LECTURES NOTE

ON

INTRODUCTION TO COMPUTER SCIENCE

Course Code: CSC-1301

DEPT. OF C. Sc.

YSU

INTRODUCTION

From the subject matter " Computer Science " many people assume that computer science is concerned with answering questions about what computers are, how they work and how they are used. It is, but there is more to computer science than that. Computers are indeed some of the most interesting and complex items of technology in everyday use, but they are only around in such numbers because they are useful tools. Often however, they are more trouble than they are worth. What happens it is usually largely the fault of those who design and built the computer system. Why is it their fault? You may ask.

A common reason is that those involved did not properly understand how to find out what was really required and therefore did not know how to build a system that met the requirement. Gaining the necessary understanding to be able to successfully carry out such tasks is a goal of computer science. Now the following intuitive defination of computer science can be given.

Defination (Computer Science): computer science is concerned with application of scientific principles to design, construction and maintenece of systems based upon the use of computers.

Conputer scientists deals mostly with software and software systems; this includes their theory, design, development, and application.

Principal areas of study within Computer Science include artificial intelligence, computer systems and networks, security, database systems, human computer interaction, vision and graphics, numerical analysis, programming languages, software engineering, bioinformatics and theory of computing.

Although knowing how to program is essential to the study of computer science, it is only one element of the field. Computer scientists design and analyze algorithms to solve programs and study the performance of computer hardware and software. The problems that computer scientists encounter range from the abstract-- determining what problems can be solved with computers and the complexity of the algorithms that solve them – to the tangible – designing applications that perform well on handheld devices, that are easy to use, and that uphold security measures.

Definition of Computer: A computer can be defined is an electronic machine that accepts data as input, stores data, processes data and produces the results (output) as electronic file of information or as a single to automatically control another machine.

i. **Data:** The term data is referred to facts about a person, object or place e.g. name, age, complexion, school, class, height etc.

ii. **Information:** Is referred to as processed data or a meaningful statement e.g. Net pay of workers, examination results of students, list of successful candidates in an examination or interview etc.

Methods of Data Processing

The following are the three major methods that have been widely used for data processing over the years:

a. Manual method

b. Mechanical method and

c. Computer method

Manual Method

The manual method of data processing involves the use of chalk, wall, pen pencil and the like. These devices, machine or tools facilitate human efforts in recording, classifying, manipulating, sorting and presenting data or information. The manual data processing operations entail considerable manual efforts. Thus, manual method is cumbersome, tiresome, boring, frustrating and time consuming. Furthermore, the processing of data by the manual method is likely to be affected by human errors. When there are errors, then the reliability, accuracy, neatness, tidiness, and validity of the data would be in doubt. The manual method does not allow for the processing of large volume of data on a regular and timely basis.

Mechanical Method

The mechanical method of data processing involves the use of machines such as typewriter, rondo machines, adding machines and the like. These machines facilitate human efforts in recording, classifying, manipulating, sorting and presenting data or information. The mechanical operations are basically routine in nature. There is

virtually no creative thinking. The mechanical operations are noisy, hazardous, error prone and untidy. The mechanical method does not allow for the processing of large volume of data continuously and timely.

Computer Method

The computer method of carrying out data processing has the following major features:

I. Data can be steadily and continuously processed

II. The operations are practically not noisy

III. There is a store where data and instructions can be stored temporarily and permanently.

IV. Errors can be easily and neatly corrected.

V. Output reports are usually very neat, decent and can be produced in various forms such as adding graphs, diagrams, pictures etc.

VI. Accuracy and reliability are highly enhanced. Below are further attributes of a computer which makes it to be an indispensable tool for human being:

Characteristics of Computer

I. **Speed:** The computer can manipulate large data at incredible speed and response time can be very fast.

II. **Accuracy:** Its accuracy is very high and its consistency can be relied upon. Errors committed in computing are mostly due to human rather than technological weakness. There are in-built error detecting schemes in the computer.

III. **Storage:** It has both internal and external storage facilities for holding data and instructions. This capacity varies from one machine to the other. Memories are built up in K(Kilo) modules where K = 1024 memory locations.

IV. **Automatic:** Once a program is in the computer's memory, it can run automatically each time it is opened. The individual has little or no instruction to give again.

V. **Reliability:** Being a machine, a computer does not suffer human traits of tiredness and lack of concentration. It will perform the last job with the same speed and accuracy as the first job every time even if ten million jobs are involved.

VI. **Flexibility:** It can perform any type of task once it can be reduced to logical steps. Modern computers can be used to perform a variety of functions like on-line processing, multi-programming, real time processing etc.

BRIEF HISTORY OF COMPUTER

Many years ago people used their fingers and toes in counting. They also used stones, pebbles and seeds of plants like the palm kernel. Then when many things had to be contented, people could no longer use their fingers, and toes, or stones and seeds in counting, and then the computer was invented. The computer was made as a counting machine. The first computer was called the Abacus counting machine.

A complete history of computing would include a multitude of diverse devices such as the ancient Chinese abacus, the Jacquard loom (1805) and Charles Babbage's "analytical engine" (1834). It would also include discussion of mechanical, analog and digital computing architectures. As late as the 1960s, mechanical devices, such as the Merchant calculator, still found widespread application in science and engineering. During the early days of electronic computing devices, there was much discussion about the relative merits of analog vs. digital computers. In fact, as late as the 1960s, analog computers were routinely used to solve systems of finite difference equations arising in oil reservoir modeling. In the end, digital computing devices proved to have the power, economics and scalability necessary to deal with large scale computations. Digital computers now dominate the computing world in all areas ranging from the hand calculator to the supercomputer and are pervasive throughout society. Therefore, this brief sketch of the development of scientific computing is limited to the area of digital, electronic computers. The evolution of digital computing is often divided into generations. Each generation is characterized by dramatic improvements over the previous generation in the technology used to build computers, the internal organization of computer systems, and programming languages. Although not usually associated with computer generations, there has been a steady improvement in algorithms, including algorithms used in computational science. The following history has been organized using these widely recognized generations as mileposts.

EARLY HISTORY

Most significant for the development of computing, the transformation of multiplication into addition greatly simplified the possibility of mechanization. Analog calculating devices based on Napier's logarithms—representing digital values with analogous physical lengths—soon appeared. In 1620 Edmund Gunter, an English mathematician who coined the terms cosine and cotangent, built a device for performing navigational calculations: the Gunter Scale or, as navigators simply called it, the Gunter. Around 1632 an English clergyman and mathematician named William Oughtred built the first slide rule, drawing on Napier's ideas. That first slide rule was circular, but Oughtred also built the first rectangular one in 1633.

Slide rule is a device consisting of graduated scales capable of relative movement, by means of which simple calculations may be carried out mechanically. Typical slide rules contain scales for multiplying, dividing, and extracting square roots, and some also contain scales for calculating trigonometric functions and logarithms. The slide rule remained an essential tool in science and engineering and was widely used in business and industry until it was superseded by the portable electronic calculator late in the 20th century.

The history of computers starts at about 2000 years ago, at the birth of the abacus, a wooden rack holding two horizontal wires with beads strung to them. When these beads are moved around, according to certain rules memorized by the user, all regular arithmetic problems can be done.

Calculating devices took a different turn when John Napier, a Scottish mathematician, published his discovery of logarithms in 1614. As any person can attest, adding two 10-digit numbers is much simpler than multiplying them together, and the transformation of a multiplication problem into an addition problem is exactly what logarithms enable. This simplification is possible because of the following logarithmic property: the logarithm of the product of two numbers is equal to the sum of the logarithms of the numbers. By 1624 tables with 14 significant digits were available for the logarithms of numbers from 1 to 20,000, and scientists quickly adopted the new labour-saving tool for tedious astronomical calculations.

French philosopher, mathematician, and physicist Blaise Pascal is usually credited for building the first digital computer in 1642. The machine added and subtracted numbers with dials and was made to help his father, a tax collector. In 1671 a German mathematician Gottfried Wilhelm von Leibniz invented a special gearing system that was built in 1694. Leibniz system enables multiplication on Pascal's machine.

In the early 19th century, French inventor Joseph-Marie Jacquard devised a specialized type of computer: a silk loom. Jacquard's loom used punched cards to program patterns that helped the loom create woven fabrics. Although Jacquard was rewarded and admired by French emperor Napoleon *I* for his work, he fled for his life from the city of Lyon pursued by weavers who feared their jobs were in jeopardy due to Jacquard's invention. The loom prevailed, however: when Jacquard died, more than 30,000 of his looms existed in Lyon. The looms are still used today, especially in the manufacture of fine furniture fabrics.

Another early mechanical computer was the Difference Engine, designed in the early 1820s by British mathematician and scientist Charles Babbage. Although never completed by Babbage, the Difference Engine was intended as a machine with a 20-decimal capacity that could solve mathematical problems. Babbage also made plans for another machine, the Analytical Engine, considered the mechanical precursor of the modern computer. The Analytical Engine was designed to perform all arithmetic operations efficiently; however, Babbage's lack of political skills kept him from obtaining the approval and funds to build it.

Augusta Ada Byron, countess of Lovelace, was a personal friend and student of Babbage. She was the daughter of the famous poet Lord Byron and one of only a few women mathematicians of her time. She prepared extensive notes concerning Babbage ideas and the Analytical Engine. Lovelace conceptual programs for the machine led to the naming of a programming language (Ada) in her honour. Although the Analytical Engine was never built, its key concepts, such as the capacity to store instructions, the use of punched cards as a primitive memory, and the ability to print, can be found in modern computers.

CLASSIFICATION OF COMPUTER

There are several methods used in classifying computers. These include the following:

1. Classification based on generation
2. Classification based on type
3. Classification based on size
4. Classification based on purpose
5. Classification based on make (manufacture)

Classification based on generations.

The evolution of digital computing is characterized by it improvements over one another in term of the technology used to build computers, their internal organizations and programming languages.

From the 1950's, the computer age took off in full force. The years since then have been divided into periods or generations based on the technology used.

First Generation Computers (1945-1954): Vacuum Tubes

These machines were used in business for accounting and payroll applications. Valves were unreliable components generating a lot of heat. They had very limited memory capacity. Magnetic drums were developed to store information and tapes were also developed for secondary storage. They were initially programmed in machine language (binary). A major breakthrough was the development of assemblers and assembly language.

1930's – Vacuum tubes were used as **electronic circuits** or **electronic switches**

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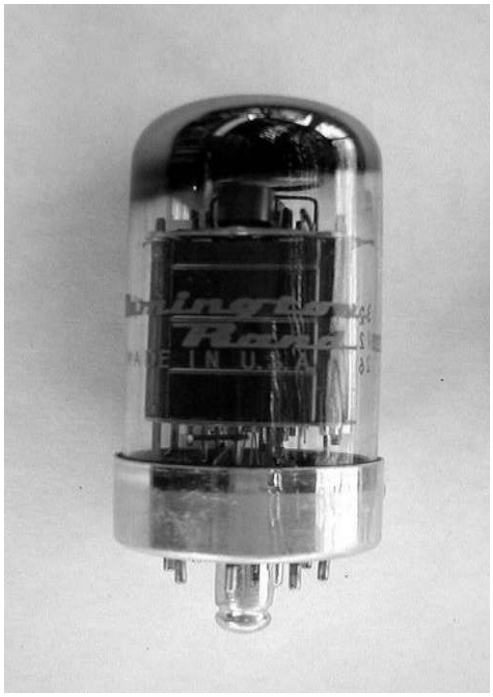
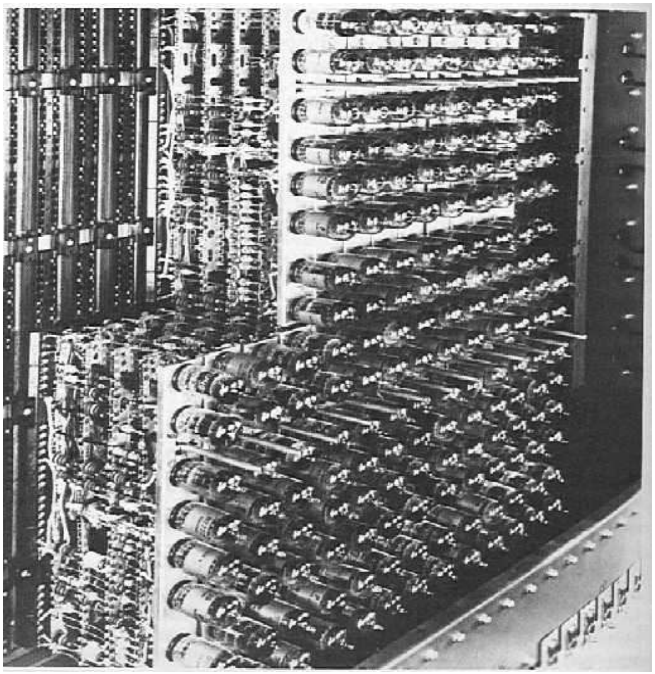




Characteristic of the first generation computer

1. They were large and costly
2. They use vacuum tube technology
3. The instructions were coded in machine language i.e 0s and 1s.
4. They generated a lot of heat
5. They had limited internal storage
6. They were scarce

Second Generation (1955-1964): Transistors

The development of the transistor revolutionized the development of computers. Invented at Bell Labs in 1948, transistors were much smaller, more rugged, cheaper to make and far more reliable than valves. Core memory was introduced and disk storage was also used. The hardware became smaller and more reliable, a trend that stills continues. Another major feature of the second generation was the use of high-level programming languages such as FORTRAN and COBOL. These revolutionized the development of software for computers.

Characteristic of the second generation

1. They were faster than first generation computer
2. They had limited internal storage
3. They use transistor technology and hence generated less heat
4. They were common
5. Instructions were coded in high level languages
6. Machine languages of the first generation computer were replaced by assembly language which was much easier
7. They were less expensive to buy and power

Third Generation (1965-1974): Integrated Circuits (ICs)

IC's were again smaller, cheaper, faster and more reliable than transistors. Speeds went from the microsecond to the nanosecond (billionth) to the picoseconds (trillionth) range. ICs were used for main memory despite the disadvantage of being volatile. Minicomputers were developed at this time. Terminals replaced punched cards for data entry and disk packs became popular for secondary storage. IBM introduced the idea of a compatible family of computers, 360 families easing the problem of upgrading to a more powerful machine. Operating systems were developed to manage and share the computing resources and time-sharing operating systems were developed. These greatly improved the efficiency of computers. Computers had by now pervaded most areas of business and administration. The number of transistors that be fabricated on a chip is referred to as the scale of integration (SI).

Characteristic of the third generation computers

1. They were less expensive to buy and power
2. They were smaller in size
3. They made use of integrated circuit technology
4. They were more energy efficient and so generated lesser amount of heat
5. Instructions were coded in high level language
6. They were faster than earlier generations
7. The generation witnessed the development of the mini computer

Fourth Generation (1975-1984): VLSI (Very Large SI)

The term fourth generation is occasionally applied to VLSI-based computer architecture. VLSI has made it possible to fabricate an entire CPU, main memory, or similar devices with a single IC. This has resulted in new classes of machines such as inexpensive personal computers, and high- performance parallel processors that contain thousands of CPUs. VLSI allowed the equivalent of tens of thousands of transistors to be incorporated on a single chip. This led to the development of the microprocessor a processor on a chip. Intel produced the 4004 which was followed by the 8008, 8080, 8088 and 8086 etc. Other companies developing microprocessors included Motorola (6800, 68000), and Zilog. Personal computers were developed and IBM launched the IBM PC based on the 8088 and 8086 microprocessors. Mainframe computers have grown in power. Memory chips are in the megabyte range. VLSI chips had enough transistors to build 20 ENIACs. Secondary storage has also evolved at fantastic rates with storage devices holding gigabytes (1024Mb = 1 GB) of data. On the software side, more powerful operating

systems are available such as UNIX. Applications software has become cheaper and easier to use.

Characteristics of the fourth generation computers

1. Several thousand of transistors are formed into a single chip.
2. They have bigger storage facilities.
3. They have larger storage capacities.
4. They have user – friendly interface facilities.
5. They use microchip technology.
6. They are smaller in size.
7. The generation witnessed the development of object- oriented programming (OOP).
8. They generate lesser amount of heat.
9. They are less expensive to buy and power.
10. Instructions are coded in high level language.
11. The generation witnessed the introduction of programmable minicomputers supplied with software packages.

Fifth Generation (1991-Present):

The race is now on building the next or "fifth" generation of computers, machine that exhibit artificial intelligence (AI). Thus new generations of computers will involve robotics and computer networks. Developments are still continuing. Computers are becoming faster, smaller and cheaper. Storage units are increasing in capacity. Distributed computing is becoming popular and parallel computers with large numbers of CPUs have been built.

Characteristics of the fifth generation computers

1. They can take decision on their own.
2. They have artificial intelligence.
3. They are in various forms.
4. They will be able to accept spoken word instructions (voice recognition).
5. They will have high speed of operation.

Classification of computers based on types

The following are the classification of computer based on types:

1. Analogue Computers.
2. Digital Computers.
3. Hybrid Computers.

Analogue Computers

These are computers that measure physical quantities such as pressure, temperature, and humidity. The values represented change continuously. Examples of the analogue computers are the car speedometer, rotating clock, voltage reader, analogue thermometer, and the analogue wristwatch.

Characteristic of analogue computers

1. They measure physical quantities.
2. The values that are represented change continuously.
3. Time is continuously observed.

Digital Computers

These are machines that perform calculations in digit and discrete numbers of decimal or binary form. Digital computers receive new programs quite easily, either through manual instructions or by automatic means. Examples of digital computers are the digital thermometer, digital meter reader, digital wristwatch, GSM phone, Pager, digital radio, and the decoder (TV decoder).

Characteristic of digital computers

1. They perform calculations in digits and discrete numbers of decimals or in binary form.
2. They receive new programs quite easily.
3. They translate numeric value into machine readable forms.
4. In a digital system, the representation of a natural event is made by measuring the changing qualities of the object at separate moments in time.

Hybrid Computers

These computers use both analogue techniques and digital techniques in other to accomplish their mean computational process.

Hybrid computers use both continuously variable techniques and discrete digital techniques in operation. An example of a hybrid computer is the automobile car speedometer.

Characteristic of hybrid computers

1. They use both analogue and digital techniques.
2. They convert values into binary values of 0s and 1s

Classification based on size

The following are the classification of computers based n size

1. Supercomputers
2. Mainframe computers
3. Minicomputers
4. Microcomputers

1. Super computers (shown below)

- Most power type of computer.
- High-capacity computers.
- Fastest processing.
- Used by large organizations, usually research facilities.

A supercomputer

2. Mainframes (shown below)

- Do not have as high of capacity or a fast processing as supercomputers.
- Capable of storing large amounts of data.
- Large corporations use them.

3. Minicomputers (shown below)

- ❖ Slower processing speed and less storage capacity than a mainframe.
- ❖ Used by medium-sized companies or departments of large corporations.
- ❖ Used for specialized purposes

A mini computer

4. Microcomputers (shown in Figure 4 below)
    - ❖ Least powerful
    - ❖ Most widely used
- o Four types ;Desktop, Notebook ,Tablet PC ,Handheld

Classification based on purpose

For the classifications based on purpose, there are two types:

1. General purpose computers
2. Special purpose computers

General purpose computers

These are computers designed to solve a wide variety of problems. They can be adapted to perform particular tasks or solve problems by means of specially written programs. Examples are network servers and desktop workstation.

Special purpose computers

Special – purpose computers are designed mainly to perform specific functions. They are built to perform some predetermined functions. Examples include computers, designed for use in petrol pumps, digital watches, space research computers, and seismic operation computers.

Classification based on make (manufacture method)

Base on the make or manufacturer, computers can be classified as:

1. Branded computers
2. Clone computers.

Branded computers

These computers are manufacture by companies that specialize in the production of various products. Each has a unique trade name and trademark. They are also called proprietary system. Examples are IBM, Dell, Dec, Atari Gateway, Compaq, Hewlett Packard, Toshiba and Zinox.

Clone computers

These are near copies of branded systems. The components of these computers are coupled together and configured by companies or individuals who possess the skill. Clone computers most often do not have known names. They are also called PC – Compatibles.

THE COMPUTER SYSTEM

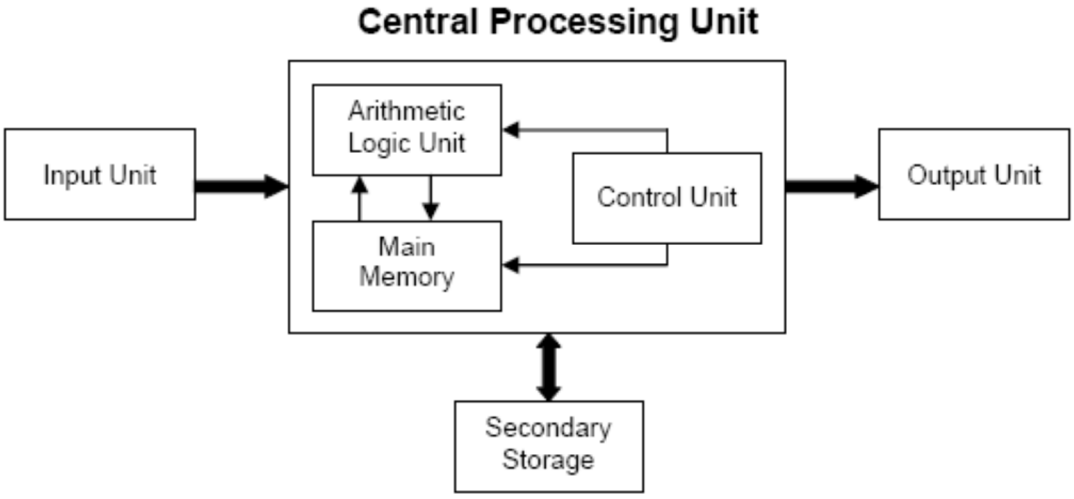
A computer system is a collection of interrelated components which work together as a system and are connected by cables or wireless devices. The physical components that make up computer system is called **computer hardware.** The programs used with a computer system are called **computer software.**

Basic Components of Computer System

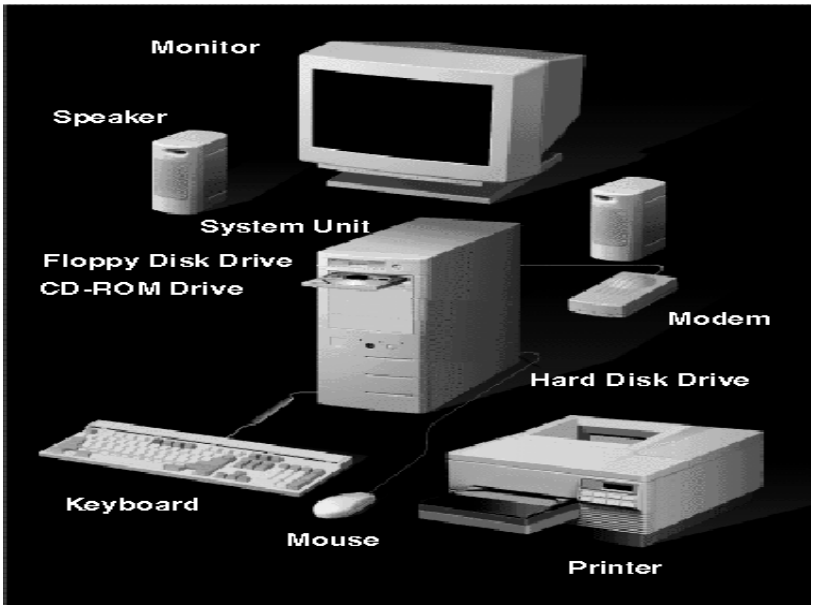
The two broad division of the computer are the software and hardware:

Computer hardware

The hardware is the physical components of the computer we can touch and feel e.g. the screen, the circuitry, the casing, the cables, monitor, mouse, keyboard etc. Hardware components are subdivided into three parts; input unit, central processing unit (CPU) and output unit. These makeup the functional components of the computer system.



Computer Hardware block diagram



The Input Units

The input device enables the computer user to communicate with the computer. Input devices are media that are used to send data and instructions into computer. An input device can only be used for input, the commonly used input devices are the keyboard and the mouse. Other examples of input device are; Touch pad, Joystick, Trackball, Microphone, Light pen, Touch screen, Scanner, Audio input and data entry (VDE), Magnetic tapes and cassette reader, Floppy and hard drives, Compacts disk and DVD reader.

Mouse

Mouse is a pointer device. The mouse allows an individual to control a pointer in a graphical user interface (GUI). Utilizing a mouse a user has the ability to perform various functions such as opening a program or file and does not require the user to memorize commands.

Digital camera

A type of camera that stores the pictures or video it takes in electronic format instead of to film.

Web Cam

A camera connected to a computer that allows anyone connected to the Internet to view still pictures or motion video of a user.

Joystick

A computer joystick allows an individual to easily navigate an object in a game such as navigating a plane in a flight simulator.

Keyboard

One of the main input devices used on a computer, a computer keyboard looks very similar to the of electric typewriters, with some additional keys.

Microphone

Sometimes abbreviated as mic, a microphone is a hardware peripheral that allows computer users to input audio into their input audio into their computers.

Scanner

Input device that allows a user to take an image and/or text and convert it into a digital file, allowing the computer to read and/or display the scanned object .

The Output Unit

The output unit receives or shows the results of processed data from the main memory and transforms it from machine codes to human understandable to man. The received result is shown to the user either as softcopy (non-permanent) output through the VDU/ voice output device, or as a hard copy (permanent) through a printer or plotter; examples of printing devices are Dot matrix, daisywheel printer, laser printers, thermal printers, DeskJet, inkjet, office Jet etc. Some examples of output devices are; Monitor Printer, Speaker, Plotter, Touch screen.

The Monitor

A monitor is a video display screen. Monitor is also called as Visual Display Unit (VDU) or Video Display Terminal (VDT).

CRT (Cathode Ray Tube) Monitors are built very similarly to older (tube) television sets. They are heavy, bulky, take up a lot of

CRT MONITOR

LCD MONITOR

The Prinnter

Examples are:

1. Laser Printer
2. Ink Jet Printer
3. Dot Matrix Printer
4. Line Printer

Computer Software

Software is a general term used for computer programs. A computer program is a set of instructions or stored instructions that directs a computer to perform a specific task or tells a computer what to do and how to do. Practical computer systems divide software systems into two major types:

1. System software
2. Application software

These two levels of software separate user from the computer system.

System Software

When you switch on the computer the programs stored in ROM are executed which activates different units of your computer and makes it ready for you to work on it. This set of programs can be called system software.

System software's are sets of programs, responsible for running the computer, controlling various operations of computer systems and management of computer resources. Operating System (OS) falls under this category.

An operating system is system software that provides an interface for a user to communicate with the computer, manages hardware devices (disk drives, keyboard, monitor, etc), manages and maintains disk file systems and supports application programs. Some popular Operating systems are UNIX, Windows and Linux.

Although operating system provides all the features users need to use and maintain their systems, inevitably, they still do not meet everyone's expectations. This has led to another type of system software called "Utilities". These are programs that bridge the gap between the functionality of an OS and the needs of users. Utility programs are a broad category of software such as compress (zip)/uncompress (unzip) files software, antivirus software, split and join files software, etc.

System software is computer software designed by computer manufacturers to direct the operations of the computer, to provide basic functionality, and to provide a platform for running application software. System software includes operating system, utility programs language translators, library programs and the window system e.tc.

Application Software

Application software is the software designed to satisfy a particular need of a particular environment. Application software enables a user to accomplish a specific task. Examples of application software are student record software, word processor, accounting software, media players. Application software has many categories such as;

- Opera (web browser)
- Microsoft word (word processing)
- Microsoft excel (spreadsheet software)
- Microsoft power point(presentation software)
- VLC media player (audio/video software)

Software is generally created (written) in a high-level programming language, one that is (more or less) readable by people.

CENTRAL PROCESSING UNIT (CPU)

The central processing unit (CPU) is referred to as the brain or heart of the computer system. It is also referred to as processor. In term of computing power, the CPU is the most important element of computer system.

The central processing unit is that part of the computer that performs manipulations of data, such as calculations or addition.

Components of the central processing unit

There are several major parts inside the simplified CPU. These parts are grouped into main parts which are:

1. Arithmetic and logical unit(ALU)
2. Control unit(CU)
3. Memory unit

The Arithmetic and logical unit

Arithmetic and logic unit or simply ALU is another important component of the CPU. It performs the arithmetic and logical operations on data. When control unit receives an instruction related to performing arithmetic or logic operations on data, it passes that instruction to the ALU.

In arithmetic operations, ALU performs the addition, subtraction, multiplication and division. In logical operations, ALU compares the numerical data as well as alphabetical data.

The control unit

Control unit is the most important component of the CPU because it control, coordinate and supervise all the activities of the other units of computer. It acts as the 'central nervous system' for other components of the computer. It also controls the execution of instruction given to the computer.

The Memory Unit : Memory refers to the data storage that comes in form of chips. The **memory unit** of the computer stores data temporarily for rapid retrieval. The basic unit of computer memory is **Bit.** We have other unit like byte, nibble, kilobytes (Kb), megabytes (MB), gigabytes (GB), terabytes (TB), petabytes (PB).

Types of memory

There are different types of memory. The two major types are:

1. **Primary memory** which can also be referred to as **main memory**; and
2. **Secondary memory** which can also be referred to as **auxiliary storage** devices.

Primary memory (Main memory)

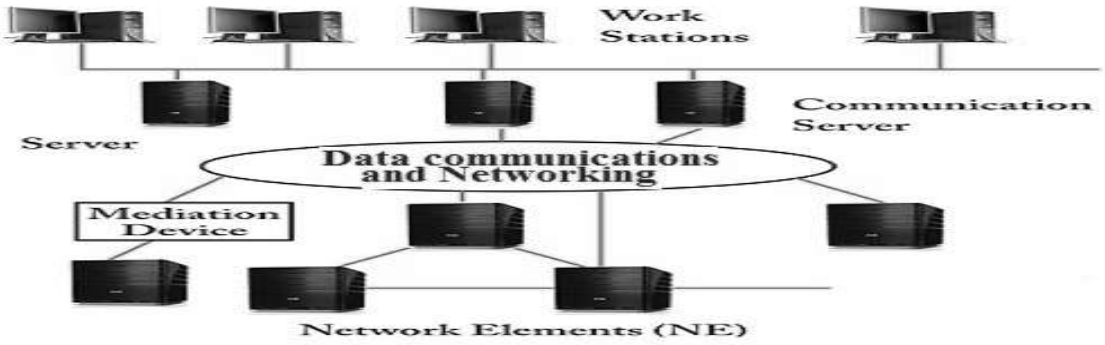
It consists of devices that hold instructions and data for fast and direct access by the computer's CPU. The primary memory is implemented by two types of memory technologies called random access memory (RAM) and read only memory (ROM).

Secondary memory (auxiliary memory)

The secondary memory can also be called an auxiliary memory or mass storage. It consists of the devices that are not directly access by the CPU. Examples are hard drives, taped flash drives, optical disks, floppy disks and digital video disk (DVD).

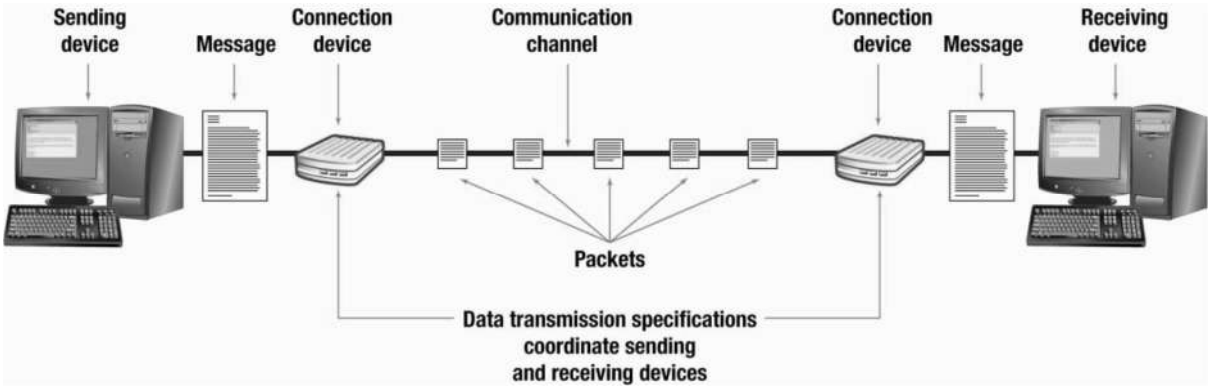
COMMUNICATION AND NETWORK

Computer communication is the transfer of data/information between computers and physically remote devices or terminals. This movement of data from one location to the other cannot be implemented without the use of hardware and software of both computer and telecommunication technology. Telecommunication is the technology use to establish a communication link between two or more locations.



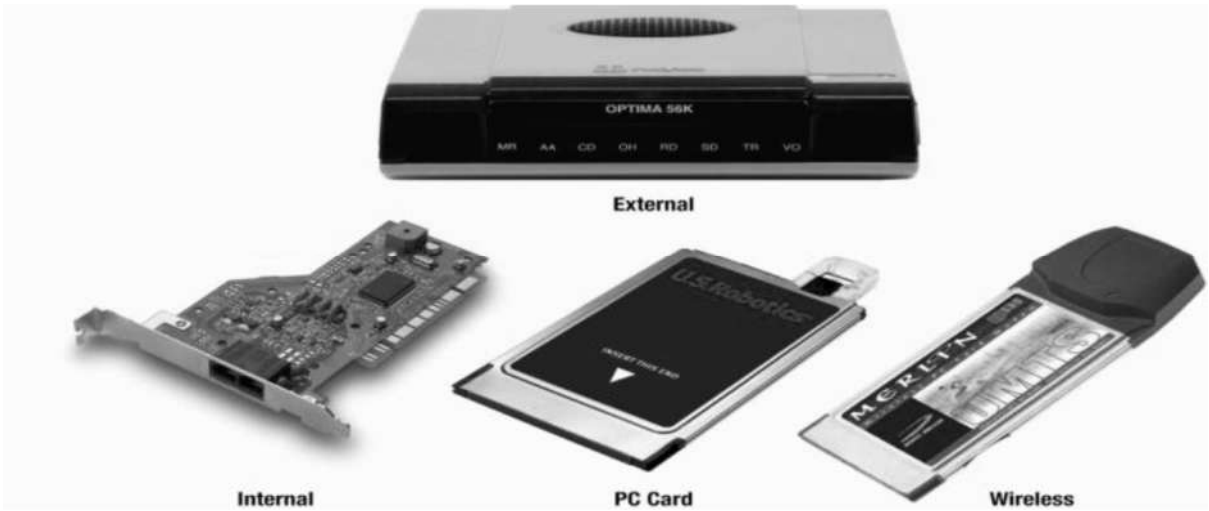
Communications Channels

They are either **physical** such as Twisted pair, Coaxial cable, and Fiber-optic cable, or **wireless** such as Infrared, Microwave (e.g. Bluetooth), and Satellite.



Connection Devices

Modems: They connect computers over analog phone lines. They convert the computers digital signals to analog signals to send over the phone line (**modulation**) and then re-convert them to digital when receiving information from the phone lines (**demodulation**). The transfer rate is measured in bits-per-second. There are four types: Internal, external, PC card, and Wireless.



Network interface cards (NIC): expansion cards located within the system unit that connect the computer to a network.

Communication system contains many types of devices:

a. Personal computers
b. Notebook computers
c. Web-enable cellular phones
d. Web-enable handheld computers
e. Web TV

The following are needed for successful communication

1. Sending devices
2. Communications devices
3. Communications channel
4. Receiving device

Sending and receiving devices

Initiate or accept transmission of data, instructions and information. E.g. notebook computer, desktop computer and mainframe computer, Etc.

The primary function of a communication is to convert digital signals to analog signals or analog signals to digital signals.

Uses of communication

i. Voice mail
ii. E-mail
iii. Fax
iv. Chat room
v. Groupware
vi. Instant messaging
vii. Video conferencing
viii. Internet telephony

Instant messaging (IM) often shortened to simply "IM" or "Iming," is the exchange of text messages through a software application in real-time.eg. Facebook messenger, skype, WhatsApp, Viber, Talk.to, Nimbuz, wechat, kik messenger, snapchat, Gtalk, ebbudy messanger.

COMPUTER NETWORK

A computer network is simply a controlled transmission medium that links together computers and related equipment such as printers and video display terminals for communication purposes.

Types of Computer Network

There are different types of computer networks describing the size (spanning) of a network. They are as follows:

1. LAN: Local area Network (relatively small network) normally found within offices or buildings, it covers 1-5km area. Network in Limited geographical area such as home, school computer laboratory.

1. MAN: Metropolitan Area Network is the network often used as backbone between several LANs; usually covers a large area like city; or a range of 5-50km.

2. WAN: Wide Area Network: is a network that covers a geographical dispersed areas or spanning a sizeable geographical area. E.g. network involving two or more states or country.
3. GAN: Global Area Network: this is the largest form of networks in the world. E.g. internet, its the network that covers the world over.

What is a peer-to-peer LAN?

• Small network that shares hardware, data, or information located on any other computer in network.

• Each computer stores files on its own storage devices

What is a client/server LAN?

• Network in which one or more computers act as a server and other computers on the network can request services from server.

INTRODUCTION TO INTERNET

The Internet (Launched in 1969) is often referred to as the Information Superhighway because it connects millions of people across the globe. Unlike a typical highway, the Internet moves idea and information.

The Web (Introduced in 1992) provides an easy-to-use multimedia interface to connect to the Internet and is used by millions of people every day.

Uses of the Internet and the Web: Communicating, Shopping, Searching, Entertainment, and Education (e-Learning). The most common way is through ISP – Internet Service Providers.

What is the Internet?

A loosely configured global wide-area network. Includes more than 31,000 different networks in Over 100 different countries. Millions of people visit and contribute to the Internet, through e-mail and the World Wide Web.

Began as a Department of Defense project. For detailed information about the history of the Internet, see: http://dir.yahoo.com/Computers_and_internet/Internet/History/

EARLY HISTORY OF THE INTERNET

In the 1950s the U.S. Department of Defense became concerned that a nuclear attack could disable its computing (and thus planning and coordinating) capabilities. By 1969 the Advanced Research Projects Agency Network (ARPANet) had been constructed. The first computers to be

connected were ones at the University of California at Los Angeles, SRI International, the University of California at Santa Barbara, and the University of Utah.

The changing Internet

Early on researchers began to find new uses for the Internet, beyond its original purpose of controlling weapons systems.

These new applications included the following:

- Electronic mail
- File transfer protocol
- Telnet
- User's News Network (Usenet)

The new uses

In 1972 a researcher wrote a program that could send and receive messages over the Internet. E-mail was quickly adopted by Internet users. File transfer protocol (FTP) allowed researchers using the Internet to transfer files easily across great distances.

Telnet allows users of the Internet to log into their computer accounts from remote sites.

All three of these applications are still widely used. We will discuss them again later.

Early use of the Internet

From 1969 until the 1980s the Internet was used primarily by government and university researchers. The development of the Internet was funded in part by the National Science Foundation (NSF) and commercial network traffic was prohibited. As personal computers became more powerful, and affordable in the 1980s, companies created their own networks. These users wanted to be able to communicate outside the network.

A growing Internet

Researchers had long considered the Internet a valuable tool. As the 1990s began, a larger variety of people thought of the Internet as a useful resource.

The Internet grew significantly in 20 years.

Year	***# of computers***
1969	**4**
1990	**313,000**

The largest growth in the Internet was yet to come.

A prehistory of the Web

In 1945, Vannevar Bush wrote an article that proposed a machine (called the Memex) to store a person's books, records, letters, and research results on microfilm. The Memex would have an index to help locate documents. In the 1960s, Ted Nelson described a similar system in which text on one page would have links to text on other pages. Nelson called this page linking system ***hypertext***. Douglas Englebart (inventor of the mouse) created the first experimental hypertext system.

The birth of the Web

Over the next two years Berners-Lee developed the code for a hypertext server program and made it available on the Internet. He envisioned the set of links between computers as a spider web, hence the name Web. The CERN site is considered the birthplace of the World Wide Web. The CERN site: http://cern.web.cern.ch/CERN/

Terminology

A *hypertext server* is a computer that stores files written in hypertext markup language (HTML) and lets other computers connect to it and read those files. It is now called a *Web server*. A *hyperlink* is a special tag that contains a pointer to another location in the same or in a different HTML document.

HTML

HTML is based on Standard Generalized Markup Language (SGML), which organizations have used for many years to manage large document filing systems. HyperText Markup Language: A language to create a document that is found online (on the internet). Such documents are called are called html documents and have the extension .htm and .html.

Websites and webpages

A webpage is an html page and a collection of webpage form a website. For example: http://www.yahoo.com is a website and http://sports.yahoo.com is a webpage from that website. The homepage is the first page displayed when you visit a website.

Early Web browsers

A *Web browser* is a software interface that lets users read (or browse) HTML documents.

Early web browsers were text based. Although the Web caught on quickly in the research community, broader acceptance was slow to materialize. Part of the problem was that the early browsers were difficult to use.

Browsers

Browsers provide a user interface to the web and allow you to visit websites. The most well known browsers: Microsoft Internet Explorer, Mozilla Firefox, Netscape Communications. Allow connections to remote computers. To access a website we need its location/address (URL - Uniform Resource Locator). URLs have two parts domain name and a domain code. For example: in http://www.yahoo.com the domain name is yahoo and the domain type.

Examples of domain types are: .com (commercial), .edu (education), .gov (government), .tv, .net, .org(organization), .com.lb (commercial in Lebanon) where lb is a country code.

GUI Web browsers

In 1993, Marc Andreessen led a team of researchers and developed the first software with a ***graphical user interface*** for viewing pages over the Web. This first GUI browser was named Mosaic. Mosaic widened the appeal of the Web by making access easier and adding multimedia capabilities. Andreessen later went on to develop the Netscape Navigator browser

Electronic Mail E-mail is the most common form of Internet communications. The e-mail message can contain text, graphics, photos, and file attachments. To send an e-mail you need an e-mail account access to the Internet, and an e-mail software. Common e-mail software packages are Microsoft's Outlook Express. Some e-mail software is web based such as hotmail and gmail.

Three basic elements:

1. Header (includes the addresses, the subject, and the attachments which files that can be sent along with the e-mail but are separate from the message),
2. Message body, and
3. Signature line – Provides additional information about the sender.

Spam: Unsolicited and unwanted e-mails.

IMAP

IMAP (Internet Message Access Protocol) is a newer protocol that, like POP, can ask if there is new mail, download e-mail, and delete e-mail. IMAP has capabilities that POP does not: It defines how a client program asks a mail server to present available mail. It can allow you to manipulate and manage e-mail without downloading it from the server

Search Engines

There billions of web pages online and around two billion pages are added daily to the Internet. A number of search engines help users locate the needed information. These engines maintain huge databases of the pages on the Internet. There are two ways to search for data:

1. Keyword search engines – uses words and phrases to find information.
2. Directory search engines – Also known as an index search organizes information by topic.

Examples: Google and Yahoo. Meta search engines automatically send requests to several search engines simultaneously.

The growth of the Internet

The Internet has grown, and continues to grow, at a phenomenal rate.

Date	*WWW Servers*	*Internet Hosts*
12/1969	N/A	4
12/1979	N/A	188
12/1989	N/A	159,000
12/1993	623	2,056,000
12/1996	603,367	21,819,000
12/1999	9,560,866	56,218,000
07/2000	18,169,498	93,047,785

Factors behind growth

There are ***four main factors*** that led to the surge in popularity of the Internet:

i. The web-like ability to link from site to site.
ii. The ease of use provided by the browsers' graphical user interface.
iii. The growth of personal computers and local area networks that could be connected to the Internet.
iv. The TCP/IP standard

Control of the Internet

No one organization currently controls the Internet. Several groups oversee aspects of the development of the Internet. Internet Engineering Task Force (IETF) Oversees the evolution of Internet protocols Internet Registries (InterNIC) Maintain and allocate Internet domains World Wide Web Consortium (W3C) Develops standards for the WWW.

Client/server model

In the client/server model there are two roles: the client and the server.

- ✓ The *client process* makes requests of the server.
- ✓ The client is only capable of sending a request to the server and then waiting for the reply.
- ✓ The *server* satisfies the requests of the client. It usually has access to a resource, such as data, that the client wants. When the resource that the client wants becomes available, it sends a message to the client.
- ✓ This model simplifies communication

HTTP and client/server

- ✓ With HTTP the client is the user's Web browser and the server is the Web server.
- ✓ To open a session, the browser sends a request to the server that holds the desired web page.
- ✓ The server replies by sending back the page or an error message if the page could not be found.
- ✓ After the client verifies that the response sent was correct, the TCP/IP connection is closed and the HTTP session ends. Each new page that is desired will result in a new
- ✓ HTTP session and another TCP/IP connection

Internet addresses

Internet addresses are represented in several ways, but all the formats are translated to a 32-bit number called an IP address. The increased demand for IP addresses will soon make 32-bit addresses too small, and they will be replaced with 128-bit addresses in the near future.

How does increasing the number of bits in the address help with increasing demand?

Dotted quads

IP numbers appear as a series of up to 4 separate numbers delineated by a period.

Examples:

students.depaul.edu: 140.192.1.100

condor.depaul.edu: 140.192.1.6

facweb.cs.depaul.edu: 140.192.33.6

Each of the four numbers can range from 0 to 255, so the possible IP addresses range from 0.0.0.0 to 255.255.255.255

Domain names

Since IP numbers can be difficult for humans to remember, domain names are associated with each IP address.

Examples:

students.depaul.edu: 140.192.1.100

facweb.cs.depaul.edu: 140.192.33.6

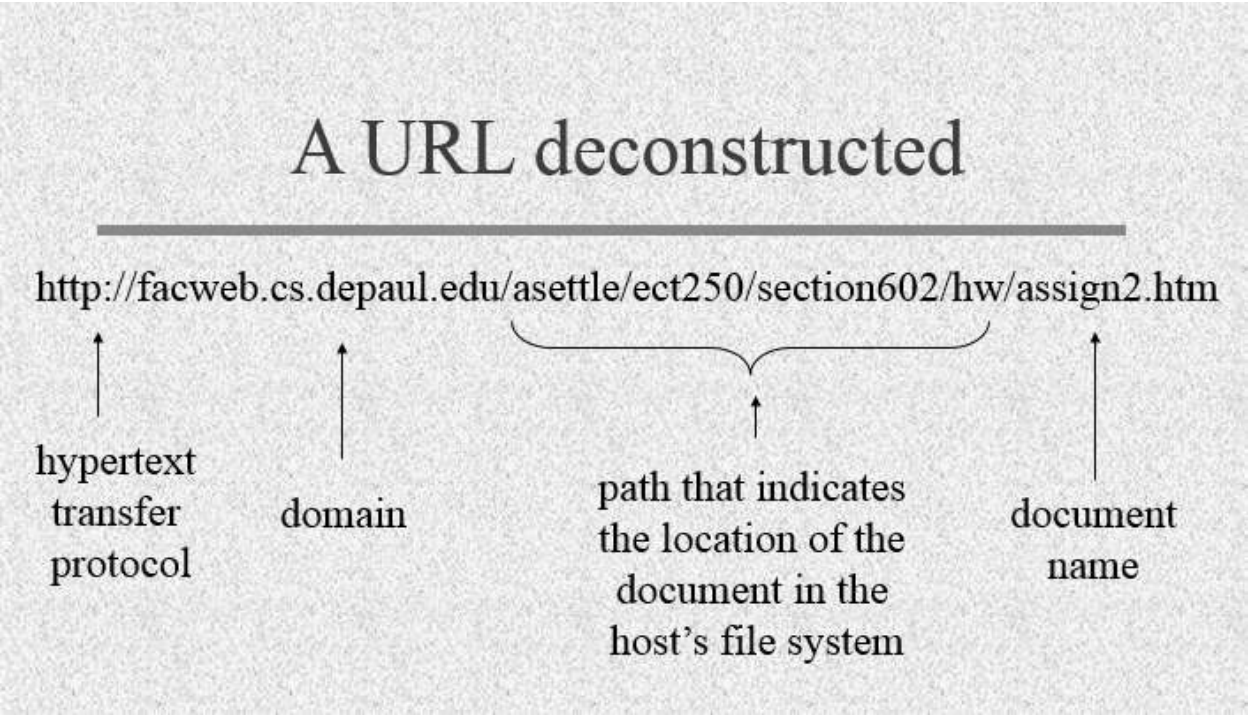
A domain name server is responsible for the mapping between domain names and IP addresses.

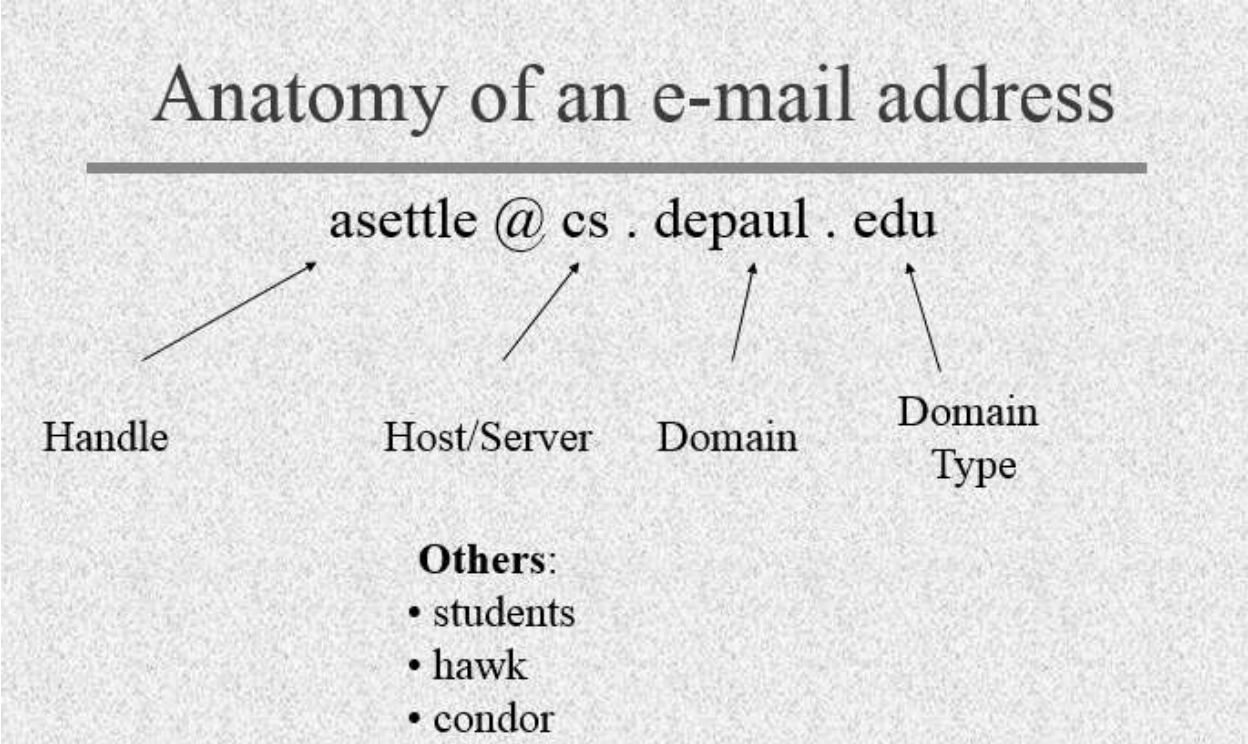
Uniform resource locator

People on the Web use a naming convention called the ***uniform resource locator*** (URL). A URL consists of at least two and as many as four parts. A simple two part URL contains the protocol used to access the resource followed by the location of the resource.

Example: http://www.cs.depaul.edu/

A more complex URL may have a file name and a path where the file can be found





BINARY NUMBER SYSTEM

The binary number system (BNS) is an organized fixed number of digits called bits (binary digit).

Numbering Systems

A numbering system assigns meaning to the position of the numeric symbols. For example, consider this set of symbols: 642

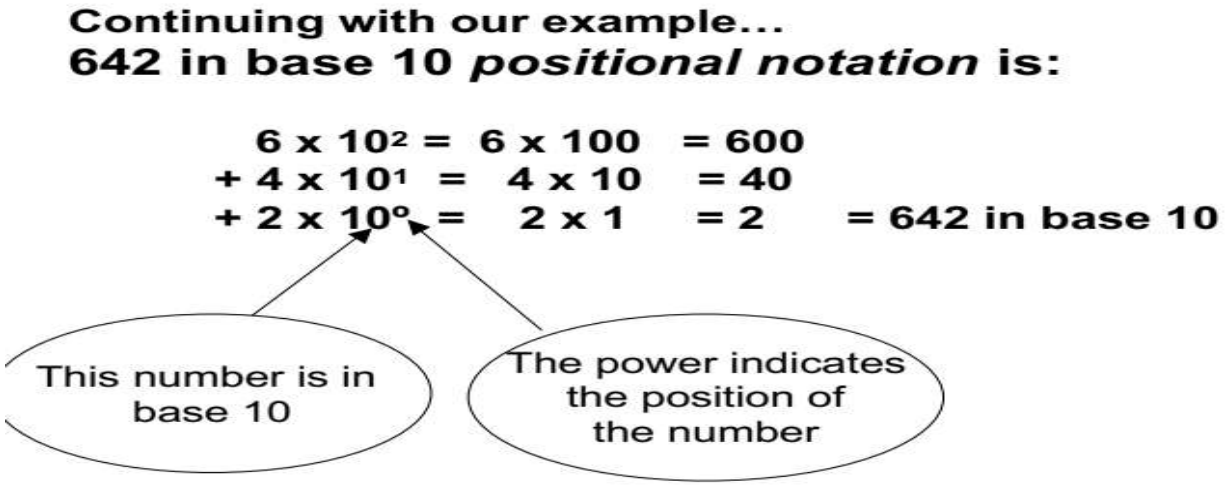
What number is it? Why?

It depends on the numbering system.

642 is 600 + 40 + 2 in **BASE 10**

The **base** of a number determines the number of digits (e.g. symbols) and the value of digit positions

Positional Notation



BINARY NUMBERS

Digital computers are made up of electronic circuits, which have exactly 2 states: on and off.

Computers use a numbering system which has exactly 2 symbols, representing on and off.

Decimal is base 10 and has 10 digits: 0,1,2,3,4,5,6,7,8,9

Binary is base 2 and has 2, so we use only 2 symbols: 0,1

Binary Numbers and Computers

A binary digit or bit can take on only these two values.

Low Voltage = 0 High Voltage = 1 all bits have 0 or 1

Binary numbers are built by concatenating a string of bits together.

Example: 10101010

Base of a numbers (radix)

- Unary(1)……..0
- Binary(2) …….0, 1
- Ternary(3)…….0, 1, 3
- Octal(8)…….0-----7
- Decimal(10)……..0-----9
- Base(5)……0---4
- Base(16)…… Hexadecimal

  0……9 A B C D E F

BINARY CONVERSIONS TO OTHER NUMBER SYSTEM

Example : convert 1011_2 to decimal (i.e. base $_2$ to base $_{10}$).

Solution:

$\{1 \times 2^3\} + \{0 \times 2^2\} + \{1 \times 2^1\} + \{1 \times 2^0\}$

$\{1 \times 8\} + \{0 \times 4\} + \{1 \times 2\} + \{1 \times 1\}$

$8 + 0 + 2 + 1 = 11$

Therefore $1011_2 = 11_{10}$

Example 2

What is the decimal equivalent of the binary number 01101110?

$$
\begin{aligned}
0 \times 2^7 &= 0 \times 128 = 0 \\
+\ 1 \times 2^6 &= 1 \times 64 = 64 \\
+\ 1 \times 2^5 &= 1 \times 32 = 32 \\
+\ 0 \times 2^4 &= 0 \times 16 = 0 \\
+\ 1 \times 2^3 &= 1 \times 8 = 8 \\
+\ 1 \times 2^2 &= 1 \times 4 = 4 \\
+\ 1 \times 2^1 &= 1 \times 2 = 2 \\
+\ 0 \times 2^0 &= 0 \times 1 = 0 \\
&= 110 \text{ (decimal)}
\end{aligned}
$$

Try another one. What is the decimal equivalent of the binary number 10101011?

$$
\begin{aligned}
&1 \times 2^7 = 1 \times 128 = 128\\
+\ &0 \times 2^6 = 0 \times 64 = 0\\
+\ &1 \times 2^5 = 1 \times 32 = 32\\
+\ &0 \times 2^4 = 0 \times 16 = 0\\
+\ &1 \times 2^3 = 1 \times 8 = 8\\
+\ &0 \times 2^2 = 0 \times 4 = 0\\
+\ &1 \times 2^1 = 1 \times 2 = 2\\
+\ &1 \times 2^0 = 1 \times 1 = 1\\
&= 171 \text{ (decimal)}
\end{aligned}
$$

Binary and Computers

Byte

8 bits – a common unit of computer memory.

Word

A computer word is a group of bits which are passed around together during computation. The word length of the computer's processor is how many bits are grouped together.

- 8-bit machine (e.g. Nintendo Gameboy, 1989)
- 16-bit machine (e.g. Sega Genesis, 1989)
- 32-bit machines (e.g. Sony PlayStation, 1994)
- 64-bit machines (e.g. Nintendo 64, 1996)

Example : convert 10101001_2 to **octal** (i.e. base $_2$ to base $_8$).

Solution:

1st step : group the digits into 3, starting from the Right to left.

i.e. 010 101 001
group 3 group 2 group 1

Note: the extra zero added to the last group to complete 3 digits is at instance of formality. It does not change anything.

2nd step: Position each of the groups separately from the right to left beginning with zero position. i.e.

2	1	0		2	1	0		2	1	0	level numbers (or positional value)
0	1	0		1	0	1		0	0	1	

3rd step: each group is converted separately: i.e.

Group 1: $\{0 \times 2^2\} + \{0 \times 2^1\} + \{1 \times 2^0\}$

$\{0 \times 4\} + \{0 \times 2\} + \{1 \times 1\} = 1$

Group 2: $\{1 \times 2^2\} + \{0 \times 2^1\} + \{1 \times 2^0\}$

$\{1 \times 4\} + \{0 \times 2\} + \{1 \times 1\} = 5$

Group 3: $\{0 \times 2^2\} + \{1 \times 2^1\} + \{0 \times 2^0\}$

$\{0 \times 4\} + \{1 \times 2\} + \{0 \times 1\} = 2$

Therefore, $10101001_2 = \mathbf{251_8}$

Binary, Hexadecimal, Decimal

Each four bits map to a hex digit.

Hexadecimal prefix 0x????

No inherent value, just means "treat as a hex number"

0x94D3

Binary	Hex	Decimal
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	A	10
1011	B	11
1100	C	12
1101	D	13
1110	E	14
1111	F	15

Hexadecimal to Decimal

Convert each hex digit into 4 bits.
Convert binary to decimal.

Example:

0x94D3

= 1001 0100 1101 0011

= $2^{15} + 2^{12} + 2^{10} + 2^7 + 2^6 + 2^4 + 2^1 + 2^0$

= 32768 + 4096 + 1024 + 128 + 64 + 16 + 2 + 1

= 38099 (decimal)

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

Exercise

My phone number: Call me!

0x16FF96419 (or: 0001 0110 1111 1111 1001 0110 0100 0001 1001)

Example: convert 110101001_2 to hexadecimal (i.e. base $_2$ to base $_{16}$).

Solution:

1st step: group the digits into 4, starting from the right to the left. i.e.

0001 1010 1001
Group 3 Group 2 Group 1

2nd step: each group is converted separately

3 2 1 0 3 2 1 0 3 2 1 0 level numbers (positional value)
1 0 0 1 1 0 1 0 1 0 0 1

3 2 1 0 positional value
Group 1: 1 0 0 1

$\{1 \times 2^3\} + \{0 \times 2^2\} + \{0 \times 2^1\} + \{1 \times 2^0\}$

$\{1 \times 8\} + \{0 \times 4\} + \{0 \times 2\} + \{1 \times 1\} = 9$

3 2 1 0 positional value
Group 2: 1 0 1 0

$\{1 \times 2^3\} + \{0 \times 2^2\} + \{1 \times 2^1\} + \{0 \times 2^0\}$

$\{1 \times 8\} + \{0 \times 4\} + \{1 \times 2\} + \{0 \times 1\} = 10 = A$

3 2 1 0 positional value
Group 3: 0 0 0 1

$\{0 \times 2^3\} + \{0 \times 2^2\} + \{0 \times 2^1\} + \{1 \times 2^0\}$

$\{0 \times 8\} + \{0 \times 4\} + \{0 \times 2\} + \{1 \times 1\} = 1$

Therefore, $110101001_2 = 1A9_{16}$.

Conversions from Decimal, octal, and hexadecimal to binary

(a) Conversion from decimal to binary

Algorithm (process) for converting number in base 10 to other bases

While (the quotient is not zero)
Divide the decimal number by the new base*
Make the remainder the next digit to the left in the answer
Replace the original decimal number with the quotient

Example: convert 21_{10} to binary (i.e. from base $_{10}$ to base $_2$)

Solution: we use continues division by 2 method

Number /divisor Quotient Remainder

21/2	10	1
10/2	5	0
5/2	2	1
2/2	1	0
1/2	0	1

Therefore, $\mathbf{21_{10} = 10101}$

(b) .Conversion from Decimal to octal

Example: Convert 26_{10} to octal (i.e. From base $_{10}$ to base $_{8}$)

Solution:

Number /divisor	Quotient	Remainder
26/8	3	2
3/8	0	3
0		

Therefore, $\mathbf{26_{10} = 32_8}$

Example: convert 1462_{10} to octal.

Solution:

Number /divisor	Quotient	Remainder
1462/8	182	6
182/8	22	6
22/8	2	6
2/8	0	2
0/		

Therefore,$\mathbf{1462_{10} = 2666_8}$

Example

What is the binary equivalent of the decimal number 103?

103 / 2 = 51, remainder 1 → rightmost bit
51 / 2 = 25, remainder 1
25 / 2 = 12, remainder 1
12 / 2 = 6, remainder 0
6 / 2 = 3, remainder 0
3 / 2 = 1, remainder 1
1 / 2 = 0, remainder 1→ leftmost bit

$103_{dec} = 1\ 1\ 0\ 0\ 1\ 1\ 1_{bin}$

(c). Conversion from decimal to hexadecimal

Example : Convert 251_{10} to hexadecimal (i.e. base$_{10}$ to base $_{16}$)

Solution:

Number /divisor	Quotient	Remainder
251/16	15	11(B)
15/8	2	15(F)
0/		

Therefore, $\mathbf{251_{10} = (FB)_{16}}$

Example: Convert 31_{10} to hexadecimal

Solution:

Number /divisor	Quotient	Remainder
31/16	15	15(f)
1/16	1	1

Therefore, $\mathbf{31_{10} = 1f_{16}}$

Exercises:

1. Convert $1f_{16}$ to binary
2. Convert $(FB)_{16}$ to binary
3. Convert 2666_8 to binary
4. Convert 45_{10} to hexadecimal

Example 10: Prove that $143_5 = 60_8$

Solutions:

$3 \times 5^0 + 4 \times 5^1 + 1 \times 5^2$

$= 3 + 20 + 25$

$= \mathbf{48_{10}}$

Then, convert $\mathbf{48_{10}}$ **to octal**

Number /divisor	Remainder
48/8	6
6/8	0
0	

Therefore, $\mathbf{48_{10} = 60_8}$

Exercises: Prove that,

1. $25_3 = 21_5$
2. $62_8 = 200_5$
3. $126_8 = 56_{16}$

Fractional numbers

Example 1: prove that, $(10.25)_{10} = (10101.01)_2$

Solution:

Number /divisor	Quotient	Remainder
10/2	5	0
5/2	2	1
2/1	1	0
1/2	0	1
0		

0.25 2 =0.50
0. 50 x 2 = 1.00

Example 2: Prove that, $(10.65)_{10} = (1010.1010)_2$

Solution:

Number /divisor	Quotient	Remainder
10/2	5	0
5/2	2	1
2/1	1	0
1/2	0	1

0.65x 2 = 1.30
0.30 x 2 = 0.60
0.60 x 2 = 1.20
0.20 x 2 = 0.40
$(1010.1010)_2$

Exercises

1. Prove that, $(10.35)_{10} = (1010.0101)_2$
2. Prove that, $(12.75)_{10} = (1100.1100)_2$
3. Prove that $(12.253)_{10} = (110.0202)_3$

Programming with the computer involves after studying the problem to be solved, the user then design the program by writing a detail logical steps to the solution of the problem in form of descriptive language.

THE PROGRAMMING DESIGN TOOLS:

Algorithm: An algorithm is well defined set of instructions that used to solve a particular problem in a finite number of steps. It involves unambiguous stating of the procedures and steps necessary to transform the input data into output.

Example 1: Develop an algorithm for addition of two numbers.

Step 1: Start
Step 2: Input number a, b
Step 3: Add C ⟵ a + b
Step 4: Print C
Step 5: Stop.

Example 2: Develop an algorithm for calculating area of a cycle

Step 1: Start
Step 2: Input radius (r)
Step 3: Calculate Area ⟵ 3.148*r*r
Step 4: Print A
Step 5: Stop

Example 2: Develop an algorithm for calculating area and perimeter of a room

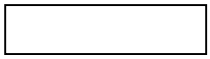
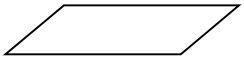
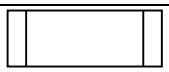
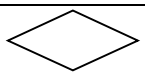
- Begin Process
- Input Length(L), Width(W)
- Calculate Area of the Room A⟵ L*W
- Calculate perimeter P ⟵2*(L*W)
- Print P
- End the process

Exercises: develop an algorithm for the following:

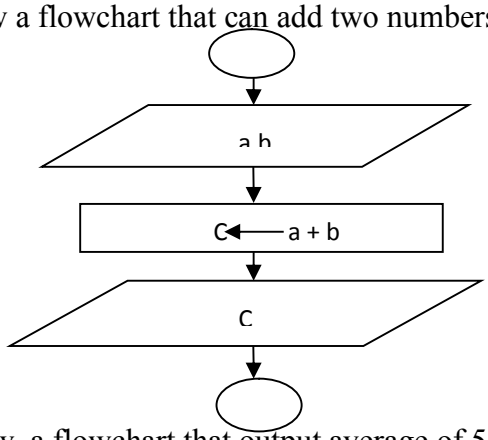
I. Calculate the simple interest (SI=PRT/100)
II. Volume of a cone ($\pi R^2h/3$)
III. F =ma
IV. Average of 5 numbers
V. Convert ^{o}C to ^{O}E (F=32+9(c/5))
VI. $A= p(1+r/100)^n$

The flowchart:

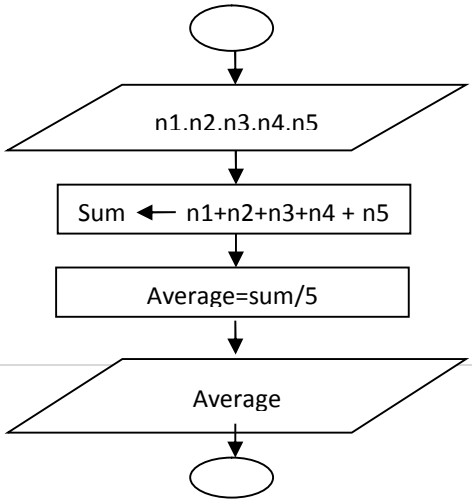
The flowchart is a pictorial or diagrammatical representation of the program **logic using** standard symbol (i.e. geometrical shape). Each symbol represents one operation or the other with specific relationship joining them together by arrows. The arrows indicate the direction the direction of logical flow of the entire process. Each box represents statement to be executed by the computer at each stage. See the symbols and their functions below:

SYMBOL	NAME	FUNCTION
	Start and Stop box (The oval box)	it is used for the start and stop of a process
	Processing box (Rectangular box)	This is used to show all assignment and processing
	The input and output box (Parallelogram box)	It is used for input and output i.e. accept and return the value
	The one-page (connector)	This is used for connecting flowchart on the same page
	The page-up Connector	It is used for continuing the same flowchart in another page
	The pre-defined Process	This is used for invoking pre-writing programs routine that helps us any time we want to write a program
	The Decision box	This is used for completion testing to see whether a condition has been satisfied or not.
	The directional Arrows	They show the direction of logic flow in a flowchart. They are used to link one flowchart symbol and another

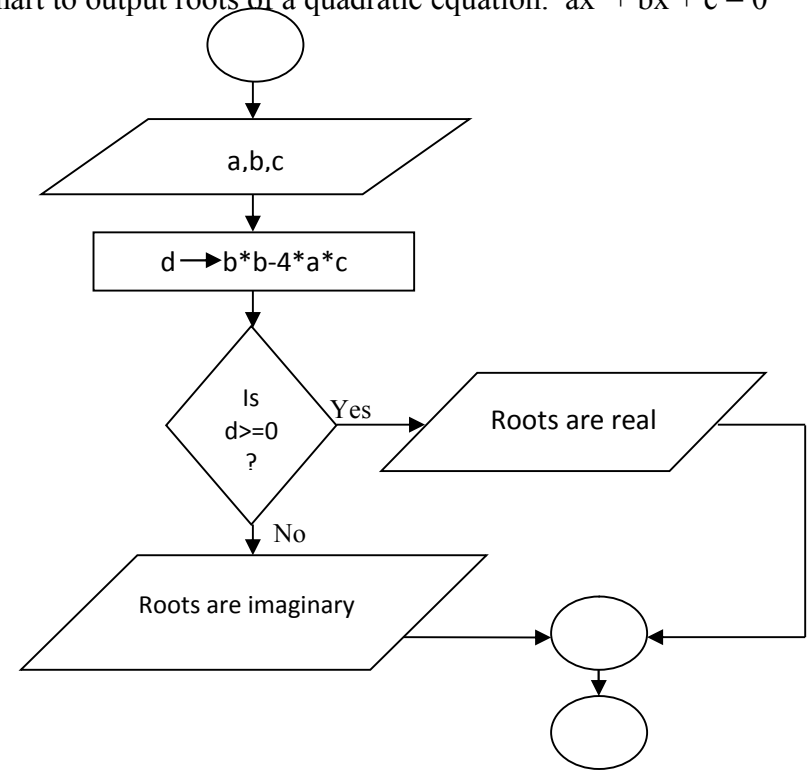
Example 1: draw a flowchart that can add two numbers



Example 2: Draw a flowchart that output average of 5 numbers.



Example 3: Draw a flowchart to output roots of a quadratic equation. $ax^2 + bx + c = 0$



Exercises:

- Area of circle
- Draw a flowchart that output all the Odd numbers between 1 to 21 inclusive
- Draw a flowchart that can accept any 3 numbers, compares them and print the largest of the 3 numbers. Assuming the numbers are A, B and C respectively.
- A flowchart to find the sum of the first ten integers.

Computer program

A **program** is sequence of instructions which enables a computer to perform a certain task or job.

Programming: This can be described as the act of coding, troubleshooting or communicating with the computer with a particular computer programming language.

Programmer: this is a person who writes a sequence of instructions for the computer to perform. Programmers simply means a person who writes and debug codes or program.

Computer programming languages

Programming languages allow people to communicate with the computers. Once a job has been identified, the programmer must translate the user codes (source codes) into list of instructions that the computer will understand (object).

Types of programming languages

Machine language Refers to numeric codes for the operations that a particular computer can execute directly. The codes are string of 0s and 1s, or binary digits (bits), which are frequently converted both from and to hexadecimal (base 16) for human viewing and modification.

Low-level programming language is a programming language that provides a little no abstraction from computer's instruction architecture. Low-level languages can be converted to machine code without using a compiler or interpreter, and the resulting codes run directly on the processor. E.g. Assembly language.

High-level language programming is a programming language with strong abstraction from the details of the computer. In comparison to low level languages, it is usually human readable form or it may use natural language elements, be easier to use, or be more portable across platforms. Such languages hide the detail of CPU operations such as memory access models and management scope.

High level languages is used for solving both commercial and scientific problems with little no problem. It is in English like form. It needs languages translator to convert to machine language before the computer can understand and execute them. The language translator of these generations is either compiler or interpreter. Examples of high level languages are: BASIC,PASCAL,FORTRAN,COBOL, ALGOL,RPG,C, C++, JAVA etc.

BASIC: is the acronym for Beginners All purpose Symbolic Instruction Code. Some versions of Basic are GWBASIC on Dos 3.3, BASICAL on Dos 4.01 and Visual BASIC on windows.

FORTRAN: Is the acronym of FORmula TRAnslation. This is basically meant for scientific or engineering purpose.

COBOL: is the acronym for Common Business Oriented Language. It is basically designed for commercial purpose e.g. banking insurance and general financial purposes.

PASCAL: this is also a scientific programming language.

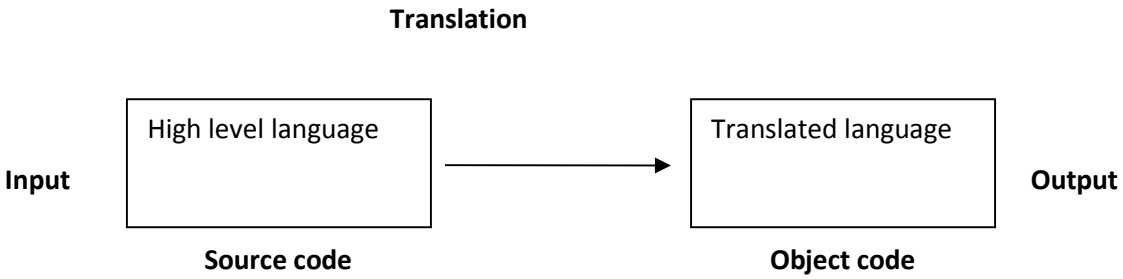
However, through this text, we shall focus our attention on the BASIC programming language as we shall see later in this course.

Conversion of languages

Basically the only language understood by the computer is the machine language (M.L), because it is the basis on which the computer components are build upon.

Program writing in high level language (H.L.L) or Low Level Language (L.L.L) are normally understood by the computer, and therefore they cannot be directly executed by the computer. As a result of, there is the need to convert them into the language the computer understood before they can execute by some special programs called **translators.**

Translators is a program which takes as its input a program in one programming language and produce the equivalent program in another language.



The language (or code) that is input to translator is called source code and the code that is output from translator is called object code (or target) code. Translator translate program written in high level language to low level language. There are three types of translators; Interpreter**,** Compiler and Assembler

1. **Assembler:** This is a program that converts a program written in low-level language (e.g. Assembly language) into machine language equivalent.

2. **Compiler:** This is a program that translates a program written in high level language (e.g. FOTRAN) into machine equivalent. Compiler is a program that translates the entire instructions of a high-level language to machine language at once. All errors are identified and reported at the same time and are to be corrected as such. Hence, compiler is faster and easier to use.
3. **Interpreter:** Interpreter is a translator that goes through the processes of translation every time the program is run, example a programming language that need interpreter are some versions of BASIC and Dbase. Interpreter is a translator that reads a program line by line and executes the lines as they are read.