used for either defense or census. | |

**The Generations of computers**

The term computer generation is often used in relation to the hardware of computers. Each phase of computer development is known as a separate generation of computers.

1**)The first Generation computers(1945-55)**

The first generation computers were very slow ,very large size and consumed a lot of power and produced large amount of heat. All these computer uses vacuum tube circuitry and programming was a difficult task

Storage devices: magnetic drum(2kb memory)

Input Methods: punched cards, output devices: punched cards, printed reports

Application: scientific purposes.

The first generations computers are as follows.

ENIAC(Electronic Numerical Integrator And Calculator),UNIVAC(Universal Automatic computer),EDVAC(Electronic Discrete variable Automatic Computer) etc.

**2) Second Generations computers(1956-65)**

The second generation computers began with the advent of semiconductor transistor by Bell laboratories .Transistor were highly reliable compared to tubes. They occupied less space and required only 1/10 of the power required by tubes and were ten times cheaper than using tubes. These computers used transistor, were faster, more reliable, relatively smaller, consumed less power.

These computer uses magnetic disk as storage devices. These computer uses high level programming languages such as FORTRAN, COBOL,Algol and snobol etc. At that time with advent of CPU and magnetic disk, operating systems came into begin which is Batch operating systems. For example: IBM 700,1401,ATLAS etc are examples of second generations computers. These computers are used for Business and engineering purposes.

**3) Third generations computers(1966-75)**

The third generation computers replaced transistor with “Integrated Circuits” known popularly as chips. These computers using integrated circuits proved to be highly reliable, relatively inexpensive and faster. These computers have CPU, large storage space. These computer uses high level programming languages . The third generations computers are IBM 360-370ICL-1900,NCR 395,CRAY-1 etc. These computers were used in educations, Research, small businesses as well as scientific and engineering purposes.

**4) Fourth Generations Computers(1976-90)**

These computers uses the concept of very large scale Integrated(VLSI) circuits. At that time the advent of microprocessor was introduced which is a single small CPU attached inside computer system. Data are entered through keyboard, and displayed using monitor. These computer uses high level programming languages such as C,C++,JAVA PROLOG etc.

This generation computer has high processing speed, large storage capacity and much more powerful operating system. E.g: IBM, PC, PENTIUM I, PENTIUM II and PENTIUM III etc.

**5) Fifth Generation (Present and Beyond)**

Fifth generations computers are only in the minds of advance research scientists and being tested out in the laboratories. These computers will be under Artificial Intelligence (AI), They will be able to take commands in a audio visual way and carry out instructions. Many of the operations which requires low human intelligence will be performed by these computers.

Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today. The use of parallel processing and superconductors is helping to make artificial intelligence a reality. Quantum computation and molecular and nanotechnology will radically change the face of computers in years to come. The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and self-organization.

**UNIT 2**

**Computer System**

Computer System: = Hardware+ Software + User

The system which is a combination of hardware and software is called computer system. Computer system consists of input devices, processing devices, storage devices and output devices. Thus computer system is a collection of different components which are combined each other to get certain objective. In other words, it is defined as combination of input unit, central processing unit (CPU), output unit and other parts.

Fig: Basic Organization of computer System or PC or

Digital Computer

Input Devices

-Keyboard

-Mouse

-Light pen

-Touch screen

-Joystick

-Scanner

-Digital camera

Memory Units

Output Devices

-Monitor

-Printer

-Speaker

Control

Unit (CU)

Arithmetic

LogicUnit(ALU)

Secondary

Storage

-Hard disk

-Floppy Disk

-CD

-Pen Drive

Primary

Storage

-RAM

-ROM,Cache

-Register

Program& Data

Output (Information)

Central processing unit (CPU)

MU -Registers

PC Hardware

A typical hardware setup of PC consists of:

•computer case with power supply   
•central processing unit (processor)   
•motherboard   
•memory card   
•hard disk   
•video card   
•visual display unit (monitor)   
•optical disc (usually DVD-ROM or DVD Writer)   
•keyboard and pointing device

PC Software

Computer software is a general term used to describe a collection of computer programs, procedures and documentation that perform some tasks on a computer system. The term includes application software such as word processors which perform productive tasks for users, system software such as operating systems, which interface with hardware to provide the necessary services for application software.

Software applications for word processing, Internet browsing, Internet faxing, e-mail and other digital messaging, multimedia playback, computer game play and computer programming are common. The user of a modern personal computer may have significant knowledge of the operating environment and application programs, but is not necessarily interested in programming nor even able to write programs for the computer.

Brief Descriptions of Computer System Components:

1 Hardware: The physical components which can be seen, touched, feel are called hardware which are resources of a computer .

2. Software: Computer software is a general term used to describe a collection of computer programs, procedures and documentation that perform some tasks on a computer system. The term includes application software such as word processors which perform productive tasks for users, system software such as operating systems, which interface with hardware to provide the necessary services for application software.

Software applications for word processing, Internet browsing, Internet faxing, e-mail and other digital messaging, multimedia playback, computer game play and computer programming are common. The user of a modern personal computer may have significant knowledge of the operating environment and application programs, but is not necessarily interested in programming nor even able to write programs for the computer.

Hardware components of computer system.

CPU (central processing unit) or processor or Microprocessor

The processing unit which performs different types of mathematical and logical operations and which control all the devices connected with it is called central processing unit. The processor is also called Brain of computer system which is a special kind of Integrated Circuit(IC) and which may be programmed and applied to wide range of applications .The CPU is linked with different peripherals equipment ,including ,INPUT’OUTPUT devices and auxiliary storage and primary storage. The CPU is attached on the main circuit board, called the mother board in a micro computer. A central processing unit (CPU), or sometimes simply processor, is the component in a digital computer that interprets computer program instructions and processes data. CPUs provide the fundamental digital computer trait of programmability, and are one of the necessary components found in computers of any era, along with primary storage and input/output facilities. A CPU that is manufactured as a single integrated circuit is usually known as a microprocessor. The phrase "central processing unit" is a description of a certain class of logic machines that can execute computer programs

Function of CPU:

1. To control the use of main storage to store data and instruction.
2. To control the sequence of operations.
3. To give commands to all parts of the computer system.
4. To carry out processing.

**ALU Memory Unit (MU)**

**Control Unit (CU)**

Block Diagram of CPU:->

Components of CPU:

1. The Arithmetic and Logic Unit(ALU)

-The arithmetic and logic unit or ALU is another part of the central processing unit whose functions is to carry out arithmetic or logical operations .The arithmetic operations may be addition, subtraction, multiplication, division(+,-,×,÷ ) and Logical operations are comparisons operations such as logical test for less than, less than or equal to, greater than or equal to, not equal to, greater than, or equal to (<,≤, ≥, ≠, >,=) on integer(whole numbers) and real numbers(with decimal point) operand. This unit consist special temporary components register to store its result and at last send to memory.

1. Control Unit(CU)

-The control unit is a part of central processing unit of a computer that coordinated all the function of computer system. It is responsible for execution of instructions of program. Control unit acts as a central nervous system for the other components of the computer. It manages and coordinates the entire computer system, including the input and output units. It obtains instructions from the program stored in the main memory, interprets the instructions and issue signals, which cause other units of the system to execute them. It consists of special type of register to hold the current instruction and next instruction to be executed.

1. Memory Unit(MU)

-The unit which is used to store data, information, programs and its instruction either temporarily or permanently is called memory unit. But the CPU consists of special memory unit called Register.

Register

-Register are temporary storage locations in the CPU that are designed for storing data temporarily during the execution of program. In other words register are electronic devices made of transistor and which are fastest memory among all. Register quickly accept, store and transfer the data and instruction that are used immediately. To execute instruction, the control unit of the CPU retrieves it from main memory and places it into a register.

Note: The size and number of these registers determines the overall speed of the computer. Register are very fast compared than other memory devices.

**The Central Processing Unit (CPU)**

|  |
| --- |
| http://homepage.cs.uri.edu/faculty/wolfe/book/images/R04/fig3_1.jpg |
| **Figure 1: The Central Processing Unit** |

The computer does its primary work in a part of the machine we cannot see, a control center that converts data input to information output. This control center, called the central processing unit (CPU), is a highly complex, extensive set of electronic circuitry that executes stored program instructions. All computers, large and small, must have a central processing unit. As Figure 1 shows, the central processing unit consists of two parts: The control unit and the arithmetic/logic unit. Each part has a specific function.

Before we discuss the control unit and the arithmetic/logic unit in detail, we need to consider data storage and its relationship to the central processing unit. Computers use two types of storage: Primary storage and secondary storage. The CPU interacts closely with primary storage, or main memory, referring to it for both instructions and data. For this reason this part of the reading will discuss memory in the context of the central processing unit. Technically, however, memory is not part of the CPU.   
  
Recall that a computer's memory holds data only temporarily, at the time the computer is executing a program. Secondary storage holds permanent or semi-permanent data on some external magnetic or optical medium. The diskettes and CD-ROM disks that you have seen with personal computers are secondary storage devices, as are hard disks. Since the physical attributes of secondary storage devices determine the way data is organized on them, we will discuss secondary storage and data organization together in another part of our on-line readings.   
  
Now let us consider the components of the central processing unit.

 **The Control Unit**   
The control unit of the CPU contains circuitry that uses electrical signals to direct the entire computer system to carry out, or execute, stored program instructions. Like an orchestra leader, the control unit does not execute program instructions; rather, it directs other parts of the system to do so. The control unit must communicate with both the arithmetic/logic unit and memory. 

 **The Arithmetic/Logic Unit**   
The arithmetic/logic unit (ALU) contains the electronic circuitry that executes all arithmetic and logical operations.   
  
The arithmetic/logic unit can perform four kinds of arithmetic operations, or mathematical calculations: addition, subtraction, multiplication, and division. As its name implies, the arithmetic/logic unit also performs logical operations. A logical operation is usually a comparison. The unit can compare numbers, letters, or special characters. The computer can then take action based on the result of the comparison. This is a very important capability. It is by comparing that a computer is able to tell, for instance, whether there are unfilled seats on airplanes, whether charge- card customers have exceeded their credit limits, and whether one candidate for Congress has more votes than another.   
  
Logical operations can test for three conditions:

* **Equal-to condition.** In a test for this condition, the arithmetic/logic unit compares two values to determine if they are equal. For example: If the number of tickets sold equals the number of seats in the auditorium, then the concert is declared sold out.
* **Less-than condition.** To test for this condition, the computer compares values to determine if one is less than another. For example: If the number of speeding tickets on a driver's record is less than three, then insurance rates are $425; otherwise, the rates are $500.
* **Greater-than condition.** In this type of comparison, the computer determines if one value is greater than another. For example: If the hours a person worked this week are greater than 40, then multiply every extra hour by 1.5 times the usual hourly wage to compute overtime pay.

A computer can simultaneously test for more than one condition. In fact, a logic unit can usually discern six logical relationships: *equal to, less than, greater than, less than or equal to, greater than or equal to*, and *not equal*.   
  
The symbols that let you define the type of comparison you want the computer to perform are called relational operators. The most common relational operators are the equal sign(=), the less-than symbol(<), and the greater-than symbol(>).

* **Registers: Temporary Storage Areas**   
  Registers are temporary storage areas for instructions or data. They are not a part of memory; rather they are special additional storage locations that offer the advantage of speed. Registers work under the direction of the control unit to accept, hold, and transfer instructions or data and perform arithmetic or logical comparisons at high speed. The control unit uses a data storage register the way a store owner uses a cash register-as a temporary, convenient place to store what is used in transactions.   
    
  Computers usually assign special roles to certain registers, including these registers:
  + **An accumulator**, which collects the result of computations.
  + **An address register**, which keeps track of where a given instruction or piece of data is stored in memory. Each storage location in memory is identified by an address, just as each house on a street has an address.
  + **A storage register**, which temporarily holds data taken from or about to be sent to memory.
  + A general-purpose **register**, which is used for several functions.
* **Memory and Storage**  
  Memory is also known as primary storage, primary memory, main storage, internal storage, main memory, and RAM (Random Access Memory); all these terms are used interchangeably by people in computer circles. Memory is the part of the computer that holds data and instructions for processing. Although closely associated with the central processing unit, memory is separate from it. Memory stores program instructions or data for only as long as the program they pertain to is in operation. Keeping these items in memory when the program is not running is not feasible for three reasons:
  + Most types of memory only store items while the computer is turned on; data is destroyed when the machine is turned off.
  + If more than one program is running at once (often the case on large computers and sometimes on small computers), a single program can not lay exclusive claim to memory.
  + There may not be room in memory to hold the processed data.

How do data and instructions get from an input device into memory?

The control unit sends them. Likewise, when the time is right, the control unit sends these items from memory to the arithmetic/logic unit, where an arithmetic operation or logical operation is performed. After being processed, the information is sent to memory, where it is hold until it is ready to he released to an output unit.   
  
The chief characteristic of memory is that it allows very fast access to instructions and data, no matter where the items are within it. We will discuss the physical components of memory-memory chips-later in this chapter.

To see how registers, memory, and second storage all work together, let us use the analogy of making a salad. In our kitchen we have:

* + a refrigerator where we store our vegetables for the salad;
  + a counter where we place all of our veggies before putting them on the cutting board for chopping;
  + a cutting board on the counter where we chop the vegetables;
  + a recipe that details what veggies to chop;
  + the corners of the cutting board are kept free for partially chopped piles of veggies that we intend to chop more or to mix with other partially chopped veggies.
  + a bowl on the counter where we mix and store the salad;
  + space in the refrigerator to put the mixed salad after it is made.

The process of making the salad is then: bring the veggies from the fridge to the counter top; place some veggies on the chopping board according to the recipe; chop the veggies, possibly storing some partially chopped veggies temporarily on the corners of the cutting board; place all the veggies in the bowl to either put back in the fridge or put directly on the dinner table.

The refrigerator is the equivalent of secondary (disk) storage. It can store high volumes of veggies for long periods of time. The counter top is the equivalent of the computer's motherboard - everything is done on the counter (inside the computer). The cutting board is the ALU - the work gets done there. The recipe is the control unit - it tells you what to do on the cutting board (ALU). Space on the counter top is the equivalent of RAM memory - all veggies must be brought from the fridge and placed on the counter top for fast access. Note that the counter top (RAM) is faster to access than the fridge (disk), but can not hold as much, and can not hold it for long periods of time. The corners of the cutting board where we temporarily store partially chopped veggies are equivalent to the registers. The corners of the cutting board are very fast to access for chopping, but can not hold much. The salad bowl is like a temporary register, it is for storing the salad waiting to take back to the fridge (putting data back on a disk) or for taking to the dinner table (outputting the data to an output device).

Now for a more technical example. let us look at how a payroll program uses all three types of storage. Suppose the program calculates the salary of an employee. The data representing the hours worked and the data for the rate of pay are ready in their respective registers. Other data related to the salary calculation-overtime hours, bonuses, deductions, and so forth-is waiting nearby in memory. The data for other employees is available in secondary storage. As the CPU finishes calculations about one employee, the data about the next employee is brought from secondary storage into memory and eventually into the registers.

The following table summarizes the characteristics of the various kinds of data storage in the storage hierarchy.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Storage** | **Speed** | **Capacity** | **Relative Cost ($)** | **Permanent?** |
| **Registers** | Fastest | Lowest | Highest | No |
| **RAM** | Very Fast | Low/Moderate | High | No |
| **Floppy Disk** | Very Slow | Low | Low | Yes |
| **Hard Disk** | Moderate | Very High | Very Low | Yes |

Modern computers are designed with this hierarchy due to the characteristics listed in the table. It has been the cheapest way to get the functionality. However, as RAM becomes cheaper, faster, and even permanent, we may see disks disappear as an internal storage device. Removable disks, like Zip disks or CDs (we describe these in detail in the online reading on storage devices) will probably remain in use longer as a means to physically transfer large volumes of data into the computer. However, even this use of disks will probably be supplanted by the Internet as the major (and eventually only) way of transferring data. Floppy disks drives are already disappearing: the new IMac Macintosh from Apple does not come with one. Within the next five years most new computer designs will only include floppy drives as an extra for people with old floppy disks that they must use.

For more detail on the computer's memory hierarchy, see the [How Stuff Works pages on computer memory.](http://www.howstuffworks.com/computer-memory.htm). *This is optional reading.*

* **How the CPU Executes Program Instructions**   
  Let us examine the way the central processing unit, in association with memory, executes a computer program. We will be looking at how just one instruction in the program is executed. In fact, most computers today can execute only one instruction at a time, though they execute it very quickly. Many personal computers can execute instructions in less than one-millionth of a second, whereas those speed demons known as supercomputers can execute instructions in less than one-billionth of a second.

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| --- |
| http://homepage.cs.uri.edu/faculty/wolfe/book/images/R04/fig3_2.jpg |
| **Figure 2: The Machine Cycle** |

* Before an instruction can be executed, program instructions and data must be placed into memory from an input device or a secondary storage device (the process is further complicated by the fact that, as we noted earlier, the data will probably make a temporary stop in a register). As Figure 2 shows, once the necessary data and instruction are in memory, the central processing unit performs the following four steps for each instruction:
  + The control unit fetches (gets) the instruction from memory.
  + The control unit decodes the instruction (decides what it means) and directs that the necessary data be moved from memory to the arithmetic/logic unit. These first two steps together are called instruction time, or I-time.
  + The arithmetic/logic unit executes the arithmetic or logical instruction. That is, the ALU is given control and performs the actual operation on the data.
  + Thc arithmetic/logic unit stores the result of this operation in memory or in a register. Steps 3 and 4 together are called execution time, or E-time.

The control unit eventually directs memory to release the result to an output device or a secondary storage device. The combination of I-time and E-time is called the machine cycle. Figure 3 shows an instruction going through the machine cycle.   
  
Each central processing unit has an internal clock that produces pulses at a fixed rate to synchronize all computer operations. A single machine-cycle instruction may be made up of a substantial number of sub-instructions, each of which must take at least one clock cycle. Each type of central processing unit is designed to understand a specific group of instructions called the instruction set. Just as there are many different languages that people understand, so each different type of CPU has an instruction set it understands. Therefore, one CPU-such as the one for a Compaq personal computer-cannot understand the instruction set from another CPU-say, for a Macintosh.

|  |
| --- |
| http://homepage.cs.uri.edu/faculty/wolfe/book/images/R04/fig3_3.jpg |
| **Figure 3: The Machine Cycle in Action** |

It is one thing to have instructions and data somewhere in memory and quite another for the control unit to be able to find them. How does it do this?

|  |
| --- |
| http://homepage.cs.uri.edu/faculty/wolfe/book/images/R04/fig3_4.jpg |
| **Figure 4: Memory Addresses Like Mailboxes** |

The location in memory for each instruction and each piece of data is identified by an address. That is, each location has an address number, like the mailboxes in front of an apartment house. And, like the mailboxes, the address numbers of the locations remain the same, but the contents (instructions and data) of the locations may change. That is, new instructions or new data may be placed in the locations when the old contents no longer need to be stored in memory. Unlike a mailbox, however, a memory location can hold only a fixed amount of data; an address can hold only a fixed number of bytes - often two bytes in a modern computer.   
  
Figure 4 shows how a program manipulates data in memory. A payroll program, for example, may give instructions to put the rate of pay in location 3 and the number of hours worked in location 6. To compute the employee's salary, then, instructions tell the computer to multiply the data in location 3 by the data in location 6 and move the result to location 8. The choice of locations is arbitrary - any locations that are not already spoken for can be used. Programmers using programming languages, however, do not have to worry about the actual address numbers, because each data address is referred to by a name. The name is called a symbolic address. In this example, the symbolic address names are Rate, Hours, and Salary.

Figure 0 shows the parts of a computer:

|  |  |  |  |
| --- | --- | --- | --- |
| * The Central Processing Unit:   + (CPU),   + Buses,   + Ports and controllers,   + ROM; * Main Memory (RAM); * Input Devices; * Output Devices; * Secondary Storage;   + floppy disks,   + hard disk,   + CD-ROM | |  | | --- | | E:\White house\WHITE HOUSE college\Libertee college notes\CHAPTER 2,3\How The Computer Works The CPU and Memory_files\mb.gif | | **Figure 0: Inside The Computer** | |

This part of the reading will examine the CPU, Buses, Controllers, and Main Memory. Other sections will examine input devices, output devices, and secondary memory.

The instruction set, also called instruction set architecture (ISA), is part of a computer that pertains to programming, which is basically [machine language](https://www.computerhope.com/jargon/m/machlang.htm). The instruction set provides commands to the processor, to tell it what it needs to do. The instruction set consists of addressing modes, instructions, native data types, registers, memory architecture, interrupt, and exception handling, and external [I/O](https://www.computerhope.com/jargon/i/io.htm)**.**

**Examples of instruction set**

* ADD - Add two numbers together.
* COMPARE - Compare numbers.
* IN - Input information from a device, e.g. keyboard.
* JUMP - Jump to designated RAM address.
* JUMP IF - Conditional statement that jumps to a designated RAM address.
* LOAD - Load information from RAM to the CPU.
* OUT - Output information to device, e.g. monitor.
* STORE - Store information to RAM.

Comparison between RISC and CISC:

The term RISC stands for ‘Reduced Instruction Set Computer’. It is a CPU design strategy based on simple instructions and fast performance.

RISC is small or reduced set of instructions. Here, each instruction is meant to achieve very small tasks. In a RISC machine, the instruction sets are simple and basic, which help in composing more complex instructions. Each instruction is of the same length; the instructions are strung together to get complex tasks done in a single operation. Most instructions are completed in one machine cycle. This pipelining is a key technique used to speed up RISC machines.

RISC is a microprocessor that is designed to carry out few instructions at the same time. Based on small instructions, these chips require fewer transistors, which make the transistors cheaper to design and produce. Some other features of RISC include:

The term CISC stands for ‘Complex Instruction Set Computer’. It is a CPU design strategy based on single instructions, which are capable of performing multi-step operations.

CISC computers have shorted programs. It has a large number of complex instructions, which takes long time to execute. Here, a single set of instruction is covered in multiple steps; each instruction set has more than three hundred separate instructions. Most instructions are completed in two to ten machine cycles. In CISC, instruction pipelining is not easily implemented.

The CISC machines have good performances, based on the simplification of program compilers; as the range of advanced instructions are easily available in one instruction set. They design complex instructions in one simple set of instructions. They perform low level operations such as an arithmetic operation, or a load from memory and memory store. CISC makes it easier to have large addressing nodes and more data types in the machine hardware. However, CISC is considered less efficient than RISC, because of it inefficiency to remove codes which leads to wasting of cycles. Also, microprocessor chips are difficult to understand and program for, because of the complexity of the hardware.

Comparison between RISC and CISC:

|  |  |  |
| --- | --- | --- |
|  | **RISC** | **CISC** |
| Acronym | It stands for ‘Reduced Instruction Set Computer’. | It stands for ‘Complex Instruction Set Computer’. |
| Definition | The RISC processors have a smaller set of instructions with few addressing nodes. | The CISC processors have a larger set of instructions with many addressing nodes. |
| Memory unit | It has no memory unit and uses a separate hardware to implement instructions. | It has a memory unit to implement complex instructions. |
| Program | It has a hard-wired unit of programming. | It has a micro-programming unit. |
| Design | It is a complex complier design. | It is an easy complier design. |
| Calculations | The calculations are faster and precise. | The calculations are slow and precise. |
| Decoding | Decoding of instructions is simple. | Decoding of instructions is complex. |
| Time | Execution time is very less. | Execution time is very high. |
| External memory | It does not require external memory for calculations. | It requires external memory for calculations. |
| Pipelining | Pipelining does function correctly. | Pipelining does not function correctly. |
| Stalling | Stalling is mostly reduced in processors. | The processors often stall. |
| Code expansion | Code expansion can be a problem. | Code expansion is not a problem. |
| Disc space | The space is saved. | The space is wasted. |
| Applications | Used in high end applications such as video processing, telecommunications and image processing. | Used in low end applications such as security systems, home automations, etc. |

**Instruction Formats**

One of the first lessons a beginner learns about computers is that in order to use a computer, a program must be written, translated into machine language, and loaded into memory; that such a program consists of machine instructions, and that a machine instruction is a binary number. In this chapter we look at the details of machine instructions, and in particular the fact that a machine instruction is rarely a single binary number. It normally consists of several numbers that are assembled (placed together) by the assembler, to become the fields of the complete instruction. As a result, any machine instruction has a certain format.

The instruction is divided into fields, each a binary number. A machine instruction must contain at least one field, namely the operation code (opcode), that tells the control unit what the instruction is supposed to do. Most instructions contain other fields specifying registers, memory addresses, immediate quantities, addressing modes, and other parameters.

**Figure 2.1: Various Instruction Formats**

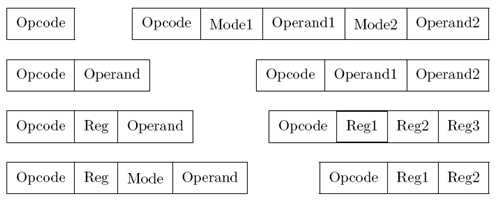


Figure 2.1 illustrates typical instruction formats. They range from the simplest to the very complex and they demonstrate the following properties of machine instructions:

* **Instructions** can have different sizes. The size depends on the number and nature of the individual fields.
* The **opcode** can have different sizes. The opcode can also be broken up into a number of separate fields.
* A **field** containing an address is much larger than a register field. This is because number of registers is small, while size of memory is large.
* Fields containing immediate **operands** (numbers used as data) can have different sizes. Experience shows that most data items used by programs are small. Thus, a well-designed instruction set should allow for both small and large data items, resulting in short instructions whenever possible.

The last point, about short instructions, is important and leads us to the next topic of discussion, namely the properties of a good instruction set. When a new computer is designed, one of the first features that has to be determined and fully specified is the instruction set. First, the instruction set has to be designed as a whole, then the designers decide what instructions should be included in the set. The general form of the instruction set depends on features such as the intended applications of the computer, the word size, address size, register set, memory organization, and bus organization. Instruction sets vary greatly, but a good design for an instruction set is based on a small number of principles that are independent of the particular computer in question. These principles demand that an instruction set should satisfy the following requirements:

1. Short instructions.

2. An instruction size that is both compatible with the word size, and variable.

**1. Short instructions:**Why should machine instructions be short? Not because short instructions occupy less memory. Memory isn’t expensive and modern computers support large memories. Also, not because short instructions execute faster. The execution time of an instruction has nothing to do with its size. A “register divide” instruction, to divide the contents of two floating-point registers, is short, since it only has to specify the registers involved. It takes, however, a long time to execute. Therefore, short instructions are required because they take less time for memory access hence they have lesser fetch time.

**2. Instruction size:**The instruction size should also be compatible with the computer’s word size. The best design results in instruction sizes of *N*, 2*N*and 3*N*where *N*is the word size. Instruction sizes such as 1*.*2*N*or 0*.*7*N*do not make any sense, since each memory read brings in exactly one word. In a computer with long words, several instructions can be packed in one word and, as a result, instruction sizes of *N/*2, *N/*3, and *N/*4 also make sense.

The two requirements above are satisfied by the use of variable-size opcodes and addressing modes.

These are the two important requirements of having a good design for an instruction set. We discuss the opcode size next and addressing modes in the subsequent sections.

**The Opcode Size**

If the instruction is to be short, individual fields in the instruction should be short. In this section we look at the opcode field. Obviously, the opcode cannot be too short or there would not be enough codes for all the instructions. An opcode size of 6–8 bits, allowing for 64–256 instructions, is common. Most modern computers, however, use variable size opcodes, for two good reasons. One reason has to do with the instruction size in relation to the word size, and the other has to do with future extensions of the instruction set.

The first reason is easy to understand. We want our instructions to be short, but some instructions have to contain more information than others and are naturally longer. If the opcode size varies, longer instructions can be assigned short opcodes. Other instructions, with short operands, can be assigned longer opcodes. This way the instruction size can be fine-tuned to fit in precisely *N*or 2*N*bits.

The second advantage of variable-size opcodes has to do with extensions to an original instruction set. When a computer becomes successful and sells well, the manufacturer may decide to come up with a new, extended, and upward compatible version of the original computer. The 68000, 80x86, and Pentium families are familiar examples.

Upward compatibility means that any program running on the original computer should also run on the new one. The instruction set of the new computer must therefore be an extension of the original instruction set. With variable-size opcodes, such an extension is easy.

When an instruction is fetched, the hardware does not know what its opcode is. It has to decode the instruction first. In a computer with variable-size opcodes, when an instruction is fetched, the control unit does not even know how long the opcode is. It has to start by identifying the opcode size, following which it can decode the instruction. Thus, with variable-size opcodes, the control unit has to work harder.

Instruction Cycle:

The time period during which one instruction is fetched from memory and executed when a computer is given an instruction in machine language. There are typically four stages of an instruction cycle that the CPUcarries out:

Fetch the instruction from memory. This step brings the instruction into the instruction register, a circuit that holds the instruction so that it can be decoded and executed.

Decode the instruction.

Read the effective address from memory if the instruction has an indirect address.

Execute the instruction.

Steps 1 and 2 are called the fetch cycle and are the same for each instruction. Steps 3 and 4 are called the execute cycleand will change with each instruction.

An instruction cycle (sometimes called a fetch–decode–execute cycle) is the basic operational process of a computer. It is the process by which a computer retrieves a program instruction from its memory, determines what actions the instruction dictates, and carries out those actions. This cycle is repeated continuously by a computer's central processing unit (CPU), from boot-up to when the computer is shut down.

**UNIT 3:COMPUTER MEMORY**

**3. Memory**

Definition:- The unit which are used to store data, information, programs and its instruction either temporarily or permanently is called memory. Computer memory refers to devices that are used to store data or programs (sequences of instructions) on a temporary or permanent basis for use in an electronic digital [computer](http://en.wikipedia.org/wiki/Computer). Computers represent information in [binary code](http://en.wikipedia.org/wiki/Binary_code), written as sequences of 0s and 1s.For example RAM,ROM,Hard Disk, CD/DVD etc.

**Computer Memory Representation:**

In computing, a memory address is a reference to a specific memory location used at various levels by software and hardware. Memory addresses are fixed-length sequences of digits. Computer data storage, often called storage or memory, is a technology consisting of computer components and recording media that are used to retain digital data. It is a core function and fundamental component of computers.

A modern digital computer represents data using the binary numeral system. Text, numbers, pictures, audio, and nearly any other form of information can be converted into a string of bits, or binary digits, each of which has a value of 1 or 0. The most common unit of storage is the byte, equal to 8 bits. A piece of information can be handled by any computer or device whose storage space is large enough to accommodate the binary representation of the piece of information, or simply data.

Physical addresses

A digital computer's memory, more specifically main memory, consists of many memory locations, each having a physical address, a code, which the CPU (or other device) can use to access it. Generally only system software, i.e. the BIOS, operating systems, and some specialized utility programs (e.g., memory testers), address physical memory using machine code operands or processor registers, instructing the CPU to direct a hardware device, called the memory controller, to use the memory bus or system bus, or separate control, address and data busses, to execute the program's commands. The memory controllers' bus consists of a number of parallel lines, each represented by a binary digit (bit). The width of the bus, and thus the number of addressable storage units, and the number of bits in each unit, varies among computers.

A computer program uses memory addresses to execute machine code, store and retrieve data. In early computers logical and physical addresses corresponded, but since the introduction of virtual memory most application programs do not have a knowledge of physical addresses.

The most fundamental unit of computer memory is the **bit**. A bit can be a tiny magnetic region on a hard disk, a tiny dent in the reflective material on a CD or DVD, or a tiny transistor on a memory stick. Whatever the physical implementation, the important thing to know about a bit is that, like a switch, it can only take one of two values: it is either “on” or “off”.

% the gap below seems to be important!??
\par
\includegraphics{store-bitbyteword}

A collection of 8 bits is called a **byte** and (on the majority of computers today) a collection of 4 bytes, or 32 bits, is called a **word**.

For example, the text *“hello”* would take up 5 bytes of storage, one per character. The text *“12345”* would also require 5 bytes

**Computer Memory**

**Main memory**

**(Primary Memory)**

**Auxiliary memory**

**(Secondary memory)**

**Volatile**

**(RAM)**

**Non-Volatile**

**(ROM)**

**Sequential Access**

**Devices**

**Direct Access**

**Devices**

**Magnetic Tape**

**Magnetic Disk**

**Optical Disk**

**SRAM**

**DRAM**

**PROM**

**Floppy Disk**

**EPROM**

**EPROM**

**Hard Disk**

**CD-ROM**

**DVD Disk**

**Fig: Memory Structure**

**SDRAM**

**RDRAM**

**DDR-RAM**

|  |  |
| --- | --- |
| Primary memory | Secondary memory |
| 1. Fast 2. Expensive 3. Low capacity 4. Connects directly to the processor | 1. Slow 2. Cheap 3. Large capacity 4. Not connected directly to the processor |

1)Main memory (primary memory or storage):

The memory unit which stores data and instruction to run computer system is called main memory. Refers to [physical](http://www.webopedia.com/TERM/M/physical.html) [memory](http://www.webopedia.com/TERM/M/memory.html) that is internal to the [computer](http://www.webopedia.com/TERM/M/computer.html). Primary storage, or internal memory, is [computer memory](http://en.wikipedia.org/wiki/Computer_memory) that is accessible to the [central processing unit](http://en.wikipedia.org/wiki/Central_processing_unit) of a [computer](http://en.wikipedia.org/wiki/Computer) without the use of computer's [input/output](http://en.wikipedia.org/wiki/Input/output) channels. Primary storage is used to store [data](http://en.wikipedia.org/wiki/Data_%28computing%29) that is likely to be in active use.

The computer can manipulate only [data](http://www.webopedia.com/TERM/M/data.html) that is in main memory. Therefore, every [program](http://www.webopedia.com/TERM/M/program.html) you [execute](http://www.webopedia.com/TERM/M/execute.html) and every [file](http://www.webopedia.com/TERM/M/file.html) you [access](http://www.webopedia.com/TERM/M/access.html) must be [copied](http://www.webopedia.com/TERM/M/copy.html) from a [storage device](http://www.webopedia.com/TERM/M/storage_device.html) into main memory. The amount of main memory on a computer is crucial because it determines how many programs can be executed at one time and how much data can be readily available to a program. Thus these memory units stores data and instruction temporarily. Primary storage is typically very fast, as in the case of [RAM](http://en.wikipedia.org/wiki/Random_access_memory). RAM is also [volatile](http://en.wikipedia.org/wiki/Volatile_memory), losing the stored information in an event of power loss, and quite expensive.

Types of main memory:

I)RAM(Random access Memory):-

RAM is called volatile memory, which means that it stores data and instruction that the computer is using at the present moment when the power is on and it loses its contents when the power is off. The RAM is called read/write memory where any data or instructions can be read or write in random way.

The primary functions of RAM:

* 1. It stores data or program and other information those can be quickly accessed by the CPU at the time of execution at consistent rate.
  2. It stores the copy of main software program that controls the general operations of the computer. This copy is loaded into the main memory when the computer power is on.
  3. It stores data that has been input from keyboard or other input devices until instruction call for the data to be transferred into the CPU for processing.

Note: The disadvantage of RAM over physically moving media is cost, and the loss of data when power is turned off. For these reasons, nearly all PCs have disc storage as "secondary storage. and its storage capacity ranges up to MB to GB.

Types of RAM:

a) SRAM(static Random Access memory):

The word "static" indicates that the memory retains its contents as long as power remains applied, unlike dynamic RAM ([DRAM](http://en.wikipedia.org/wiki/Dynamic_random_access_memory)) that needs to be periodically [refreshed](http://en.wikipedia.org/wiki/Memory_refresh) whereas SRAM do not need to refresh(ie recharging the memory circuit chips)and SRAM is a little more expensive, but faster more reliable than DRAM. SRAM is also easier to control.

B) DRAM(Dynamic Random Access Memory):

DRAM are slower ,cheaper and popular than SRAM. DRAM is called dynamic because it must constantly be refreshed or it will lose the data which it is supposed to be storing. Refreshing DRAM consists of reading the contents from the DRAM and immediately writing them back to the DRAM.

This memory cells needs to be constantly refreshed.

Types of DRAM:

-SDRAM(Synchronous DRAM): Synchronous dynamic random access memory (SDRAM) is [dynamic random access memory](http://en.wikipedia.org/wiki/Dynamic_random_access_memory) (DRAM) that has a synchronous interface which means it is directly depend on the clock speed of the entire system.The SDRAM can handle higher bus speed.The SDRAM is faster than DRAM ie the SDRAM could operate at up to 100MHz.

-RDRAM(Rambus DRAM): Stands for "Rambus Dynamic Random Access Memory." It is a type of RAM made by Rambus (big surprise) and is the fastest type of computer memory available. Typical SDRAM can transfer data at speeds up to 133 MHz, while standard RDRAM can crank it up over 1 GHz. Though some motherboards can use RDRAM as system memory, it is so fast, most boards cannot fully benefit from the speed. Because of this, RDRAM is typically used for video memory on graphics acclerator cards, for cache memory (located on the CPU), and for system memory in high-performance workstations and servers.

-VRAM(video-DRAM): It is another types of DRAM that is used in PC’S to handle graphical data and display images on the screen. it is called display or graphic memory. This memory chips is mounted on display cards,quite fast,as it needs to respond quickly to the CPU’s instructions and constantly refresh and update the screen image so that there is no flicker.

II) Cache memory:

There is a small amount of high-speed memory that lies between the CPU’s and the main memory which is used to improves the processing speed of CPU’s by storing frequently used data and instruction is called cache memory. Cache memory is random access memory ([RAM](http://searchMobileComputing.techtarget.com/sDefinition/0,,sid44_gci214255,00.html)) that a computer [microprocessor](http://searchSMB.techtarget.com/sDefinition/0,,sid40_gci212568,00.html) can access more quickly than it can access regular RAM. As the microprocessor processes data, it looks first in the [cache](http://searchStorage.techtarget.com/sDefinition/0,,sid_gci211728,00.html) memory and if it finds the data there (from a previous reading of data), it does not have to do the more time-consuming reading of data from larger memory. The speed of CPU is extremely high compared to the access time of main memory. Therefore the performance of CPU decreases due to the slow speed of main memory so to decreases mismatch in operating speed a small memory chip is attached between CPU and main memory which is called cache memory. These memories are very expensive as have bigger size of cache memory hence its size is normally kept small. The modern computers have two types of cache:Level1(L1): Which is called primary cache or internal cache is directly built into CPU chips which have very small capacity ranges fro 8KB to 64KB.for example: Pentium II uses L1 cache.LEVEL2:Which is not part of processor chip or external chip and consists of high-speed SRAM chip.L2 cache is slightly slower than L1 cache but larger capacity up to 2MB.

2) Non-volatile memory-ROM:

NVM or non-volatile storage, is [computer memory](http://en.wikipedia.org/wiki/Computer_memory) that can retain the stored information even when not powered. Examples of non-volatile memory include [read-only memory](http://en.wikipedia.org/wiki/Read-only_memory), [flash memory](http://en.wikipedia.org/wiki/Flash_memory), most types of magnetic [computer storage](http://en.wikipedia.org/wiki/Computer_storage) devices (e.g. [hard disks](http://en.wikipedia.org/wiki/Hard_disk), [floppy disk](http://en.wikipedia.org/wiki/Floppy_disk) drives, and [magnetic tape](http://en.wikipedia.org/wiki/Magnetic_tape)), [optical disc](http://en.wikipedia.org/wiki/Optical_disc) drives. Non-volatile memory is typically used for the task of [secondary storage](http://en.wikipedia.org/wiki/Secondary_storage), or long-term persistent storage. The ROM that type of memory chip which store data that only can be Read only. That is the data stored in ROM can not be modified hence named Read only. Thus ROM consists of data and set of program instruction to load the computer system when you first turned on the computer. These sequence of instructions are stored permanently in ROM chips often by chip manufacturing company which is called firmware. Note: most of digital devices such as calculators, mobile, laser printer uses ROM.

Types of ROM:

1. PROM(Programmable Read only memory):

A PROM is a blank memory chip on which data can be written only once and and can be read many times but can not changed data. Once the program has been written onto PROM ,it remains there permanently. The difference between ROM and PROM is that ROM is programmed during the manufacturing process where PROM is manufactured as a blank memory. To write data on PROM you need special components PROM burner.The process of programming a PROM is called burning the PROM.

1. EPROM(Erasable Programmable Read only memory):

EPROM chips are developed as an improvements over PROM chips.It works as PROM except that data written can be erased. so to erase data it uses special ultraviolet light and then new data can be written.To change instruction on EPROM chip,the chip must be taken out from the machine.In EPROM we can not make changes in the data individually that have already written.To write new data or delete existing data,we have to erase all the data from the EEPROM.

1. EEPROM(Electrically Erasable Read-only memory):

EEPROM chip avoids the inconvenience of having to take out chips out of the computer to change data and instructions.instead changes are made under software control.Unlike EPROM we can make changes to the existing data without erasing the entire data.EEPROM requires data written and erased one bit at a time.But EEPROM are expensive than other ROM.

1. Flash Memory:

Flash Memory is special type of EEPROM that can be programmed and erased in blocks instead of one bit at a time.These memories are popular in world which are commonly used in pen drives,Digital cameras,mobile phones etc.The modern PC uses flash memory to store instructions so that which makes easily to update. Flash memory gets its name because the microchip is organized so that a section of memory cells are erased in a single action or "flash." Flash memory is [non-volatile](http://en.wikipedia.org/wiki/Non-volatile_memory) [computer memory](http://en.wikipedia.org/wiki/Computer_storage) that can be electrically erased and reprogrammed.

speed: Common flash memory parts (individual internal components or "chips") range widely in capacity from kilobits to several gigabits each

Secondary memory (Auxiliary memory)

Secondary memory is where programs and data are kept on a long-term basis. Common secondary storage devices are the hard disk and floppy disks. Secondary memory (or secondary storage) is the slowest and cheapest form of [memory](http://www.webopedia.com/TERM/S/memory.htm). It cannot be processed directly by the [CPU](http://www.webopedia.com/TERM/S/CPU.htm). It must first be copied into primary storage(also known as [RAM](http://www.webopedia.com/TERM/S/RAM.htm) ). Secondary memory devices include magnetic disks like [hard drives](http://www.webopedia.com/TERM/S/hard_disk_drive.htm) and [floppy disks](http://www.webopedia.com/TERM/S/floppy_disk.htm) ; [optical disks](http://www.webopedia.com/TERM/S/optical_disk.htm) such as [CDs](http://www.webopedia.com/TERM/S/compact_disc.htm) and [CDROMs](http://www.webopedia.com/TERM/S/CD_ROM.htm) ; and magnetic [tapes](http://www.webopedia.com/TERM/S/tape.htm), which were the first forms of secondary memory.

Secondary Storage

a) Magnetic Tape:

Magnetic tape is the most popular storage medium for large data, which are sequentially accessed and processed. the magnetic tape medium is a plastic ribbon, which is ½” or ¼” wide and 50 to 2400 feet long. It is coated with a magnetically recording material, such as iron oxide. This type of device is still used for large data backup because these are cheaper than other devices. Like audio or videotape, the magnetic tape used in computer system which can also erased and reused indefinitely. old data on a tape are automatically erased ,as new data are recorded in the same area. Tapes for computer are similar to the tapes used to store music. Accessing data on tapes however is much slower than accessing data on disk.

1) Magnetic Disk:

Magnetic disk is a circular disk which is coated with magnetic material. the disk rotates with very high speed inside the computer drive. Data is stored on both the surface of the disk. magnetic disks are most popular for direct access storage device. Each disk consists of a number of indivisible concentric circles called tracks. Information recorded on tracks of a disk surface in the form of magnetic spots. A good example of magnetic disks is hard disk .

1. Hard Disk:

The hard disk is direct-access storage medium with a rigid magnetic disk.The disk is divided into number of tracks and each tracks are divided into sectors.

A hard disk uses round, flat disks called platters, coated on both sides with a special media material designed to store information in the form of magnetic patterns. The platters are mounted by cutting a hole in the center and stacking them onto a spindle. The platters are rotated at very high speed, driven by a special spindle motor connected to the spindle. Each platters consists of READ/WRITE head to read and write data. The disks are rotated at very high speed (usually around 7200RPM-revolution per minute.)

c) Floppy Disk:

Floppy disk is a round, flat piece of flexible plastic coated with magnetic oxide. These are small removal, media storage device. The data is recorded on thin plastic film. Floppy disk is a soft magnetic disk and it is a thin piece of flexible plastic called floppy disk, or also called floppy Diskette .They are removable disks.

A floppy disk is inserted inside the computer the floppy drive when needed. These are different sizes of floppy disk 5.25” or 3.5” having capacity 1.2MB and 1,44MB respectively.

d) Optical Disk:

An optical disk is random access storage medium. It is made up glass. Optical disks uses light technology where laser beam is projected and reflected light is observed. the As compared to magnetic tape and disk, optical disk is relatively new secondary storage medium. An optical disk storage system consists of a rotating disk which is coated with a thin metal or some material that is highly reflective. This type of disk uses laser beam technology for READ/WRITE data. Due to the use of laser beam technology, optical disks are also known as laser disk or optical laser disks. Unlike magnetic disks, which have several concentric tracks, an optical disk has one long track, which starts at the outer edge and spirals inwards to the center. The optical disk has no mechanical R/W arm movements.

Advantages of optical disks:

1. The cost-per-bit of storage for optical disks is very low, because of their low cost.
2. The use of a single spiral track makes optical disks an ideal storage medium for reading large blocks of sequential data such as music.
3. Optical disks have no mechanical read/write, which makes optical disks a more reliable storage medium than magnetic tapes or disks.
4. Due to their compact size and light weight, optical disks are easy to handle, store and port from one place to another.

Limitation:

-The data access speed for optical disks is slower than magnetic disks.

- Optical disk requires a more complicated drive mechanism than magnetic disks.

Types of optical disks:

CD-ROM(compact-disk read only memory)

it is a music CD technology and works much like the music CD’S used in music system. The CD-ROM disk is a shiny, silver color metal disk. it has storage capacity of about 650MB or more and it is a read only storage medium such that can not be modified.

CD-RW(compact disk read/write)

CD-RW is a CD-Rewritable disc and this is new type of CD disc that enables us to write onto it in multiple session. Thus we can treat the optical disk just like floppy disk or hard disk writing onto multiple times.

DVD( Digital versatile Disc)

It is family of optical discs that are the same overall dimension of a CD, but have significantly higher capacity. DVD’s are double sided, whereas CD’s are single sided. it needs DVD drive and its capacity ranges from 4.5gb to 17GB.

**UNIT4:**

INPUT/OUTPUT DEVICES (I/O DEVICES)

Introduction:

- The unit which is used to supply data into a computer is called input devices.Those devices which are used to input data into computer and retrieve data from computer is called input/output (I/O) devices.These I/O devices provide the environment of communication between the computer and outer the world.These I/O devices are called peripheral devices.for example:-keyboard, mouse, scanner, monitor, printer etc are I/O devices.

INPUT DEVICES:

1: Keyboard:-Keyboard is an input device with various keys that enables you to enter data into computer.computer keyboard are similar with electric typewriter except consisting extra additional keys.keyboard consists following types of keys:

-Alpanumeric keys:-Letters, and numbers

-Punctation keys:-comma, period, semicolon and so on.

-Special keys:-function keys, control keys, arrows keys cap lock key, and so on.

There are different types of keyboard having different number of keys.for example the original PC keyboard has 84 keys,AT keyboard has also 84 keys,similarly the enhanced keyboard has 101 keys.other keyboard consists up to 104 keys.

2: MOUSE:

The device that control the movments of cursor or pointer on a display screen is called mouse.A mouse is a small object that you can roll along a hard flat surface.As you move the mouse the pointer on the display screen moves in the same direction.Mouse consists one to three button which have different function as reqired.

Types of mice

There are three types of mice:

A) Mechanical mouse- This type of mouse has a rubber or metal ball on its underside that roll in all directions. Mechanical sensors within the mouse detect the direction the ball is rolling and move the screen pointer accordingly.

b) Opt mechanical: - same as mechanical mouse but it uses optical sensor to detect motion of the ball...

c) Optical mouse: - this type of mouse uses laser beam (special light) to detect the mouse’s movement.optical mouse has no mechanical moving parts; optical mouse removes the drawback of mechanical mouse. So that they respond more quickly and precisely than mechanical and opt mechanical mice but they area also more expensive than other mice.

Mouse Connection

Mice use three methods to connect PC’S-

-serial mice connect directly to an RS-232, SERIAL PORT or PS/2 port.This is the simplest type of connection.

-bus mice connect to the bus through an interface card. This is some what more complicated because you need to configure and install an expansion board.

-cordless mice are not physically connected at all. Instead they rely on infrared or radio waves to communicate with the computer.

3) Trackball: Track ball is similar to mouse except that it requires less space than mice. When space is limited trackball is used to move the pointer you have to rotate the ball with your thumb, fingers or the palm of your hand. Due to limited space in LAPTOP computer, track ball is used instead of mouse. There are usually one to three buttons on trackball. Trackball is popular than mice because it is stationary so it does not require much space and we can place it into any type of surface.

4) Joystick:-A joystick is a pointing device which is often used for playing compute games. The joystick has gearshift like lever that is used to move the pointer on the screen. On most joysticks a button on the top is used to select option. it is used to control robots. With a joystick the pointer continues moving in the direction the joystick pointing, to stop the pointer you must return the joystick to its upright position.

5) Digitizing tablet:

-This is an input device that enables you to enter drawing and sketches into a computer. A digiting tablet consists of an electronic tablet and a cursor or pen. Then cursor is similar to mouse except that it has a window with cross hairs for pinpoint placement and it can have as many as 16 buttons. The pen is also called a stylus and looks like a simple ballpoint pen but uses an electronic head instead of ink. The tablet contains electronics that enables it to detect the movement of the cursor or pen and translate the movements into digital signals that it sends to the computer.

For digiting tablet each point on the tablet represents a point on the display screen in a fixed manner. The static nature of ditizing tablets makes them particularly effective for tracing drawings.Digiting tablets are also called digitizers, graphics tablets, touch tablets or simply tablets.

5) Scanner:

- a scanner is an input device that can read text and transfer from a piece of paper into computer represent able. To do this the scanner sends a beam of light to the page and then measures the amount of light reflected back. A scanner works by digitizing an image –dividing it into a grid of boxes and representing each box with either zero or a one, Depending on weather the box is filled in. Each box is represented by 24 bits, the resulting matrix of bits called a bit map, can stored in a file displayed on a screen and manipulated by programs.

6) Digital camera:-

Digital camera is used to input image into computer. Digital camera uses the digital photographic technology. Normal camera capture images on specially coated film whereas digital cameras capture images electronically. then it sends images as digital data into computer.

7) Magnetic ink character Reader (MICR)

MICR is that type of device which reads text printed using magnetic ink. MICR devices were developed to help the banking field in processing the large volumes of cheques. The MICR devices is used automatically to read cheque number, bank identification code and customer account number.MICR is used to read those number and character which are made with magnetic materials.

8) Optical character Reader:-OCR is the ability of machine to recognize characters.OCR is a type of optical scanner, which can detect alphanumeric characters printed on paper. The OCR uses special light, or optic to read text from a piece of paper. A special font standard is needed to recognize character. The OCR system consist combination of hardware and software to recognize characters. The advanced OCR system can read variety of fonts, but still have difficulty to read hand written text.

The OCR devices examine each character by analyzing point of characters then when the whole character is scanned, it is compared with standard fonts in which OCR devices are programmed to recognize the optical characters. OCR is used for large volume processing application such as reading of passenger tickets, processing motor vehicles registration etc.

9) Optical mark Reader (OMR)-OMR is a type of input device that reads hand-draw marks such as small circles or rectangles. CMR is also type of optical scanner that read marks in multiple choice questions. OMR senses the presence or absence of mark, such as pencil mark. OMR can read information in the form of numbers or letters and put it into computer.

10) Bar Code Reader:-Bar code Reader also called as bar code scanner is a input device that uses laser beams to read bar codes on products such as books, packages. so it is used in supermarkets, bookshops etc.

The bar code reader can identify the description of product items and latest price.

11) Touch Screen:-This is easiest way to enter data using the finger touch. Touch screens enables the user to select an option by pressing a specific part of the screen. Touch screen is a type of display screen that has a touch sensitive transparent panel covering the screen. Touch screen enables us to directly select objects instead of using pointing devices such as mouse,light pens. Touch screen are commonly used in fast food restaurants and information centers.

12) Touch Pad:-Many Laptop computers use a touch pad in front of the keyboard. We can move our fingers on the pad to move the cursor on the screen. When we want to click, we can tap pad or use the buttons front of the pad, which works like mouse buttons.

13) Light Pen:-light pen is used as pointing device, which is very sensitive to light. It uses a light-sensitive detector to select objects on display screen. A light pen is similar to mouse except that with a light pen you can move the pointer and select objects on the display screen by directly pointing to objects with the pen. Now a days light pens are used in big hotel’s room for the customer for selecting their choice of menu and other items.

OUTPUT DEVICES:

An ouput device is a machines which accept data from a computer and translates as a result or information which is suitable for use by the outside the world (users).

There are two types of output generated by output devices:

a) Soft-copy output:- A soft-copy output is an output, which is not produced on paper or some materials. So it can’t be touched and carried for being shown to others. for example: output seen on display screen.

b)Hard-copy output:- A hard copy output is an output which is produced on paper or some materials, which can be touched and carried for beings shown to others. These types of output are permanent in nature and can be kept in paper files, or can be looked later when the person is not using the computer. For examples output produced by printers or plotters are hard copy output.

Types of output Devices

1) Monitor:-Monitor is called visual display unit (VDU) and it is also called display screen .The user can sees their result on the monitor screen. Monitor gives soft copy output. Computer monitor are similar with television screens except that monitor are extremely flexible and reliable devices.

The two basic types of monitors used are Cathode Ray Tube (CRT) and LCD(Liquid Crystal Display).The CRT monitor look much like television and are used with non-portable computer system. On the other hand LCD monitor are thinner and lighter are commonly used with portable computer systems like laptop and notebook computers.

Classification of monitor Based on Signals.

Monitors accept either analog or digital signal from video adapter. so there are two types of monitor based on signals.

A)Digital Monitor:-

A digital monitor accepts digital signals rather than analog signals. All monitors (except LCD) use CRT technology, which is essentially analog. The term digital therefore refers only to the type of input received from the video adapter. Then digital monitor then translates the digital signals into analog signals that control the actual display. Thus digital monitors are fast and produce clear images.

b) Analog Monitor:-

This is the traditional type of color display screen that has been used for years in televisions. So in reality all monitors based on CRT technology ((that is all monitors except LCD) are analog.

*Characteristics of a monitor*

1. size:-

The size shows type of screen based on size example 14 inch, 17 inch etc.

1. Resolution:

The resolution of monitor is expressed by the number of pixels on the screen, expressed as a matrix. The resolution refers to the number of dots displayed in the x (across) and y (down) co-ordinates. The resolution of a monitor indicates how densely the pixels are packed. Pixel is short for picture Element; a pixel is a single point in graphic image. The quality of display monitor largely depends on its resolution, for example a resolution of 800×600 means that there are 800 pixels in horizontally and 600 pixels in vertically.

1. Band Width:-

The Bandwidth refers the amount of data that can be transmitted in a fixed amount of time. Thus this determines how much data it can process and therefore how fast it can refresh at higher resolution. For digital computer it is expressed in bits or byte per second (bps) and for analog it uses hers (HZ).

D) Refresh Rate:-

Refresh rate refers to the number of times per second that the image is redrawn on the monitor screen.i.e Refresh rate means how many times per second the screen is refreshed(redrawn).Display monitors must be refreshed many times per second. The refresh rate for a monitor measured in hertz(Hz).The faster the refresh rate ,the less monitor flickers.

|  |  |
| --- | --- |
| Impact Printers  -An impact printer is like typewriter and the characters are formed by physically striking the type device against an inked ribbon.Impact printers can produce a page, a line,or a character at a time.Large computer use line printers that can give hard copy ouput at 3000 lines per minute.  Print quality is low and these printers are mainly used for printing backup copies of large amount of data.  Example:of impact printers are –Dot matrix,Daisy Wheel Drum,Line printers. | Non-Impact Printers  -Non –impact printers are the most widely used printers for PCs today.  -Non-Impact printers can produce both text and graphics.  -In non-impact printersnothing strikes the paper,which are quite.As there is no physical contact between th paper and the printer and that they have fewer moving parts.  -Non-impact printers are comparatively much more reliable,quiter and faster than impact printers.  For Example:Laser printer,ink jet printers. |

Printer:

Printers are one of the main output devices. it gives hard copy output. The output we get through this device is called as hardcopy or hard output. Printers are classified into two categories on speed.

Impact Printers:

1)Daisy-Wheel printer:-

Daisy-wheel printer has a plastic or metal wheel on which the shape of each character stands out in relief. A hammer presses the wheel against a ribbon, which in turn makes an ink stain in the shape of the character on the paper.Daisy-wheel printer’s produces letter-quality type.

Daisy –wheel printers are noisy and slow and can print from 10 to 75 characters per second.This type of printers can not print graphics.

2)Dot-Matrix printer:-Dot-matrix printer produces character by striking pins against an ink ribbon.Each pin makes a dotm and combination of dots form characters.print head is a type of these printers which consists of a matrix of tiny needles,typically seven rows with nine needles in each(9\*7 matrix).

Dot- matrix printer are inexpensive and relatively fast (can print 50 t0 500cps) and noisy also.

Non-impact printers

1) ink-jet printer:-

Ink-jet printer is called non-impact printer because they print by spraying ink on paper and ,which print characters by spraying small drops of ink at a sheet of paper.The ink is different from normal ink having a high iron content.There are magnetized plates in the ink’s path which direct the ink onto the paper in the desired shapes.Ink-jet printers can also print in high color,which makes them popular for home users. Although ink-jet printersare inexpensive and produce excellent output, they are slow.But it can not be used to produce multiple copies of a document in a single printing.

2) Laser printer:-

Laser printers work like photo copy machines.laser printer uses laser beam to produce image.Laser printer can produce very high quality print and are capable of printing an almost unlimited variety of fonts.The light of laser alters the electrical charge on the drum wherever it hits.These charges attract toner,which is transferred to the paper and fuesed to the surface by a heat process.laser printer are faster and more expensive tha others.The Laser print quality is measured in number of dots per inch(dpi) i.e The Best laser printer can produce 600dpi or more.

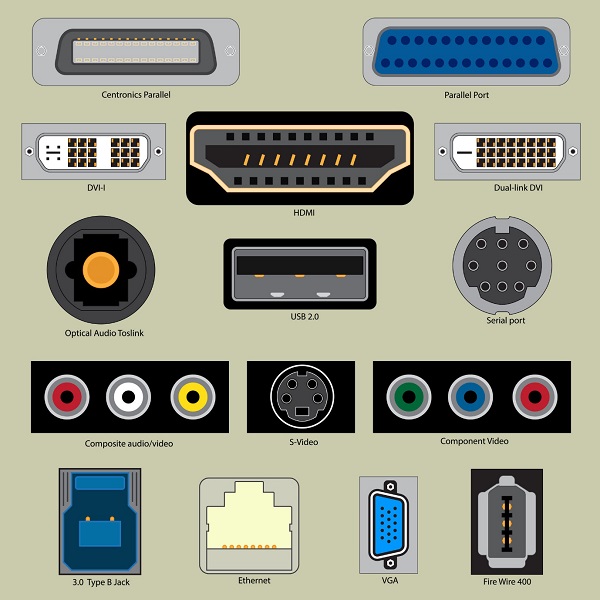
Plotters:-

A plotter or graph plotter is a device used to output graphics on ouput medium like paper.This device provides completely different form of output and have a variety of applications.outputting graphics means plotting(drawing) shapes of graph,bar charts,pie charts,maps etc.They produce line by pen,and more expensive than printers and widely used for engineering applications.

Sound card and speakers: sound card is an ouput device which is related with production of sound in the computer system.An expansion board that enables a computer to manipulate and output sounds.

A connection point that acts as interface between the computer and external devices like mouse, printer, modem, etc. is called **port**. Ports are of two types −

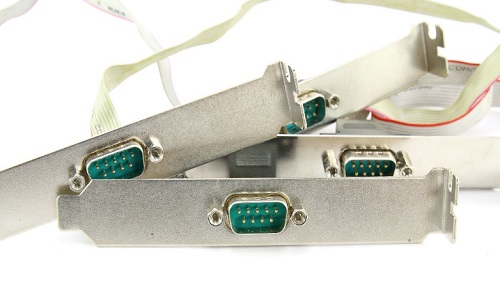
* **Internal port** − It connects the motherboard to internal devices like hard disk drive, CD drive, internal modem, etc.
* **External port** − It connects the motherboard to external devices like modem, mouse, printer, flash drives, etc.



Let us look at some of the most commonly used ports.

Serial Port

Serial ports transmit data sequentially one bit at a time. So they need only one wire to transmit 8 bits. However it also makes them slower. Serial ports are usually 9-pin or 25-pin male connectors. They are also known as COM (communication) ports or RS323C ports.



Parallel Port

Parallel ports can send or receive 8 bits or 1 byte at a time. Parallel ports come in form of 25-pin female pins and are used to connect printer, scanner, external hard disk drive, etc.



USB Port

USB stands for Universal Serial Bus. It is the industry standard for short distance digital data connection. USB port is a standardized port to connect a variety of devices like printer, camera, keyboard, speaker, etc.



PS-2 Port

PS/2 stands for **Personal System/2**. It is a female 6-pin port standard that connects to the male mini-DIN cable. PS/2 was introduced by IBM to connect mouse and keyboard to personal computers. This port is now mostly obsolete, though some systems compatible with IBM may have this port.

Infrared Port

**Infrared port** is a port that enables wireless exchange of data within a radius of 10m. Two devices that have infrared ports are placed facing each other so that beams of infrared lights can be used to share data.

Bluetooth Port

**Bluetooth** is a telecommunication specification that facilitates wireless connection between phones, computers and other digital devices over short range wireless connection. Bluetooth port enables synchronization between Bluetooth-enabled devices. There are two types of Bluetooth ports −

* **Incoming** − It is used to receive connection from Bluetooth devices.
* **Outgoing** − It is used to request connection to other Bluetooth devices.