LECTURE NOTES

ON

COMPUTER APPLICATION

Diploma 1st Year (1st/2nd Sem Common)

(SCTEVT Odisha Curriculum)

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Syllabus

Th.1b. COMPUTER APPLICATION

(2nd Sem Mechanical Engineering)

1. COMPUTER ORGANISATION

Introduction to Computer, Evolution of Computers, Generation of Computers, Classification of Computers, Basic Organisation of Computer (Functional Block diagram), Input Devices, CPU & Output Devices. Computer Memory and Classification of Memory.

2. COMPUTER SOFTWARE

Software concept, System software, Application software, Overview of Operating System, Objectives and Functions of O.S, Types of Operating System: Batch Processing, Multiprogramming, Time Sharing OS, Features of DOS, Windows and UNIX, Programming Languages Compiler, interpreter Computer Virus, Different Types of computer virus, Detection and prevention of Virus, Application of computers in different Domain.

3. COMPUTER NETWORK AND INTERNET

Networking concept, Protocol, Connecting Media, Data Transmission mode, Network Topologies, Types of Network, Networking Devices like Hub, Repeater, Switch, Bridge, Router, Gateway & NIC, Internet Services like E-Mail, WWW, FTP, Chatting, Internet Conferencing, Electronic Newspaper & Online Shopping, Different types of Internet connectivity and ISP.

4. FILE MANAGEMENT AND DATA PROCESSING

Concept of File and Folder, File Access and Storage methods. Sequential, Direct, ISAM Data Capture, Data storage, Data Processing and Retrieval.

5. PROBLEM SOLVING METHODOLOGY

Algorithm, Pseudo code and Flowchart Generation of Programming Languages Structured Programming Language Examples of Problem solving through Flowchart.

6. OVERVIEW OF C PROGRAMMING LANGUAGE

Constants, Variables and Data types in C Managing Input and Output operations. Operators, Expressions, Type conversion & Typecasting Decision Control and Looping Statements (If, If-else, If-else-if, Switch, While, Do-while, For, Break, Continue & Goto) Programming Assignments using the above features.

7. ADVANCED FEATURES OF C

Functions and Passing Parameters to the Function (Call by Value and Call by Reference) Scope of Variables and Storage Classes Recursion Function and Types of Recursion One Dimensional Array and Multidimensional Array String Operations and Pointers Pointer Expression and Pointer Arithmetic Programming Assignments using the above features. Structure and Union (Only concepts, No Programming)

Lecture 1

Chapter-1

COMPUTER ORGANISATION

Introduction to Computer

A Computer is an electronic device that accepts data as input, and transforms it under the influence of a set of special instructions called Programs, to produce the desired output (referred to as Information).

Input processing Output

Data

- ✓ Data is a collection of raw facts, figures or instructions that do not have much meaning to the user.
- ✓ Data may be in form of numbers, alphabets/letters or symbols, and can be processed to produce information.

Information

- ✓ Information is the data which has been refined, summarized & manipulated in the way you want it, or into a more meaningful form for decision-making.

Program

A computer Program is a set of related instructions written in the language of the computer & is used to make the computer perform a specific task (or, to direct the computer on what to do).

Lecture 2

Evolution of Computers

It refers to the change in computer technology right from the time computers were first used to the present. Some of the popular computing devices starting with the first to recent ones are described below:

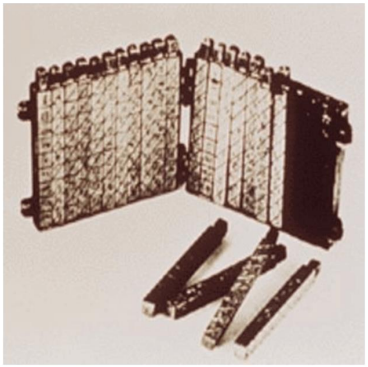
Abacus

The history of computer begins with the birth of abacus which is believed to be the first computer. It is said that Chinese invented Abacus around 4,000 years ago.

It was a wooden rack which has metal rods with beads mounted on them. The beads were moved by the abacus operator according to some rules to perform arithmetic calculations. Abacus is still used in some countries like China, Russia and Japan.

Napier's Bones

It was a manually-operated calculating device which was invented by John Napier (1550-1617) of Merchiston. In this calculating tool, he used 9 different ivory strips or bones marked with numbers to multiply and divide. So, the tool became known as "Napier's Bones. It was also the first machine to use the decimal point.



Pascaline

Pascaline is also known as Arithmetic Machine or Adding Machine. It was invented between 1642 and 1644 by a French mathematician-philosopher Blaise Pascal. It is believed that it was the first mechanical and automatic calculator.

Pascal invented this machine to help his father, a tax accountant. It could only perform addition and subtraction. It was a wooden box with a series of gears and wheels. When a wheel is rotated one revolution, it rotates the neighbouring wheel. A series of windows is given on the top of the wheels to read the totals.

Stepped Reckoner or Leibnitz wheel

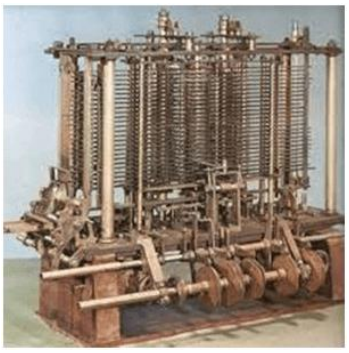
It was developed by a German mathematician-philosopher Gottfried Wilhelm Leibnitz in 1673. He improved Pascal's invention to develop this machine. It was a digital mechanical calculator which was called the stepped reckoner as instead of gears it was made of fluted drums.

Difference Engine

In the early 1820s, it was designed by Charles Babbage who is known as "Father of Modern Computer". It was a mechanical computer which could perform simple calculations. It was a steam driven calculating machine designed to solve tables of numbers like logarithm tables.

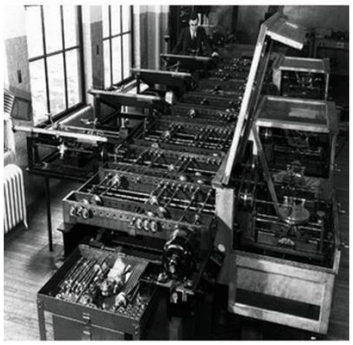
Analytical Engine

This calculating machine was also developed by Charles Babbage in 1830. It was a mechanical computer that used punch-cards as input. It was capable of solving any mathematical problem and storing information as a permanent memory.



Differential Analyzer

It was the first electronic computer introduced in the United States in 1930. It was an analog device invented by Vannevar Bush. This machine has vacuum tubes to switch electrical signals to perform calculations. It could do 25 calculations in few minutes.



Mark I

The next major changes in the history of computer began in 1937 when Howard Aiken planned to develop a machine that could perform calculations involving large numbers. In 1944, Mark I computer was built as a partnership between IBM and Harvard. It was the first programmable digital computer.

Generation of Computers

Generation of computers refers to the specific improvements in computer technology with time. There are five generation of computers.

First Generation of Computers (1940s-1950s)

- ✓ The main electronic component used in the computers of the 1940s to 1950s era was vacuum tubes.
- ✓ The main memory storing units were magnetic tapes and magnetic drums.
- ✓ The machine language was used as the programming language.
- ✓ The sizes used to be very large which could take up entire rooms and the speed was very slow.
- ✓ The only input/output devices were paper tape and punched cards.
- ✓ Around 100 different vacuum tubes were used in order to produce the computers.
- ✓ Examples are UNIVAC1, ENIAC, IBM 701 and IBM 650, etc.

Second Generation of Computers (1950s-1960s)

- ✓ The main electronic component used in the computers of the 1950s to 1960s era was transistors.
- ✓ The main memory storing units were magnetic tape or disk and magnetic core.
- ✓ The assembly language was used as the programming language.
- ✓ The sizes were smaller as compared to those of the first generation and they used to consume low power and generate less heat.
- ✓ There was an improvement in speed.
- ✓ The input/output devices were magnetic tape and punched cards.
- ✓ Examples are IBM 1401, IBM 7094 AND IBM 7090, UNIVAC 1107, and so on.

Third Generation of Computers (1960s-1970s)

- ✓ The main electronic components used in the computers of the era 1060s to 1970s were integrated circuits ICs.
- ✓ The memory storing units were the magnetic disk or take and a large magnetic core.
- ✓ High-level languages such as BASIC, COBOL, and Pascal were used as the programming language.
- ✓ The sizes were smaller and efficient and the computers were called minicomputers.
- ✓ There was an improvement in reliability and speed as compared to the second generation of computers.
- ✓ The input/output devices were keyboards, magnetic tape monitor, printer, etc.

- ✓ Examples are IBM 370, IBM 360, UNIVAC 1108 and so on.

Fourth Generation of Computers (1970s-present)

- ✓ The main electronic components used in the fourth generation of computers are microprocessors and very large scale integration (VLSI).
- ✓ When thousands of transistors are attached to a single microchip, it is known as VLSI.
- ✓ Semiconductor memory storage units such as RAM, ROM, etc were introduced.
- ✓ RAM (random-access memory) - Temporarily stores the programs and data and the contents are lost when the computer is shut down.
- ✓ ROM (read-only memory) - Permanently stores the data and programs and the contents are retained even after shutting down the computer.
- ✓ High-level languages such as C#, JAVA, Python, JavaScript are used as programming languages.
- ✓ The sizes are smaller and the speed has improved.
- ✓ The input/output devices are a monitor, mouse, keyboard, printer, and so on.
- ✓ Examples are STAR 1000, APPLE II, IBM PC, and so on.

Fifth Generation of Computers (present and the future)

- ✓ The main electronic components that are used in the present generation of computers are Artificial Intelligence which uses the parallel processing method and the Ultra-Large Scale Integration (ULSI).
- ✓ The fifth generation of computers understands the natural human language.
- ✓ The speeds are really fast and the sizes are also small.
- ✓ The fifth-generation computers are portable and have a huge storage capacity.
- ✓ The input/output devices are keyboards, monitors, touchscreen pens, printers, light scanners, and so on.
- ✓ Examples are laptops, desktops, tablets, smartphones, etc.

Lecture 3

Classification of Computers

The computer systems can be classified on the following basis:

1. On the basis of size.
2. On the basis of functionality.
3. On the basis of data handling.

Classification on the basis of size

Super computers: The super computers are the most high performing system. A supercomputer is a computer with a high level of performance compared to a general-purpose computer. The actual Performance of a supercomputer is measured in FLOPS instead of MIPS. All of the world's fastest 500 supercomputers run Linux-based operating systems. Additional research is being conducted in China, the US, the EU, Taiwan and Japan to build even faster, more high performing and more technologically superior supercomputers. Supercomputers actually play an important role in the field of computation, and are used for intensive computation tasks in various fields, including quantum mechanics, weather forecasting, climate research, oil and gas exploration, molecular modelling, and physical simulations. and also Throughout the history, supercomputers have been essential in the field of the cryptanalysis.
eg: PARAM, jaguar, roadrunner.

Mainframe computers : These are commonly called as big iron, they are usually used by big organisations for bulk data processing such as statistics, census data processing, transaction processing and are widely used as the servers as these systems has a higher processing capability as compared to the other classes of computers, most of these mainframe architectures were established in 1960s, the research and development worked continuously over the years and the mainframes of today are far more better than the earlier ones, in size, capacity and efficiency.
Eg: IBM z Series, System z9 and System z10 servers.

Mini computers : These computers came into the market in mid 1960s and were sold at a much cheaper price than the main frames, they were actually designed for control, instrumentation, human interaction, and communication switching as distinct from calculation and record keeping, later they became very popular for personal uses with evolution.
In the 60s to describe the smaller computers that became possible with the use of transistors and core memory technologies, minimal instructions sets and less expensive peripherals such as the ubiquitous Teletype Model 33 ASR. They usually took up one or a few inch rack cabinets, compared with the large mainframes that could fill a room, there was a new term "MINICOMPUTERS" coined.
Eg: Personal Laptop, PC etc.

Microcomputers: A microcomputer is a small, relatively inexpensive computer with a microprocessor as its CPU. It includes a microprocessor, memory, and minimal I/O circuitry mounted on a single printed circuit board. The previous to these computers, mainframes and minicomputers, were comparatively much larger, hard to maintain and more expensive. They actually formed the foundation for present day microcomputers and smart gadgets that we use in day to day life.
Eg: Tablets, Smart watches.

Classification on the basis of functionality

Servers: Servers are nothing but dedicated computers which are set-up to offer some services to the clients. They are named depending on the type of service they offered. Eg: security server, database server.

Workstation: Those are the computers designed to primarily to be used by single user at a time. They run multi-user operating systems. They are the ones which we use for our day to day personal / commercial work.

Information Appliances: They are the portable devices which are designed to perform a limited set of tasks like basic calculations, playing multimedia, browsing internet etc. They are generally referred as the mobile devices. They have very limited memory and flexibility and generally run on "as-is" basis.

Embedded computers: They are the computing devices which are used in other machines to serve limited set of requirements. They follow instructions from the non-volatile memory and they are not required to execute reboot or reset. The processing units used in such device work to those basic requirements only and are different from the ones that are used in personal computers- better known as workstations.

Classification on the basis of data handling

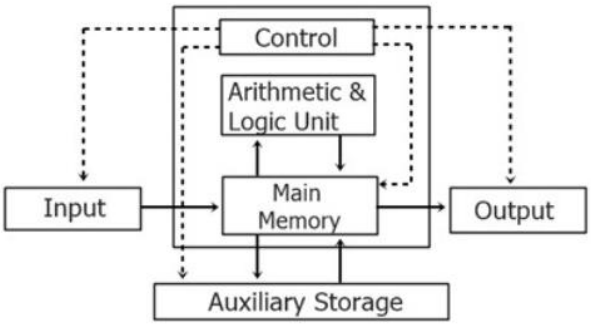
Analog : An analog computer is a form of computer that uses the continuously-changeable aspects of physical fact such as electrical, mechanical, or hydraulic quantities to model the problem being solved. Anything that is variable with respect to time and continuous can be claimed as analog just like an analog clock measures time by means of the distance travelled for the spokes of the clock around the circular dial.

Digital : A computer that performs calculations and logical operations with quantities represented as digits, usually in the binary number system of "0" and "1", "Computer capable of solving problems by processing information expressed in discrete form. From manipulation of the combinations of the binary digits, it can perform mathematical calculations, organize and analyse data, control industrial and other processes, and simulate dynamic systems such as global weather patterns.

Hybrid: A computer that processes both analog and digital data, Hybrid computer is a digital computer that accepts analog signals, converts them to digital and processes them in digital form.

Lecture 4

Basic Organisation of Computer (Functional Block diagram)



Block diagram of computer

Central Processing Unit (CPU)

- The CPU can be called the brain of a computer system.
- The central processing unit (CPU) is where the majority of the important calculations and comparisons are performed.
- In addition, the CPU is in charge of turning on and controlling the operation of the other units.
- It has 2 units:

a) Arithmetic Logic Unit (ALU)

- The arithmetic logic unit is responsible for carrying out all of the mathematical operations, including addition, subtraction, multiplication, and division.
- In addition to that, a logical operation is used for the comparison.

b) Control Unit (CU)

- In addition, the control unit of a central processing unit is responsible for directing the overall operation of a computer.
- In addition to this, it exercises control over all devices connected to the CPU, including memory and input/output devices.
- The CU is responsible for retrieving instructions from memory, decoding those instructions, interpreting those instructions to determine what tasks are to be carried out, and then sending appropriate control signals to the other components so that they can carry out the steps necessary to execute the instruction.

Input/output Unit

- The input/output unit is made up of different devices that are responsible for transmitting and receiving information between the memory of the computer and the outside world.
- The information that is entered into the computer via the input unit is saved in the memory of the device for later processing.
- The completed processing can then be saved in the memory and either recorded or displayed on the output medium.

Memory Unit

- Memory units are an integral part of any modern digital computer. It is the repository for all of the results, both intermediate and final.
- The data that are read from the primary storage or an input unit are moved to the memory of the computer so that they can be processed. These data can come from either the main storage or an input unit.
- The data that needs to be processed and the instructions that need to be carried out are both stored in this memory unit so they can be accessed quickly.

a) Primary Storage Unit

- Primary memory is connected to the input unit as well as the output unit in a straightforward manner.
- It stores both the data that was input and the result of the calculation.

b) Secondary Storage Unit

- It is not possible to store data permanently on the primary storage for use at a later time.
- Because of this, additional forms of data storage technology, also known as secondary or auxiliary storage, are required in order to store the data in a manner that is both permanent and accessible over an extended period of time.

Lecture 5

Input devices

Input device enables the user to send data, information, or control signals to a computer.

Some of the popular input devices are:

Keyboard

The keyboard is a basic input device that is used to enter data into a computer or any other electronic device by pressing keys. It has different sets of keys for letters, numbers, characters, and functions. Keyboards are connected to a computer through USB or a Bluetooth device for wireless communication.

Types of keyboards: There can be different types of keyboards based on the region and language used. Some of the common types of keyboards are as follows:

i) QWERTY Keyboard:

It is the most commonly used keyboard with computers in modern times. It is named after the first six letters of the top row of buttons and is even popular in countries that do not use Latin-based alphabet. It is so popular that some people think that it is the only type of keyboard to use with computers as an input device.

ii) AZERTY Keyboard:

It is considered the standard French keyboard. It is developed in France as an alternative layout to the QWERTY layout and is mainly used in France and other European countries. Some countries have manufactured their own versions of AZERTY.

Its name is derived from the first six letters that appear on the top left row of the keyboard. The Q and W keys in AZERTY keyboard are interchanged with A and Z keys in QWERTY keyboard. Furthermore, in AZERTY keyboard M key is located to the left of the L key.

AZERTY keyboard differs from QWERTY keyboard not only in the placement of letters but also in many other ways, e.g., it gives emphasis on accents, which is required for writing European languages like French.

iii) DVORAK Keyboard:

This type of keyboard layout was developed to increase the typing speed by reducing the finger movement while typing. The most frequently used letters are kept in a home row to improve typing.

2) Mouse

The mouse is a hand-held input device which is used to move cursor or pointer across the screen. It is designed to be used on a flat surface and generally has left and right button and a scroll wheel between them. Laptop computers come with a touchpad that works as a mouse. It lets you control the movement of cursor or pointer by moving your finger over the touchpad. Some mouse comes with integrated features such as extra buttons to perform different buttons.

The mouse was invented by Douglas C. Engelbart in 1963. Early mouse had a roller ball integrated as a movement sensor underneath the device. Modern mouse devices come with optical technology that controls cursor movements by a visible or invisible light beam. A mouse is connected to a computer through different ports depending on the type of computer and type of a mouse.

Common types of the mouse:

i) Trackball Mouse:

It is a stationary input device that has ball mechanism to move the pointer or cursor on the screen. The ball is half inserted in the device and can be easily rolled with finger, thumb or the palm to move the pointer on the screen. The device has sensor to detect the rotation of ball. It remains stationary; you don't need to move it on the operating surface. So, it is an ideal device if you have limited desk space as you don't need to move it like a mouse.

ii) Mechanical Mouse:

It has a system of a ball and several rollers to track its movement. It is a corded type of mouse. A mechanical mouse can be used for high performance. The drawback is that they tend to get dust into the mechanics and thus require regular cleaning.

iii) Optical Mouse:

An optical mouse uses optical electronics to track its movement. It is more reliable than a mechanical mouse and also requires less maintenance. However, its performance is affected by the surface on which it is operated. Plain non-glossy mouse mat should be used for best results. The rough surface may cause problems for the optical recognition system, and the glossy surface may reflect the light wrongly and thus may cause tracking issues.

iv) Cordless or Wireless Mouse:

As the name suggests, this type of mouse lacks cable and uses wireless technology such as IrDA (infrared) or radio (Bluetooth or Wi-Fi) to control the movement of the cursor. It is used to improve the experience of using a mouse. It uses batteries for its power supply.

3) Scanner

The scanner uses the pictures and pages of text as input. It scans the picture or a document. The scanned picture or document then converted into a digital format or file and is displayed on the screen as an output. It uses optical character recognition techniques to convert images into digital ones. Some of the common types of scanners are as follows:

Types of Scanner:

i) Flatbed Scanner:

It has a glass pane and a moving optical CIS or CCD array. The light illuminates the pane, and then the image is placed on the glass pane. The light moves across the glass pane and scans the document and thus produces its digital copy. You will need a transparency adapter while scanning transparent slides.

ii) Handheld Scanner:

It is a small manual scanning device which is held by hand and is rolled over a flat image that is to be scanned. The drawback in using this device is that the hand should be steady while scanning; otherwise, it may distort the image. One of the commonly used handheld scanners is the barcode scanner which you would have seen in shopping stores.

iii) Sheetfed Scanner:

In this scanner, the document is inserted into the slot provided in the scanner. The main components of this scanner include the sheet-feeder, scanning module, and calibration sheet. The light does not move in this scanner. Instead, the document moves through the scanner. It is suitable for scanning single page documents, not for thick objects like books, magazines, etc.

iv) Drum Scanner:

Drum scanner has a photomultiplier tube (PMT) to scan images. It does not have a charge-coupled device like a flatbed scanner. The photomultiplier tube is extremely sensitive to light. The image is placed on a glass tube, and the light moves across the image, which produces a reflection of the image which is captured by the PMT and processed. These scanners have high resolution and are suitable for detailed scans.

v) Photo Scanner:

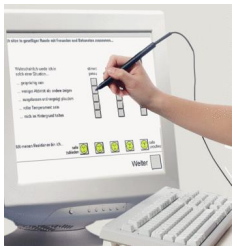
It is designed to scan photographs. It has high resolution and color depth, which are required for scanning photographs. Some photo scanners come with in-built software for cleaning and restoring old photographs.

Joystick

A joystick is also a pointing input device like a mouse. It is made up of a stick with a spherical base. The base is fitted in a socket that allows free movement of the stick. The movement of stick controls the cursor or pointer on the screen.

The frist joystick was invented by C. B. Mirick at the U.S. Naval Research Laboratory. A joystick can be of different types such as displacement joysticks, finger-operated joysticks, hand operated, isometric joystick, and more. In joystick, the cursor keeps moving in the direction of the joystick unless it is upright, whereas, in mouse, the cursor moves only when the mouse moves.

Light Pen



A light pen is a computer input device that looks like a pen. The tip of the light pen contains a light-sensitive detector that enables the user to point to or select objects on the display screen. Its light sensitive tip detects the object location and sends the corresponding signals to the CPU. It is not compatible with LCD screens, so it is not in use today. It also helps you draw on the screen if needed. The first light pen was invented around 1955 as a part of the Whirlwind project at the Massachusetts Institute of Technology (MIT).

Digitizer

Digitizer is a computer input device that has a flat surface and usually comes with a stylus. It enables the user to draw images and graphics using the stylus as we draw on paper with a pencil. The images or graphics drawn on the digitizer appear on the computer monitor or display screen. The software converts the touch inputs into lines and can also convert handwritten text to typewritten words.

It can be used to capture handwritten signatures and data or images from taped papers. Furthermore, it is also used to receive information in the form of drawings and send output to a CAD (Computer-aided design) application and software like AutoCAD. Thus, it allows you to convert hand-drawn images into a format suitable for computer processing.

Microphone

The microphone is a computer input device that is used to input the sound. It receives the sound vibrations and converts them into audio signals or sends to a recording medium. The audio signals are converted into digital data and stored in the computer. The microphone also enables the user to telecommunicate with others. It is also used to add sound to presentations and with webcams for video conferencing.

Magnetic Ink Character Recognition (MICR)

MICR computer input device is designed to read the text printed with magnetic ink. MICR is a character recognition technology that makes use of special magnetized ink which is sensitive to magnetic fields. It is widely used in banks to process the cheques and other organizations where security is a major concern. It can process three hundred cheques in a minute with hundred-percent accuracy. The details on the bottom of the cheque (MICR No.) are written with magnetic ink. A laser printer with MICR toner can be used to print the magnetic ink.

The device reads the details and sends to a computer for processing. A document printed in magnetic ink is required to pass through a machine which magnetizes the ink, and the magnetic information is then translated into characters.

Optical Character Reader (OCR)

OCR computer input device is designed to convert the scanned images of handwritten, typed or printed text into digital text. It is widely used in offices and libraries to convert documents and books into electronic files.

Digital camera

It is a digital device as it captures images and records videos digitally and then stores them on a memory card. It is provided with an image sensor chip to capture images, as opposed to film used by traditional cameras. Besides this, a camera that is connected to your computer can also be called a digital camera.

It has photo sensors to record light that enters the camera through the lens. When the light strikes the photo sensors, each of the sensors returns the electrical current, which is used to create the images.

Ouput devices

The output device displays the result of the processing of raw data that is entered in the computer through an input device.

Some of the popular visual output devices are:

Monitor

The monitor is the display unit or screen of the computer. It is the main output device that displays the processed data or information as text, images, audio or video.

The types of monitors are given below.

i) CRT Monitor

CRT monitors are based on the cathode ray tubes. They are like vacuum tubes which produce images in the form of video signals. Cathode rays tube produces a beam of electrons through electron guns that strike on the inner phosphorescent surface of the screen to produce images on the screen. The monitor contains millions of phosphorus dots of red, green and blue colour. These dots start to glow when struck by electron beams and this phenomenon is called cathodoluminescence.

ii) LCD Monitor

The LCD monitor is a flat panel screen that is compact and light-weight as compared to CRT monitors. It is based on liquid crystal display technology which is used in the screens of laptops, tablets, smart phones, etc.

iii) LED monitor

The LED monitor is an improved version of an LCD monitor. It also has a flat panel display and uses liquid crystal display technology like the LCD monitors.

iv) Plasma Monitor

The plasma monitor is also a flat panel display that is based on plasma display technology. It has small tiny cells between two glass panels. These cells contain mixtures of noble gases and a small amount of mercury. When voltage is applied, the gas in the cells turns into a plasma and emits ultraviolet light that creates images on the screen, i.e., the screen is illuminated by a tiny bit of plasma, a charged gas. Plasma displays are brighter than liquid crystal displays (LCD) and also offer a wide viewing angle than an LCD.

Printer

A printer produces hard copies of the processed data. It enables the user, to print images, text or any other information onto the paper. Users can pick from various printer types, such as inkjet, laser, or dot matrix, to meet their printing demands. Printers enable the generation of tangible copies for record-keeping, presentations, marketing materials, and other purposes, from household to professional settings.

Projector

A projector is an output device that enables the user to project the output onto a large surface such as a big screen or wall. It can be connected to a computer and similar devices to project their output onto a screen. It uses light and lenses to produce magnified texts, images, and

videos. So, it is an ideal output device to give presentations or to teach a large number of people.

Speakers

Speakers are important output devices that transform electrical impulses into audible sounds. They're essential to many modern devices, including computers, televisions, music players, and mobile phones.

Headphones/Earphones

Headphones and earphones are personal audio devices worn over the ears or inserted into the ear canal, respectively. They deliver Music to the user directly, giving a private and immersive listening experience.

Lecture 6

Computer Memory and Classification of Memory

A computer memory is a storage space that stores and fetches data.

Types of Computer Memory

Computer memory can be classified into mainly two types-

- Internal Memory
- External Memory

Internal Memory

Internal Memory refers to the chips or modules that are directly connected to the motherboard.

Types:

RAM

RAM stands for "Random Access Memory" and constitutes the internal memory of the CPU to store the given instructions and their results. RAM is also known as read-write-memory. It is a primary volatile memory as we lose the data when we turn off the computer or have any power failure. RAM is smaller in size and much faster than most of the available computer memories. However, it is not as fast as the registers.

RAM can further be divided into the following categories:

a) SRAM: Static Random Access Memory or SRAM stores the data in a static form, meaning the data remains in the memory for as long as the computer is on. SRAM uses a matrix of six transistors and no capacitors. Transistors do not need the power to prevent leakage hence; we do not need to refresh SRAM again and again.

b) DRAM: Dynamic Random Access Memory is widely used in computer systems. Earlier, there was a single data rate (SDR) used in computers but now, a dual data rate (DDR) is used in them. DDR is also available in different versions such as DDR2, DDR3 and DDR4 which are more energy efficient and provide better performance. DRAM is made up of a transistor and a capacitor in each cell because of which it has a leakage problem. Hence, we need to refresh a DRAM again and again.

ROM

ROM stands for Read Only Memory into which the data cannot be normally written. While the data can easily be read from this type of memory. ROM is a primary non-volatile memory, meaning it can retain all the data in the memory without the power supply. It is a

very fast computer memory that stores the instructions required to start the computer as soon as we connect it to the power source. When we connect the computer to the power source, the CPU starts reading the instructions stored in ROM. It also does not require support from the driver or any complex software to load the necessary parts of the operating system in the primary memory.

ROM can be divided into the following subcategories-

a) MROM: MROM stands for "Masked Read Only Memory". It is a type of memory whose contents are pre-programmed with specific functional data by the integrated circuit manufacturer. MROM cannot enable users to change the data stored, like other types of ROM. If it tries to do so, the process would be difficult or slow.

b) PROM: It stands for Programmable Read Only Memory and as the name suggests, these memory are programmable. A user can program or code this memory as PROM is manufactured as a blank memory. A PROM programmer can be used to enter a set of programs or codes in a blank PROM. Once data or instructions are written in it, they cannot be changed.

c) EPROM: This stands for Erasable Programmable Read Only Memory which is an upgraded version of PROM. This type of memory allows its users to erase the stored data as well as rewrite it. The data stored in EPROM can be erased by passing ultraviolet light for a particular length of time using an EPROM eraser.

d) EEPROM: This stands for "Electrically Erasable Programmable Read Only Memory" and as per its name, this memory can be programmed and erased electrically. The programming and erasing of data takes around 4 to 10 milliseconds and this can be done around 10,000 times. EEPROM can be erased 1 byte at a time rather than erasing the entire memory at once.

External Memory

External memory can also be known as secondary memory or backing store. It is used to store a huge amount of data because it has a huge capacity.

The external memory can be categorized into four parts:

1. Magnetic disk
2. Raid
3. Optical memory
4. Magnetic Tape

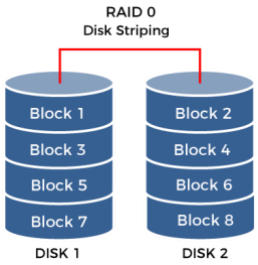
Magnetic Disk

A disk is a type of circular platter constructed by a nonmagnetic material, which is known as a **substrate.** It is covered with a magnetic coating used to hold the information. The substrate

is traditionally constructed by aluminium or aluminium alloy material. But recently, another material has been introduced, which is known as **glass substrates.**

RAID

The RAID is also known as a **redundant array of independent disks.** It is a type of data virtualization technology, which is used to combine components of multiple disks into a logical unit so that they can improve the performance or create redundancy. If there are multiple disks/drives, it will allow the employment of various techniques such as disk mirroring, parity, and disk striping.



Striping: In this, data will be split between more than one disk.

Mirroring: In this, data will mirror between more than one disk.

Parity: It can also be called checksum. It can be described as a calculated value, which is used to mathematically rebuild the data.

Optical Memory

The optical memory was released in 1982, and Sony and Philips developed it. These memories perform their operations with the help of light beams, and it also needs option drive for the operations. We can use optical memory to store backup, audio, video, and also for caring data. The speed of a flash drive and the hard drive is faster as compared to the read/write speed. There are various examples of optical memory that are:

a. Compact disk (CD)

b. Blu-ray Disk (BD)

c. Digital Versatile Disk (DVD)

Compact Disk (CD)

It is a type of digital audio system, which is used to store data. It is composed of circular plastic, in which **aluminium alloy** is used to coat the single side of plastic, which is used to store the data. It also contains an additional thin plastic covering, which is used to protect the data. CD will perform its operations with the help of a CD drive. The compact disk can be called the non-erasable disk.

Types of Compact Disk

CD-ROM:

CD-ROM is also known as **CD read-only memory.** It is mainly used to store computer data. As we know earlier, the compact disks were used to store the video and audio data, but it uses the digital form to store the data, so we can also be used the compact disks to store the computer data.

CD-R:

CD-R is also known as **CD-Recordable.** It is a type of write once read many, or we can say that it allows single time recording on a disk. It is used in these types of applications that require one or a small number of copies of a set of data.

CD-RW:

CD-RW is also known as **CD-Rewritable.** It is a type of compact disk format which allow us to repeatedly recording on a disk. CD rewritable and CD recordable both are composed of the same material.

Digital Versatile Disk (DVD)

The DVD (digital versatile disk) technology was first launched in 1996. The appearance of the CD (compact disk) and the DVD (digital versatile disk) has the same. The storage size is the main difference between CD and DVD.

Magnetic Tape

Reading and writing techniques in the tape system is the same as the disk system. In this, the medium is **flexible polyester** tape coated with a **magnetizable material.** The tape's data can be structured as a number of parallel tracks that will be run lengthwise. In this form, the recording of data can be called a **parallel recording.** Instead of the parallel recording, most of the modern system uses serial recording. The **serial recording** uses the sequence of bits along with each track to lay of the data.

Units of memory

Full Form	Units	Bytes
1 Bit	Binary Digit (0/1)	
1 Nibble	4 bits	
1 Byte	8 bits	
1 kilobyte(KB)	1024 byte	2^{10} bytes
1 Megabyte(MB)	1024 KB	2^{20} bytes
1 Gigabyte (GB)	1024 MB	2^{30} bytes
1 Terabyte(TB)	1024 GB	2^{40} bytes
1 Petabyte(PB)	1024 TB	2^{50} bytes
1 Exabyte(EB)	1024 PB	2^{60} bytes
1 Zettabyte(ZB)	1024 EB	2^{70} bytes
1 Yottabyte(YB)	1024 ZB	2^{80} bytes
1 Brontobyte	1024 YB	2^{90} bytes
1 Geopbyte	1024 Brontobyte	2^{100} bytes

Lecture 7

Question Answer discussion

Questions

MCQs:

1. Who is the father of Computers?
a) James Gosling
b) Charles Babbage
c) Dennis Ritchie
d) Bjarne Stroustrup

Answer: b

2. What is the full form of CPU?
a) Computer Processing Unit
b) Computer Principle Unit
c) Central Processing Unit
d) Control Processing Unit

Answer: c

3. Which of the following is the brain of the computer?
a) Central Processing Unit
b) Memory
c) Arithmetic and Logic unit
d) Control unit

Answer: a

4. Which of the following is the smallest unit of data in a computer?
a) Bit
b) KB
c) Nibble
d) Byte

Answer: a

5. The fourth generation was based on integrated circuits.

a) True
b) False

Answer: b

6. _____ generation of computer started with using vacuum tubes as the basic components.
a) 1st
b) 2nd

c) 3rd
d) 4^{th}

Answer: a

7. ULSI stands for?
a) Ultra Large Scale Integration
b) Under Lower Scale Integration
c) Ultra Lower Scale Integration
d) Under Large Scale Integration

Answer: a

8. What was the main programming language used in first-generation computers?

a) Java
b) Python
c) C++
d) Machine language

Answer: d

9. What were the main input/output devices used in first-generation computers?

a) Keyboards and mice
b) Touchscreens and digital pens
c) Paper tape and punched cards
d Printers and scanners

Answer: c

10. Which of following refers to the fastest, biggest and most expensive computer?

a) Personal computer
b) Super computer
c) Laptop
d) Notebook

Answer: b

Short type:

1. Differentiate between data and information.
2. What do you mean by volatile memory?
3. Distinguish between RAM and ROM.
4. Write some input and output devices.

5. Differentiate between SRAM and DRAM.

Long type:

1. Explain the basic organization of computer with block diagram.
2. Discuss about some input devices.
3. Discuss about some output devices.
4. Explain types of memory.

Lecture 8

Chapter-2

COMPUTER SOFTWARE

Software Concept

- ✓ Software is a set of programs (sequence of instructions) that allows the users to perform a well-defined function or some specified task.″
- ✓ Software is classified broadly into two groups:

1. System software.
2. Application software.

System Software

- System software is a computer program that helps the user to run computer hardware or software and manages the interaction between them**.**
- Essentially, it is software that constantly runs in the computer background, maintaining the computer hardware and computer's basic functionalities, including the operating system, utility software, and interface**.**
- In simple terms, you can say that the system acts as a middle man that checks and facilitates the operations flowing between the user and the computer hardware.

Example:

1. Operating systems (OS): Windows, Linux, macOS, etc.
2. Device drivers: software that enables the communication between hardware and OS.
3. Firmware: pre-installed low-level software that controls a device's basic functions.
4. Utility software: tools for system maintenance and optimization.
5. Boot loaders: software that initializes the OS during startup.

Application Software

- An application, also referred to as an application program or application software, is a computer software package that performs a specific function directly for an end user or, in some cases, for another application.
- An application can be self-contained or a group of programs.

Example:

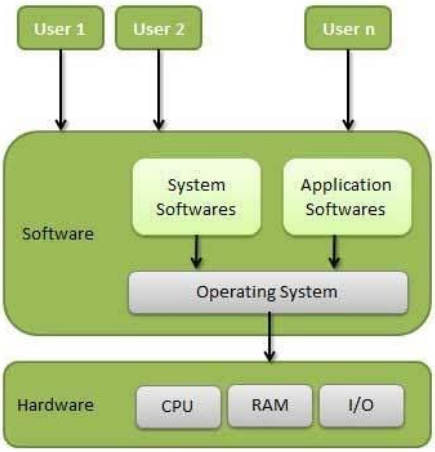
1. The Microsoft suite. Office, Excel, Word, PowerPoint, Outlook, etc.
2. Internet browsers. Firefox, Chrome, Safari, Internet Explorer.
3. Music software. Pandora, Apple Music, Spotify.
4. Communication software. Slack, Skype, Zoom, Teams.

Lecture 9

Overview of Operating System

- An operating system is a program that acts as an interface between the user and the computer hardware and controls the execution of all kinds of programs.
- The software that contains the core components of the operating system is called the **kernel**.
- Example: Apple macOS, Microsoft Windows, Google's Android OS, Linux Operating System, and Apple iOS.

Architecture:



Objectives and Functions of OS

Objective:

1. Efficiency
2. Hardware abstraction
3. Convenience
4. System resource management

Efficiency

The operating system increases the production efficiency. This is because the system configuration takes less time. By default, the operating system handles system tasks such as allocating resources to processes and resolving conflicts between different programs and users. This saves the user time and results in a more efficient result.

Hardware abstraction

The operating system performs a good job of concealing the computer's intricate details. The user can fully utilise the computer hardware without having to cope with the accompanying

difficulties. The operating system coordinates communication between user programs and computer hardware.

Convenience

In the absence of an operating system, users would have to deal with the hardware directly without access to the pre-configured utility packages that come with an operating system. This would make using a computer extremely inconvenient. Operating systems allow users to go right to work on the tasks they want to do without dealing with the burden of setting up the system beforehand.

System resource management

The operating system serves as a neutral arbitrator. It serves a management role in the computer system by ensuring equitable resource distribution among various operations and consumers.

Functions:

1. Security

To safeguard user data, the operating system employs password protection and other related measures. It also protects programs and user data from illegal access.

2. Control over System Performance

The operating system monitors the overall health of the system in order to optimise performance. To get a thorough picture of the system's health, keep track of the time between system responses and service requests. This can aid performance by providing critical information for troubleshooting issues.

3. Job Accounting

The operating system maintains track of how much time and resources are consumed by different tasks and users, and this data can be used to measure resource utilisation for a specific user or group of users.

4. Error Detecting Aids

The OS constantly monitors the system in order to discover faults and prevent a computer system from failing.

5. Coordination between Users and Other Software

Operating systems also organise and assign interpreters, compilers, assemblers, as well as other software to computer users.

6. Memory Management

The operating system is in charge of managing the primary memory, often known as the main memory. The main memory consists of a vast array of bytes or words, each of which is allocated an address. Main memory is rapid storage that the CPU can access directly. A program must first be loaded into the main memory before it can be executed. For memory management, the OS performs the following tasks:

- The OS keeps track of primary memory – meaning, which user program can use which bytes of memory, memory addresses that have already been assigned, as well as memory addresses yet to be used.
- The OS determines the order in which processes would be permitted memory access and for how long in multiprogramming.
- It allocates memory to the process when the process asks for it and deallocates memory when the process exits or performs an I/O activity.

7. Process Management

The operating system determines which processes have access to the processor and how much processing time every process has in a multiprogramming environment. Process scheduling is the name for this feature of the operating system. For processor management, the OS performs the following tasks:

- It keeps track of how processes are progressing.
- A traffic controller is a program that accomplishes this duty.
- Allocates a processor-based CPU to a process. When a process is no longer needed, the processor is deallocated.

8. Device Management

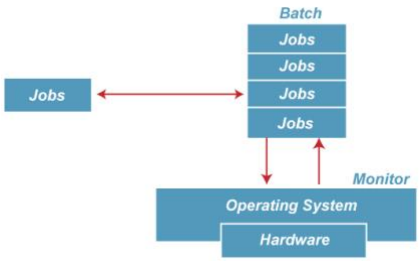
A file system is divided into directories to make navigation and usage more efficient. Other directories and files may be found in these directories. The file management tasks performed by an operating system are: it keeps track of where data is kept, user access settings, and the state of each file, among other things. The file system is the name given to all of these features.

Lecture 10

Types of Operating System

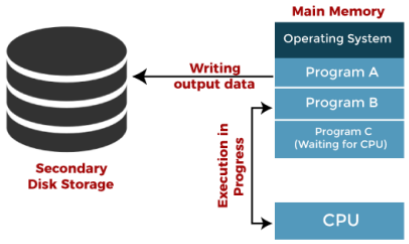
1. Batch Processing OS

- In the 1970s, Batch processing was very popular. In this technique, similar types of jobs were batched together and executed in time. People were used to having a single computer which was called a mainframe.
- In Batch operating system, access is given to more than one person; they submit their respective jobs to the system for the execution.
- The system put all of the jobs in a queue on the basis of first come first serve and then executes the jobs one by one. The users collect their respective output when all the jobs get executed.



2. Multiprogramming OS

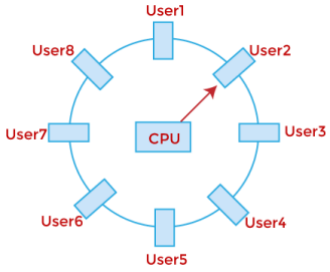
- Multiprogramming is an extension to batch processing where the CPU is always kept busy. Each process needs two types of system time: CPU time and IO time.
- In a multiprogramming environment, when a process does its I/O, The CPU can start the execution of other processes. Therefore, multiprogramming improves the efficiency of the system.



Jobs in multiprogramming system

3. Time Sharing OS

- In the Time Sharing operating system, computer resources are allocated in a time-dependent fashion to several programs simultaneously. Thus it helps to provide a large number of user's direct access to the main computer.
- It is a logical extension of multiprogramming. In time-sharing, the CPU is switched among multiple programs given by different users on a scheduled basis.



Timesharing in case of 8 users

Lecture 11

Features of DOS

- It is a single user system.
- It controls program.
- It is machine independence.
- It manages (computer) files.
- It manages input and output system.
- It manages (computer) memory.
- It provides command processing facilities.
- It operates with Assembler.

Features of Windows

- Graphical User Interface
- Icons (pictures, documents, application, program icons, etc.)
- Taskbar
- Start button
- Windows explorer
- Mouse button
- Hardware compatibility
- Software compatibility
- Help, etc.

Features of UNIX

- It is an operating system that has multitasking features.
- It has multiuser computer operating systems.
- It runs practically on every sort of hardware and provides stimulus to the open source movement.
- It has comparative complex functionality and hence an untrained user cannot use it; only the one who has taken training can use this system.
- Another drawback of this system is, it does not give notice or warn about the consequences of a user's action (whether user's action is right or wrong).

Lecture 12

Programming Languages

- The language used in the communication of instruction to a computer is known as programming language.
- An artificial language used to write instructions that can be translated into machine language and then executed by a computer.
- Computer language is divided in to following types:

1. Machine-level language

- ✓ This is also known as low level language.
- ✓ The programs are written in the form of string of 0s or 1s.
- ✓ It is Machine dependent.
- ✓ It does not require any translator.

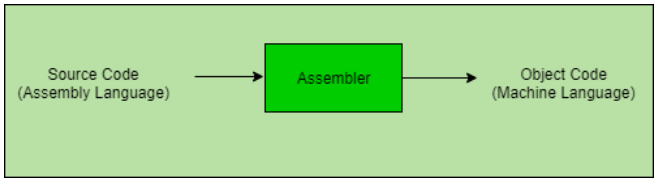
2. Assembly language

In an assembly language, mnemonics are used to represent operations to be performed by the computer.

- ✓ Strings of characters to represent addresses of locations in the computer's memory where the operands will be stored.
- ✓ It is Machine dependent.

Assembler

An assembler is a translator which translates a program written in assembly language to equivalent Machine-level languages program, which can be executed by a computer.



3. High-level languages

A high-level language is computer programming language which is English like language follows some syntax.

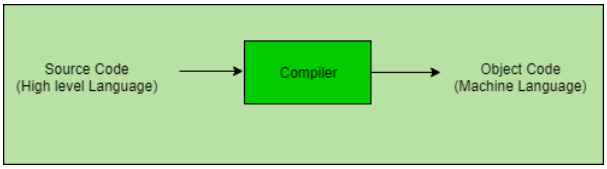
• It is not limited by the computer, designed for a specific job, and is easier to understand.

• Examples: FORTARN, C, C, C++ etc.

• Translator like compiler or interpreter is required to translate it to equivalent machine level language programme.

Compiler

The language processor that reads the complete source program written in high-level language as a whole in one go and translates it into an equivalent program in machine language is called a Compiler.



Interpreter

An interpreter is a translator which translates a program written in High-level language to equivalent Machine-level languages programme line by line.

Difference between Compiler and Interpreter

Compiler	Interpreter
A compiler is a program that converts the entire source code of a programming language into executable machine code for a CPU.	An interpreter takes a source program and runs it line by line, translating each line as it comes to it.
The compiler takes a large amount of time to analyse the entire source code but the overall execution time of the program is comparatively faster.	An interpreter takes less amount of time to analyse the source code but the overall execution time of the program is slower.
The compiler requires a lot of memory for generating object codes.	It requires less memory than a compiler because no object code is generated.
Generates intermediate object code.	No intermediate object code is generated.
Examples: C, C++, C#	Examples: Python, Perl, JavaScript, Ruby.

Lecture 13

Computer Virus

- VIRUS stands for Vital Information and Resources Under Seize.
- A Computer Virus is a program that is designed to spread from one computer to another and may corrupt data on your computer, use your e-mail program to spread itself to other computers, or delete data on your hard disk.
- Viruses are most easily spread by attachments in e-mails and can be disguised as attachments of word documents, images, greeting cards, or audio and video files.
- A virus also spreads through downloads on the Internet. They can be hidden in software or other files or programs you download.

Types of computer virus

1. Boot Sector Virus

- Infects the boot or MBR of diskettes and hard drives through the sharing of infected disks and pirated software applications.
- Once your hard drive is infected all diskettes that you use in your computer will be infected.

2. Program Virus

- Becomes active when the program file (usually with extensions .BIN, .COM, .EXE, .OVL, .DRV) carrying the virus is opened.
- It then makes copies of itself and will infect other programs on the computer.

3. Multipartite Virus

- Hybrid of a Boot Sector and Program viruses.
- It infects program files and when the infected program is active it will affect the boot record.

4. Stealth Virus

- Disguises itself to prevent from being detected by antivirus software.
- It alters its file size or conceals itself in memory.

5. Polymorphic Virus

- Act like a chameleon, changing its virus signature (binary pattern) every time it multiples and infects a new file.

6. Macro Virus

- Programmed as a macro embedded in a document, usually found in Microsoft Word and Excel.
- Once it gets in to your computer, every document you produce will become infected.

Detection and prevention of Virus

Even though your computer is infected, you may not realize that you have introduced a virus until you notice something is not quite right. Here are a few things to keep in mind that may indicate that your computer is infected:

- Your computer appears to be running slower than normal.
- Your printer does not work.
- Unusual Error messages appear regularly.
- Your computer crashes regularly.
- Your computer restarts by itself regularly.
- Drives on your computer appear inaccessible.
- Applications on the computer do not work correctly.
- You see distorted menus and dialog boxes.
- There is a double extension on an attachment that you recently opened, such as a .jpg, .vbs, .gif, or .exe extension.
- An antivirus program is disabled for no reason.
- Additionally, the antivirus program cannotbe restarted.
- An antivirus program cannot be installed on the computer, or the antivirus program will not run.
- New icons appear on the desktop that you did not put there, or the icons are not associated with any recently installed programs.
- Strange sounds or music plays from the speakers unexpectedly.
- A program disappears from the computer even though you did not intentionally remove the program.

Prevention:

To prevent your computer against viruses, follow these steps:

Keep up-to-date antivirus software running at all times on your Computer. Antivirus software is designed to protect your computer from known viruses. Unfortunately new viruses are created daily so they need to be kept up-to-date. These two products are popular choices Norton Antivirus 2005 Special Edition, AVG Antivirus Free Edition.

Use a Firewall - it's not difficult to install and will prevent hackers from breaking into your computer. Some good firewalls available are Windows XP, Windows Vista , Zone Alarm and Outpost. Never open an email attachment from an unknown supply particularly if the attachment hasan .exe extension. Be careful of opening email attachments from someone you know as they may not know that it contains a virus. Keep informed of recent threats by doing research on the Internet. Download from reputable sites and avoid downloading files you can't be sure are safe. These may include freeware, screensavers, games and any other executable files.

Backup: No antivirus product can guarantee that a virus does not exist on your computer, as there are continually new ones out there. To guard against disasters, make sure you have an up-to-date backup of your computer and store backups in a separate location.

Lecture 14

Application of computers in different Domain

Home

Computers are used at homes for several purposes like online bill payment, watching movies or shows at home, home tutoring, social media access, playing games, internet access, etc. They provide communication through electronic mail. They help to avail work from home facility for corporate employees. Computers help the student community to avail online educational support.

Medical Field

Computers are used in hospitals to maintain a database of patients' history, diagnosis, X-rays, live monitoring of patients, etc. Surgeons nowadays use robotic surgical devices to perform delicate operations, and conduct surgeries remotely. Virtual reality technologies are also used for training purposes. It also helps to monitor the fetus inside the mother's womb.

Entertainment

Computers help to watch movies online, play games online; act as a virtual entertainer in playing games, listening to music, etc. MIDI instruments greatly help people in the entertainment industry in recording music with artificial instruments. Videos can be fed from computers to full screen televisions. Photo editors are available with fabulous features.

Industry

Computers are used to perform several tasks in industries like managing inventory, designing purpose, creating virtual sample products, interior designing, video conferencing, etc. Online marketing has seen a great revolution in its ability to sell various products to inaccessible corners like interior or rural areas. Stock markets have seen phenomenal participation from different levels of people through the use of computers.

Education

Computers are used in education sector through online classes, online examinations, referring e-books, online tutoring, etc. They help in increased use of audio-visual aids in the education field.

Government

In government sectors, computers are used in data processing, maintaining a database of citizens and supporting a paperless environment. The country's defense organizations have

greatly benefitted from computers in their use for missile development, satellites, rocket launches, etc.

Banking

In the banking sector, computers are used to store details of customers and conduct transactions, such as withdrawal and deposit of money through ATMs. Banks have reduced manual errors and expenses to a great extent through extensive use of computers.

Business

Nowadays, computers are totally integrated into business. The main objective of business is transaction processing, which involves transactions with suppliers, employees or customers. Computers can make these transactions easy and accurate. People can analyze investments, sales, expenses, markets and other aspects of business using computers.

Training

Many organizations use computer-based training to train their employees, to save money and improve performance. Video conferencing through computers allows saving of time and travelling costs by being able to connect people in various locations.

Arts

Computers are extensively used in dance, photography, arts and culture. The fluid movement of dance can be shown live via animation. Photos can be digitized using computers.

Science and Engineering

Computers with high performance are used to stimulate dynamic process in Science and Engineering. Supercomputers have numerous applications in area of Research and Development (R&D). Topographic images can be created through computers. Scientists use computers to plot and analyze data to have a better understanding of earthquakes.

Lecture 15

Quiz Test

Questions:

MCQs

1. Which software is used to manage and control the hardware components and allows interaction between the hardware and the other different types of software?

(a) Application software
(b) System software
(c) Utility software
(d) Operating system

Answer: (b)

2. A computer program that functions as an intermediary between a computer user and the computer hardware is called

(a) software
(b) hardware
(c) operating system.
(d) driver

Answer: (c)

3. Which of the following is not a kind of system software?

(a) BIOS software
(b) Unix, Linux
(c) Microsoft Windows, and Mac OS
(d) Microsoft Word

Answer: (d)

4. Which of the following is not application software?

(a) MS-Word
(b) Google Docs
(c) Adobe Acrobat
(d) Turbo C compiler

Answer: (d)

5. Choose the odd one out.

(a) Interpreter
(b) Compiler
(c) Interpreter
(d) Operating system
(e) Programmer

Answer: (e)

6. Which among the following application software can be used to create, edit, and print documents?

(a) Spreadsheet
(b) Word processing

(c) Database software
(d) Desktop publishing (DTP)

Answer: (b)

7. Which of the following is not a kind of application software?

(a) Word processor
(b) Database
(c) Browser
(d) Device driver

Answer: (d)

8. Microsoft Word, Microsoft Excel, and Google Docs are the examples of

(a) An operating software
(b) system software
(c) utility software
(d) application software

Answer: (d)

9. What is a computer virus?

a) A hardware component
b) A type of antivirus software
c) A Malicious software that infects other files
d) A computer programming language

Answer:(c)

10. A virus that is specifically designed to spread through email?

a) Worm
b) Macro virus
c) Email virus
d) Adware

Answer: (c)

Short type:

1. What do you mean by software?
2. What is an operating system?
3. Differentiate between compiler and interpreter.
4. What is multiprogramming OS?
5. Differentiate between system and application software.

Long type:

1. What is a virus? Explain its types. Write detection and prevention of virus.
2. Write the objective and functions of OS. Also explain its types.

Lecture 16

Chapter-3

COMPUTER NETWORK AND INTERNET

Networking Concept

Data communication:

Data communications are the exchange of data between two devices viasome form of transmission medium such as a wire cable.

Components of data communication:

1. Sender

2. Receiver

3. Medium

4. Message

5. Protocol

Protocol: Protocol is the set of rule which governs data communication between computers in a network.

Computer Network

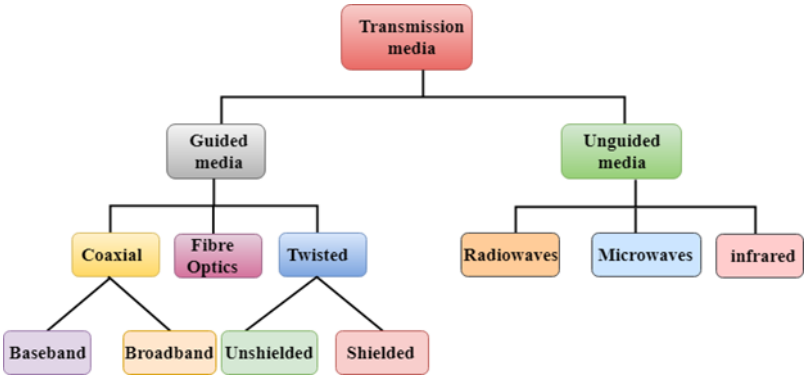
A computer network is a set of devices (often referred to as nodes) connected by communication links. A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network.

Lecture 17

Connecting Media/Transmission Media

Transmission media is a communication channel that carries the information from the sender to the receiver.

Classification of Transmission Media:



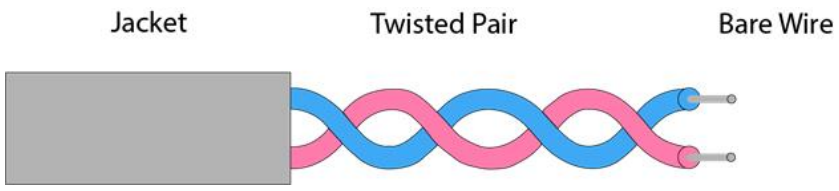
Guided Media

It is defined as the physical medium through which the signals are transmitted. It is also known as Bounded media.

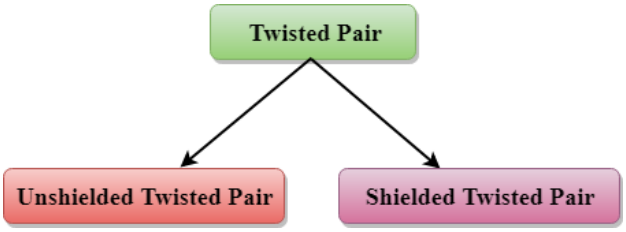
Types Of Guided media:

1. Twisted pair:

- Twisted pair is a physical media made up of a pair of cables twisted with each other. The frequency range for twisted pair cable is from 0 to 3.5KHz.
- A twisted pair consists of two insulated copper wires arranged in a regular spiral pattern.
- The degree of reduction in noise interference is determined by the number of turns per foot. Increasing the number of turns per foot decreases noise interference.



Types of Twisted pair:

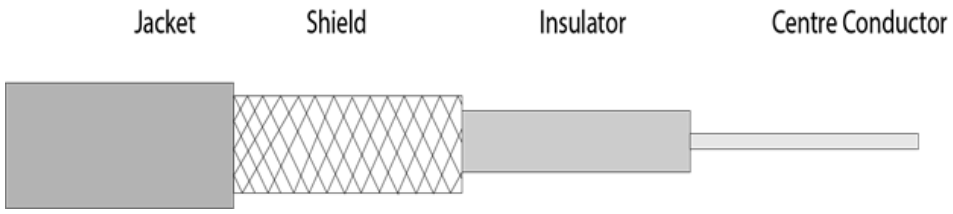


Unshielded Twisted Pair: An unshielded twisted pair is widely used in telecommunication.

Shielded Twisted Pair: A shielded twisted pair is a cable that contains the mesh surrounding the wire that allows the higher transmission rate.

2. Coaxial Cable

- Coaxial cable is very commonly used transmission media, for example, TV wire is usually a coaxial cable.
- The name of the cable is coaxial as it contains two conductors parallel to each other.
- It has a higher frequency as compared to Twisted pair cable.
- The inner conductor of the coaxial cable is made up of copper, and the outer conductor is made up of copper mesh. The middle core is made up of non-conductive cover that separates the inner conductor from the outer conductor.
- The middle core is responsible for the data transferring whereas the copper mesh prevents from the **EMI**(Electromagnetic interference).



Coaxial cable is of two types:

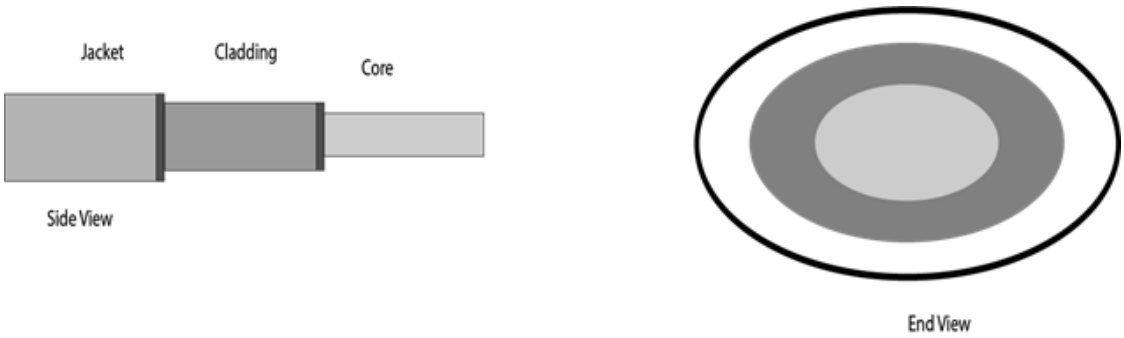
- **Baseband transmission:** It is defined as the process of transmitting a single signal at high speed.
- **Broadband transmission:** It is defined as the process of transmitting multiple signals simultaneously.

3. Fibre Optic

- Fibre optic cable is a cable that uses electrical signals for communication.
- Fibre optic is a cable that holds the optical fibres coated in plastic that are used to send the data by pulses of light.

- The plastic coating protects the optical fibres from heat, cold, electromagnetic interference from other types of wiring.
- Fibre optics provide faster data transmission than copper wires.

Diagrammatic representation of fibre optic cable:



Basic elements of Fibre optic cable:

- **Core:** The optical fibre consists of a narrow strand of glass or plastic known as a core. A core is a light transmission area of the fibre. The more the area of the core, the more light will be transmitted into the fibre.
- **Cladding:** The concentric layer of glass is known as cladding. The main functionality of the cladding is to provide the lower refractive index at the core interface as to cause the reflection within the core so that the light waves are transmitted through the fibre.
- **Jacket:** The protective coating consisting of plastic is known as a jacket. The main purpose of a jacket is to preserve the fibre strength, absorb shock and extra fibre protection.

Unguided Transmission

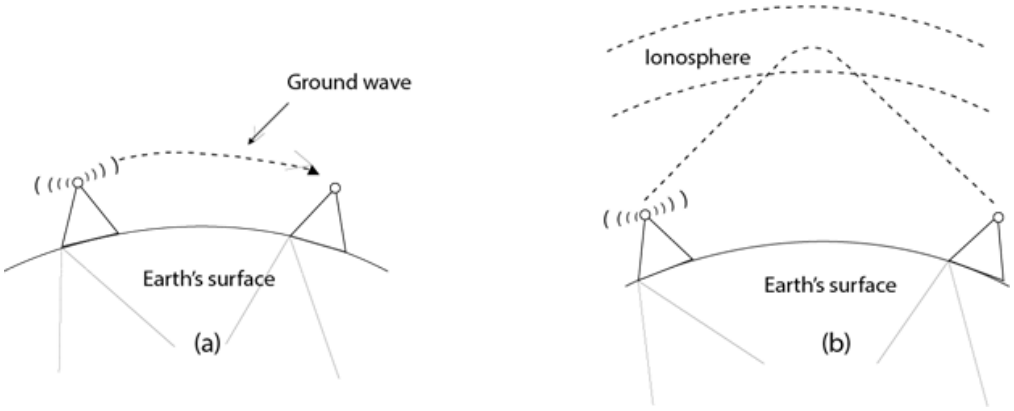
- An unguided transmission transmits the electromagnetic waves without using any physical medium. Therefore it is also known as **wireless transmission**.
- In unguided media, air is the media through which the electromagnetic energy can flow easily.

Unguided transmission is broadly classified into three categories:

1. Radio waves

- Radio waves are the electromagnetic waves that are transmitted in all the directions of free space.
- Radio waves are omnidirectional, i.e., the signals are propagated in all the directions.
- The range in frequencies of radio waves is from 3Khz to 1 khz.

- In the case of radio waves, the sending and receiving antenna are not aligned, i.e., the wave sent by the sending antenna can be received by any receiving antenna.
- An example of the radio wave is **FM radio**.



2. Microwaves

- Microwaves travel in straight lines, and so the transmitter and receiver stations should be accurately aligned to each other.
- Microwave propagation is line – of – sight propagation. So, towers hoisting the stations should be placed so that the curvature of the earth or any other obstacle does not interfere with the communication.
- Since it is unidirectional, it allows multiple receivers in a row to receive the signals without interference.
- Microwaves do not pass through buildings. So, indoor receivers cannot be used effectively.
- Used in Long distance telephone communication, Cellular phones, Television networks Satellites, Wireless LANs etc.

3. Infrared

- An infrared transmission is a wireless technology used for communication over short ranges.
- The frequency of the infrared in the range from 300 GHz to 400 THz.
- It is used for short-range communication such as data transfer between two cell phones, TV remote operation, data transfer between a computer and cell phone resides in the same closed area.

Lecture 18

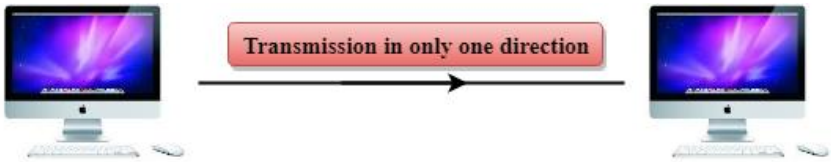
Data Transmission mode

- The way in which data is transmitted from one device to another device is known as **transmission mode**.
- The transmission mode is also known as the communication mode.

The Transmission mode is divided into three categories:

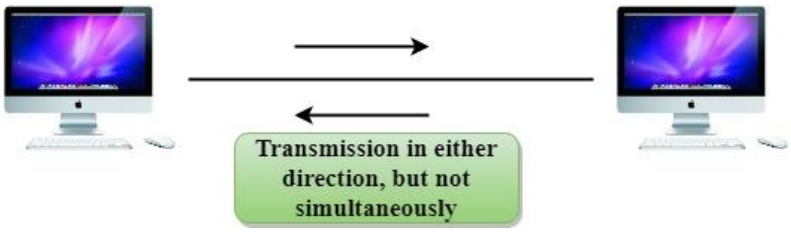
- Simplex mode
- Half-duplex mode
- Full-duplex mode

Simplex mode:



- In Simplex mode, the communication is unidirectional, i.e., the data flow in one direction.
- A device can only send the data but cannot receive it or it can receive the data but cannot send the data.
- Keyboard and Monitor are the examples of the simplex mode as a keyboard can only accept the data from the user and monitor can only be used to display the data on the screen.

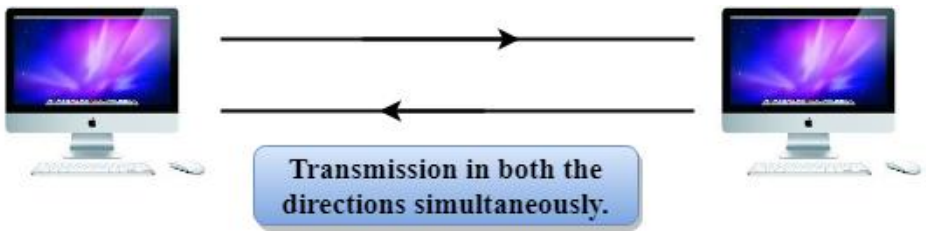
Half-Duplex mode:



- In a Half-duplex channel, direction can be reversed, i.e., the station can transmit and receive the data as well.
- Messages flow in both the directions, but not at the same time.

- A **Walkie-talkie** is an example of the Half-duplex mode. In Walkie-talkie, one party speaks, and another party listens. After a pause, the other speaks and first party listens. Speaking simultaneously will create the distorted sound which cannot be understood.

Full-duplex mode



- In Full duplex mode, the communication is bi-directional, i.e., the data flow in both the directions.
- Both the stations can send and receive the message simultaneously.
- Full-duplex mode has two simplex channels. One channel has traffic moving in one direction, and another channel has traffic flowing in the opposite direction.
- The most common example of the full-duplex mode is a telephone network. When two people are communicating with each other by a telephone line, both can talk and listen at the same time.

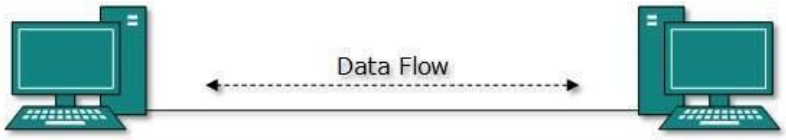
Lecture 19

Network Topologies

A Network Topology is the arrangement with which computer systems or network devices are connected to each other.

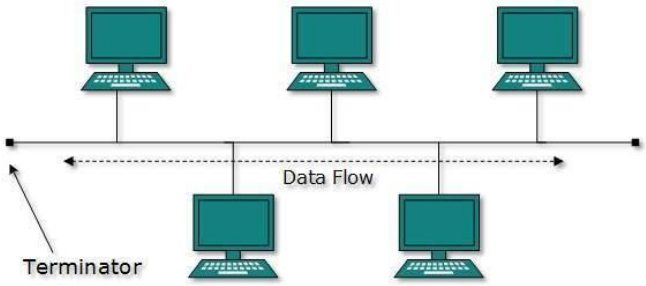
Point-to-Point

Point-to-point networks contains exactly two hosts such as computer, switches or routers, servers connected back to back using a single piece of cable. Often, the receiving end of one host is connected to sending end of the other and vice-versa.



Bus Topology

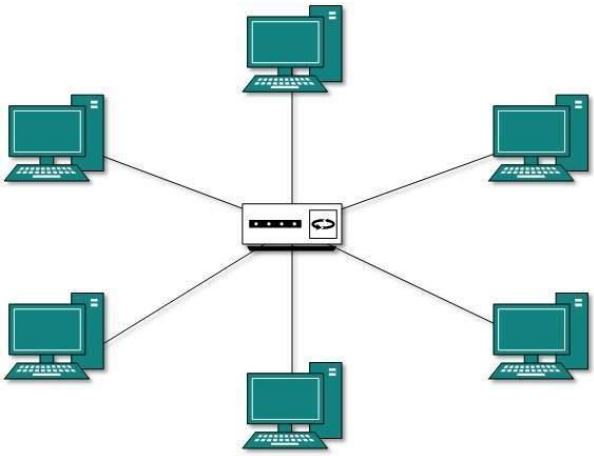
In case of Bus topology, all devices share single communication line or cable. Bus topology may have problem while multiple hosts sending data at the same time



Both ends of the shared channel have line terminator. The data is sent in only one direction and as soon as it reaches the extreme end, the terminator removes the data from the line.

Star Topology

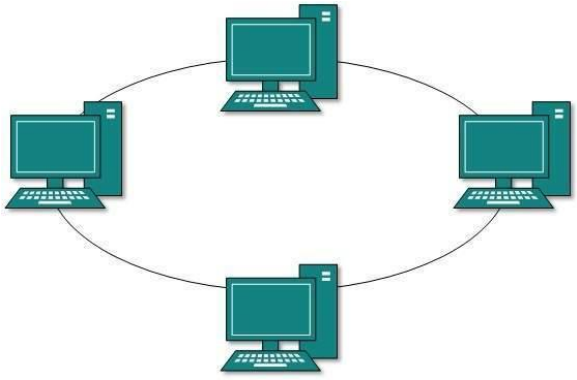
All hosts in Star topology are connected to a central device, known as hub device, using a point-to-point connection.



If hub fails, connectivity of all hosts to all other hosts fails.

Ring Topology

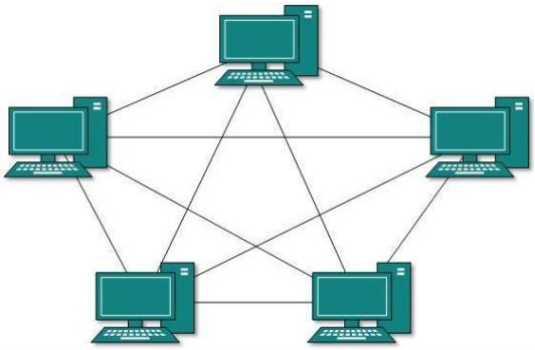
In ring topology, each host machine connects to exactly two other machines, creating a circular network structure. When one host tries to communicate or send message to a host which is not adjacent to it, the data travels through all intermediate hosts. To connect one more host in the existing structure, the administrator may need only one more extra cable.



Failure of any host results in failure of the whole ring. Thus, every connection in the ring is a point of failure. There are methods which employ one more backup ring.

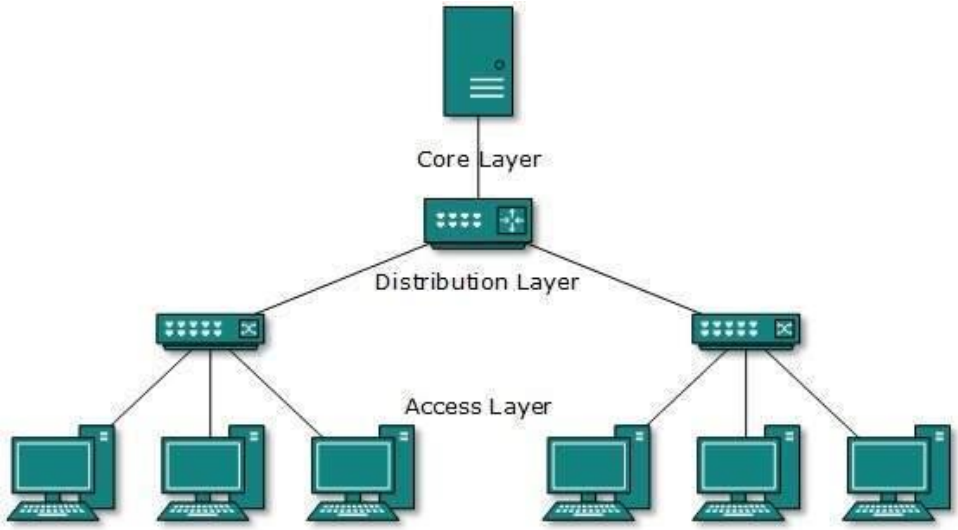
Mesh Topology

In this type of topology, a host is connected to one or multiple hosts. This topology has hosts in point-to-point connection with every other host or may also have hosts which are in point-to-point connection to few hosts only.



Tree Topology

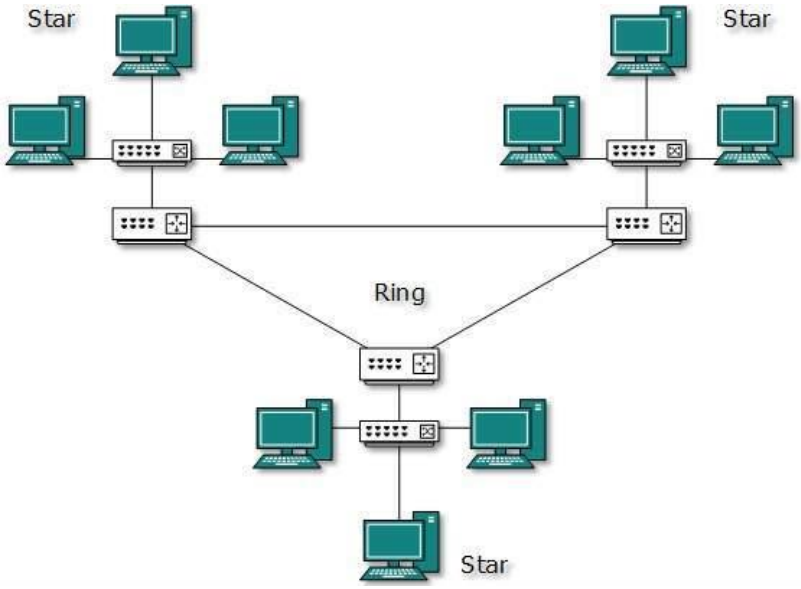
Also known as Hierarchical Topology, this is the most common form of network topology in use presently. This topology imitates as extended Star topology and inherits properties of bus topology.



All neighboring hosts have point-to-point connection between them. Similar to the Bus topology, if the root goes down, then the entire network suffers even though it is not the single point of failure. Every connection serves as point of failure, failing of which divides the network into unreachable segment.

Hybrid Topology

A network structure whose design contains more than one topology is said to be hybrid topology. Hybrid topology inherits merits and demerits of all the incorporating topologies.


Star
Star
Ring
Star

Lecture 20

Types of Network

A **computer network** is mainly of **four types**:

- LAN(Local Area Network)
- PAN(Personal Area Network)
- MAN(Metropolitan Area Network)
- WAN(Wide Area Network)

LAN(Local Area Network)

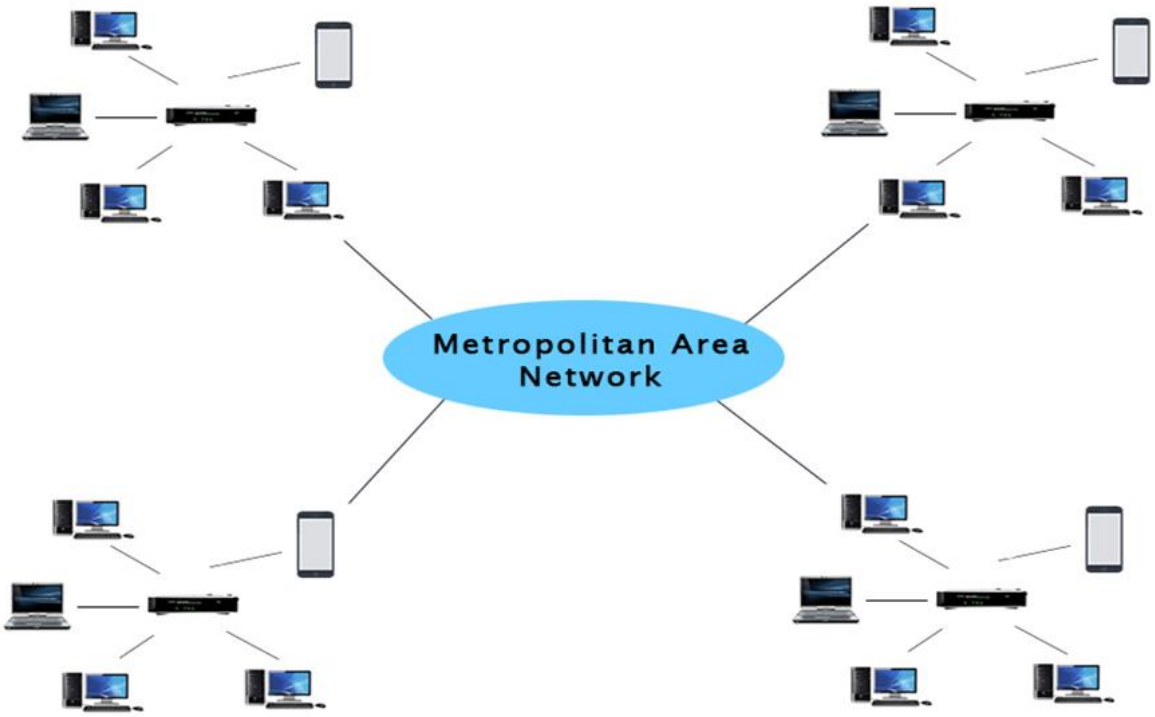
- Local Area Network is a group of computers connected to each other in a small area such as building, office.
- LAN is used for connecting two or more personal computers through a communication medium such as twisted pair, coaxial cable, etc.
- It is less costly as it is built with inexpensive hardware such as hubs, network adapters, and ethernet cables.
- The data is transferred at an extremely faster rate in Local Area Network.
- Local Area Network provides higher security.

PAN(Personal Area Network)

- Personal Area Network is a network arranged within an individual person, typically within a range of 10 meters.
- Personal Area Network is used for connecting the computer devices of personal use is known as Personal Area Network.
- **Thomas Zimmerman** was the first research scientist to bring the idea of the Personal Area Network.
- Personal Area Network covers an area of **30 feet**.
- Personal computer devices that are used to develop the personal area network are the laptop, mobile phones, media player and play stations.

MAN(Metropolitan Area Network)

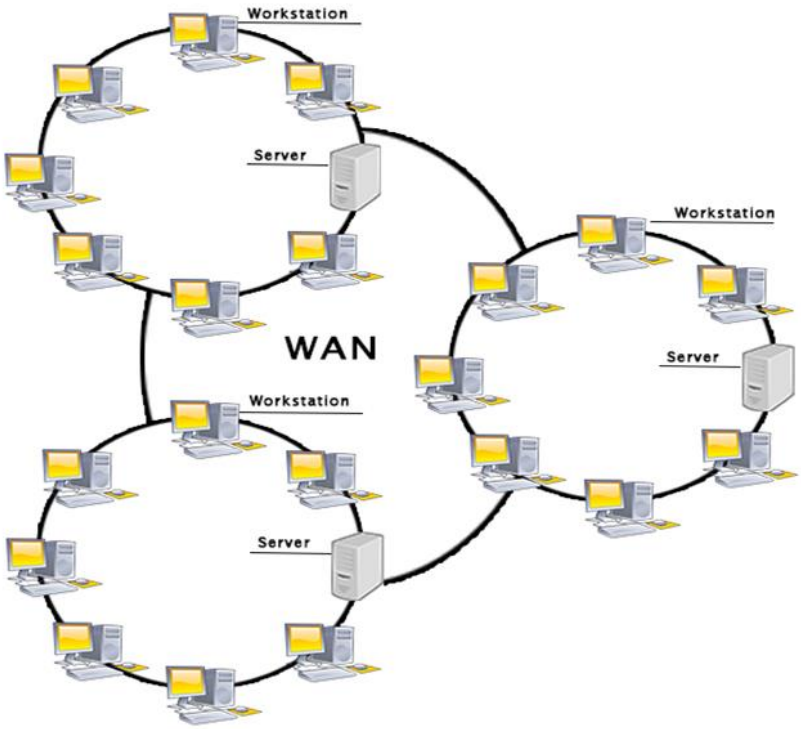
- A metropolitan area network is a network that covers a larger geographic area by interconnecting a different LAN to form a larger network.
- Government agencies use MAN to connect to the citizens and private industries.
- In MAN, various LANs are connected to each other through a telephone exchange line.
- The most widely used protocols in MAN are RS-232, Frame Relay, ATM, ISDN, OC-3, ADSL, etc.
- It has a higher range than Local Area Network(LAN).



WAN(Wide Area Network)

- A Wide Area Network is a network that extends over a large geographical area such as states or countries.
- A Wide Area Network is quite bigger network than the LAN.

- A Wide Area Network is not limited to a single location, but it spans over a large geographical area through a telephone line, fibre optic cable or satellite links.
- The internet is one of the biggest WAN in the world.
- A Wide Area Network is widely used in the field of Business, government, and education.



Lecture 21

Networking Devices

Hardware devices that are used to connect computers, printers, fax machines and other electronic devices to a network are called **network devices**.

NIC

A network interface card (NIC) is a hardware component without which a computer cannot be connected over a network. It is a circuit board installed in a computer that provides a dedicated network connection to the computer.

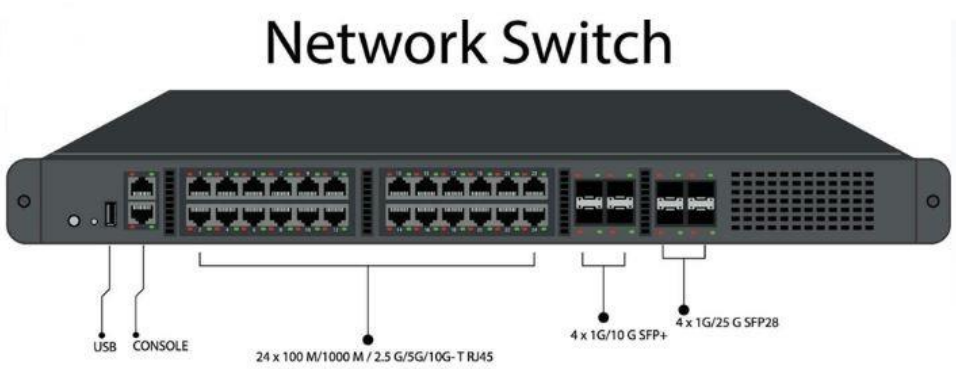
Hub

These devices connect multiple devices on a local network. Hubs function by broadcasting data to all the devices that are connected to it, regardless of their destination. Hubs can help in simplifying the wiring and installation of a LAN by providing a central point of connection.

Apart from its functions that are mentioned above, it does have some limitations, such as low security, low performance.

Switch

The main purpose of switches is to connect end devices within a network and allow the forwarding of data packets utilizing their MAC addresses.

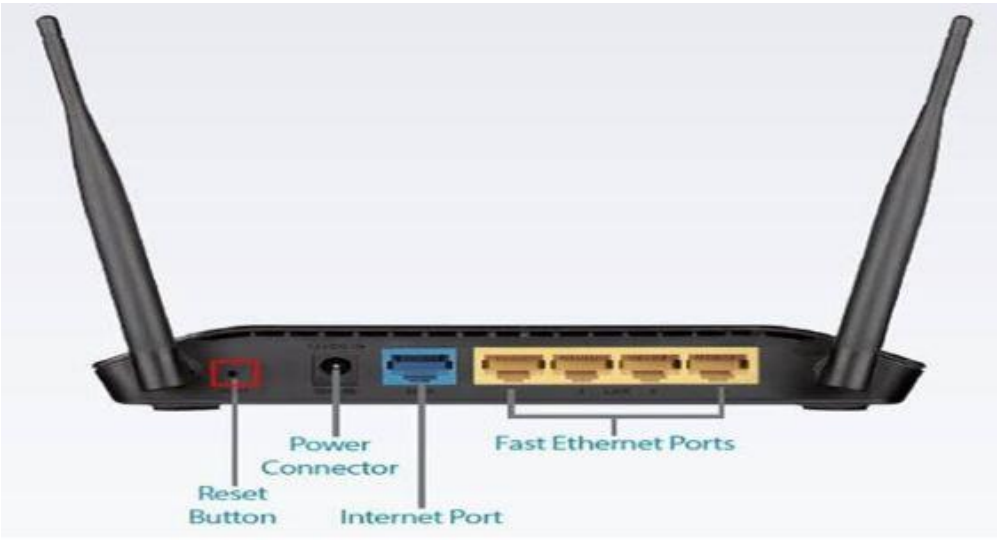


Bridge

Their primary role is to connect segments within a network and enable the forwarding of data packets based on their corresponding MAC addresses.

Router

The main function of the router is to connect networks and allow the forwarding of data packets based on their respective IP addresses.



There are many types of Routers in computer networking. Some of the common routers are:

- Edge Routers
- Access Routers

- Core Routers
- Brouters
- Wireless Routers

Repeater

Repeaters are sometimes also known as “Signal Booster”. The main function of the repeater is to regenerate an incoming signal from the sender before retransmitting it to the receiver.

A repeater can extend the range of the network by boosting the signal and reducing the error and loss of data.

Gateway

These are responsible for connecting networks that are using different protocols or architectures. They do so by translating or converting data formats or protocols between different networks.

Lecture 22

Internet Services

E-Mail

Electronic mail also known as e-mail, is a method of exchanging digital messages from a sender to one or more recipients. These are the main components of Email messages:

To : field is where the e-mail address of the person receiving the e-mail is placed.
From : field is where your e-mail address put.
Subject : field indicated the purpose of e-mail.
Cc : stands for carbon copy. It specifies recipients who are not direct addresses. This field is optional.
Bcc : stands for Blind Carbon Copy. It is similar to Cc, except the recipients are secret. This field is also optional.
Message Body : is the area where you type your main message.

WWW

- World Wide Web, which is also known as a Web, is a collection of websites or web pages stored in web servers and connected to local computers through the internet.
- These websites contain text pages, digital images, audios, videos, etc. Users can access the content of these sites from any part of the world over the internet using their devices such as computers, laptops, cell phones, etc.
- The WWW, along with internet, enables the retrieval and display of text and media to your device.
- The World Wide Web was invented by a British scientist, Tim Berners-Lee in 1989.

FTP

- FTP stands for File transfer protocol.
- FTP is a standard internet protocol provided by TCP/IP used for transmitting the files from one host to another.
- It is mainly used for transferring the web page files from their creator to the computer that acts as a server for other computers on the internet.
- It is also used for downloading the files to computer from other servers.

Chatting

Chatting refers to the kind of communication done with the help of the internet which present live transmission of text messages from sender to receiver. Online chatting can be termed as the point-to-point, one sender-to-one receiver, or one sender-to-many receiver. It

also features voice, video, and also web conferencing services. Chatting can be done as a chat-based as well as video-based (using webcams).

Following are the most common type of chatting:

- **Instant Messaging:** It is the most common way of chatting. It is text-based communication. It happens between two people or groups of people.
- **Internet Relay Chat:** It is known as IRC. It is also a text-based chat. It is not owned by any company and to use IRC we need a client program. Using IRC we can participate in discussion channels or can communicate with only two partners or users.
- **ICQ:** It is known as I seek you. It is the most useful communication program. Using ICQ we can send files, URLs, and more. It is just like instant messaging but allows you to enter into the chat room and can chat with multiple people at a time.
- **Voice Chatting:** We can chat not only with text but also with sounds as well. It is known as voice chatting. Voice chatting can be used with the internet just as a phone call. Internet voice call is free and unlimited, it only needs a good internet connection.
- **Video chatting:** Video chatting is also a kind of chatting which is also done with the help of the internet and it also requires a webcam as it is a face to face chatting. Internet speed required by video chatting is higher as compared to text and video chatting. And a good quality camera too.

Internet Conferencing

It allows participants to communicate and collaborate with each other through audio, video, and chat, regardless of their geographical location. Audio conferencing, video conferencing, screen sharing, and webinars are all generally referred to as web conferencing.

Electronic Newspaper

An online newspaper (or electronic news or electronic news publication) is the online version of a newspaper, either as a stand-alone publication or as the online version of a printed periodical.

Online Shopping

The purchase of products and services on the Internet.

Advantages:

- Wide selection of products and services
- Offers greater convenience than shopping at multiple online shops
- Consumers can make multiple purchases in one transaction.

Lecture 23

Types of Internet connectivity

The connection types in this section include:

1) Dial-up Connections

2) Leased Line Connection

3) ADSL Connections

4) Cable Connections

5) VSAT

Dial-up Connections:

A dial-up connection allows you to connect to the internet via a local server using a standard 56k modem. Your PC literally dials (hence the name) a phone number (provided by your ISP) and connects to the server and therefore the internet.

Leased Line Connection:

Leased connection is also known as direct Internet access. It is the secure, dedicated and most expensive, level of Internet connection. With leased connection, our computer is dedicatedly and directly connected to the Internet using high speed transmission lines. It is on-line twenty-four hours a day, seven days a week.

ADSL (Asymmetric Digital Subscribers Line) Connections:

The connections work by splitting your phone line into two separate channels, one for data (internet) and one for voice (phone calls), which means you can talk on the phone and be connected to the internet at the same time. 4) Cable connections: Through the use of a cable modem you can have a broadband Internet connection that is designed to operate over cable TV lines. Cable Internet works by using TV channel space for data transmission, with certain channels used for downstream transmission, and other channels for upstream transmission.

VSAT (very small aperture terminal):

It is an earthbound station used in satellite communications of data, voice and video signals, excluding broadcast television. A VSAT consists of two parts, a transceiver that is placed outdoors in direct line of sight to the satellite and a device that is placed indoors to interface the transceiver with the end user's communications device, such as a PC.

ISP

An internet service provider (ISP) is a company that provides access to the internet. ISPs can provide this access through multiple means, including dial-up, DSL, cable, wireless and fiber-optic connections. A variety of companies serve as ISPs, including cable providers, mobile

carriers, and telephone companies. Internet service providers are Tata Teleservices, Telenor India, Videocon, Airtel, JIO and etc.

Lecture 24

Revision

Questions

MCQs

1. What is internet?
a) A single network
b) A collection of unrelated computers
c) interconnection of local area networks
d) interconnection of wide area networks

Answer: d

2. To join the internet, the computer has to be connected to a _____
a) internet architecture board
b) internet society
c) internet service provider
d) different computer

Answer: c

3. Which of the following protocols is used in the internet?
a) HTTP
b) DHCP
c) DNS
d) DNS, HTTP and DNS

Answer: d

4. A device that connects networks with different protocols –
a) Switch
b) Hub
c) Gateway
d) Proxy Server

Answer: c

5. A device that is used to connect a number of LANs is –
a) Router
b) Repeater
c) Bridge
d) Switch

Answer: a

6. Which of the following is an example of Bluetooth?
a) wide area network
b) virtual private network

c) local area network
d) personal area network

Answer: d

7. Physical or logical arrangement of network is _____
a) Topology
b) Routing
c) Networking
d) Control

Answer: a

8. Which network topology requires a central controller or hub?
a) Star
b) Mesh
c) Ring
d) Bus

Answer: a

9. Data communication system spanning states, countries, or the whole world is _____
a) LAN
b) WAN
c) MAN
d) PAN

Answer: b

10. Data communication system within a building or campus is_____
a) LAN
b) WAN
c) MAN
d) PAN

Answer: a

Short Type:

1. What is topology?
2. Write the difference between ring and star topology
3. What is MAN?
4. What is data transmission mode?
5. Write short notes on chatting

Long Type:

1. What is network topology? Explain different types of network topologies.

2. Discuss about different types of computer network.
3. Explain the different types of network devices.
4. Discuss different types of internet connection.

Lecture 25

Chapter-4

FILE MANAGEMENT AND DATA PROCESSING

Concept of File and Folder

File:

- File is a set of related data or information that is being stored in memory.
- File is the common storage unit in a computer.
- All programs and data are contained.
- Computer reads and writes files.
- Files that contain text is often referred as documents.
- Files can have extensions like .txt, .jpg, .exe etc.
- Data file contains data and information.
- Program file contains program code and can be executed.

Folder:

- A folder is used to contain many other files and folders.
- It holds one or more files.
- It can be empty with just a name.
- A folder can also contain other folder and subfolders.
- It is a method for organizing files.
- Folders are also called as “directories”.
- Any number of files and folders are possible.
- Each folder can have different/numerous entries depending on the files created where each file has a position in a parent folder.

Lecture 26 & 27

File Access and Storage methods

File Access methods

File access methods define how data is accessed and modified within a file. There are 3 methods to aces files.

- Sequential Access Method
- Direct Access Method
- Indexed Sequential Access Method

Sequential Access Method

Sequential access is a file access method in which data is accessed in a linear or sequential order. This means that data can only be accessed in the order in which it is stored in the file. Sequential access reads or writes data one after the other, starting from the beginning of the file and ending at the end of the file.

Direct Access Method

Direct access is a file access method that allows data to be accessed directly by using the data's physical location within the file. In other words, data can be read or written to any location in the file, much like with random access. However, direct access does not use an index or address like random access, and instead relies on the physical location of the data within the file.

Indexed Sequential Access Method (ISAM)

The indexed access method involves accessing files through an index or directory that contains a list of file names and their corresponding locations on the disk. This method is suitable for applications that need to access files by their names or attributes, such as file managers or search engines. The indexed access method provides a fast and efficient way to locate and access files.

File Storage methods

There are three basic ways of storing files: **lateral, vertical and stacking.**

- **Lateral filing** is done in four-drawer filing cabinets, with the files held upright on their long narrow edge, often within a ‘hanging folder’.
- **Vertical filing**, where files are held upright on their short narrow edge with their ‘spines’ facing outwards, is done in cupboards (which may or may not be enclosed) or on racking or shelves.
- **Stacking method** stores files flats, one on top of the other, with the spines of the files facing out.

Lecture 28

Data Capture

- Data capture is the process of identification and extraction of data from ascanned document, often to be sent to a workflow for routing and action aspart of business process.
- Multiple methods are available for capturing data from unstructured documents (letters, invoices, email, fax, forms etc.)
- Methods of capture from documents in electronic format are identified below:

Single click:

- It is an optical character recognition (OCR) tool that can be used to capture machine produced characters in low volume ad-hoc capture application and populating a line of business application.

OCR:

- OCR as technology provides the ability to successfully capture machine produced characters in full page.
- OCR systems can recognize many different OCR fonts as well as typewriter and computer printed characters.

ICR (Intelligent character recognition):

- ICR is the computer translation hand printed and written characters.
- Data is entered from hand printed forms through a scanner and the image of the capture data is then analyzed and then translated by sophisticated ICR software.

Barcode Recognition:

- Dependent upon the type of barcodes that is used, the amount of meta data that can be included is high, as is the level of recognition.
- The application of single and multiple bar codes to particular document types such as proof of delivery notes.

IDR (Intelligent document recognition):

- The level of capability is dependent upon the individual product.
- These applications are used to capture metadata from documents that is ruled based.
- Ex: The product will identify post codes, logos, keywords.

Data Storage:

- Data storage is the holding of data in an electromagnetic from for access by a computer processor.
- There are two kinds of storage:

i. Primary storage is data that is held in RAM and other memory devices that are built into computers.
ii. Secondary storage is data that is stored on external storage devices such as hard disks, tapes, CD, Pen drive etc.

Following are some main devices for data storage:

- Hard disks
- Floppy disks
- Optical disks
- CD
- Pen drives
- Flat memory card/memory card

Lecture 29

Data Processing:

- Data processing must be processed in order to convert it into information.
- For this purpose, different operations may be performed on data.
- Data processing is defined as a sequence of operations on data to convert it into useful information.
- The data processing can be accomplished through following methods:

1. **Manual Data Processing:**
    - In this method, data is processed manually without using any machine or tool to get required results.
    - In manual data processing, all the calculations and logical operations are performed manually on the data.
    - Ex: Mark sheets, fee receipts

2. **Mechanical Data Processing:**
    - In this method, data is processed by using different devices like type writers, mechanical printers or other mechanical devices.
    - Examination board and printing press use mechanical data processing devices frequently.

3. **Electronic Data Processing:**
    - It is the modern technique to process data.
    - The data is processed through computer; data and set of instructions are given to the computer as input and the data according to the given set of instructions.
    - The computer is also known as electronic data processing machine.
    - Ex: results of students are prepared through computers.

Data Retrieval:

- Data is one of the most important assets of any business.
- Data recovery refers to the whole process of salvaging this lost data that is corrupted, failed, damaged or inaccessible.
- Lost files can occur because of any of the below possibilities.

✓ File was mistakenly deleted.
✓ File was corrupted or deleted by scandisk.
✓ Another program deleted the file.
✓ File is password protected.

Following are some different methods of data recovery: -

Physical damage to storage devices:

Different failure can cause physical damage to your storage media.

Media errors and corrupt partitions and file systems:

In some cases, media errors or damage to the file system or partition table can make the data on a hard drive to be unreadable.

Online data recovery:

- This is another popular method of data recovery Sydney business use to restore deleted or lost files.
- It is a method of data recovery that is performed over the internet without necessarily having the computer or the drive in possession.

Lecture 30

Question Answer discussion

Lecture 31

Chapter-5

PROBLEM SOLVING METHODOLOGY

Algorithm

An algorithm is a procedure that describes a set of instructions that must be carried out in a specific order to get the desired result.

Examples

1. Algorithm of the sum of two numbers:

Step 1: Start.

Step 2: Declare variables num1, num2 and sum.

Step 3: Read values for num1, num2.

Step 4: Add num1 and num2 and assign the result to a variable sum.

Step 5: Display sum.

Step 6: Stop.

2. Algorithm to find the greater number between two numbers:

Step 1: Start

Step 2: Declare variables a, b.

Step 3: If a > b go to step 4 otherwise go to step 5

Step 4: If A is the biggest Print "A is Bigger"

Step 5: else print "B is Bigger"

Step 6: Stop

Pseudo code

- A Pseudo code is defined as a step-by-step description of an algorithm.
- Pseudo code does not use any programming language in its representation instead it uses the simple English language text as it is intended for human understanding rather than machine reading.

- Pseudo code is the intermediate state between an idea and its implementation (code) in a high-level language.

Example

Pseudo code to find sum of two numbers:

Begin.

WRITE “Please enter two numbers to add”

READ num1.

READ num2.

Sum = num1+num2.

WRITE Sum.

End.

Flowchart

Flowchart is a diagrammatic representation of sequence of logical steps of a program.

Symbol	Name	Function
	Start/end	An oval represents a start or end point
	Arrows	A line is a connector that shows relationships between the representative shapes
	Input/Output	A parallelogram represents input or output
	Process	A rectagle represents a process
	Decision	A diamond indicates a decision

Lecture 32

Generation of Programming Languages

Programming Language:

- Programming language is a tool to express the logic or instructions for understanding of the computer.
- **Examples** of programming languages are BASIC, FORTRAN, COBOL, Pascal, C, C++, Java, Python etc.

Generations of Programming Language

The Programming languages can be classified into 5 generations:

1. First generation languages (1GL)
2. Second generation languages (2GL)
3. Third generation languages (3GL)
4. Fourth generation languages (4GL)
5. Fifth generation languages (5GL)

1. First Generation Language (Machine language)

The first generation programming language is also called low-level programming language because they were used to program the computer system at a very low level of abstraction. i.e. at the machine level. The machine language also referred to as the native language of the computer system is the first generation programming language. In the machine language, a programmer only deals with a binary number.

2. Second Generation language (Assembly Language)

The second generation programming language also belongs to the category of low-level-programming language. The second generation language comprises assembly languages that use the concept of mnemonics for the writing program. In the assembly language, symbolic names are used to represent the opcode and the operand part of the instruction.

3. Third Generation languages (High-Level Languages)

The third generation programming languages were designed to overcome the various limitations of the first and second generation programming languages. The languages of the third and later generation are considered as a high-level language because they enable the programmer to concentrate only on the logic of the programs without considering the internal architecture of the computer system.

Examples: FORTRAN, ALGOL, COBOL, C++, C

4. Fourth generation language (Very High-level Languages)

The languages of this generation were considered as very high-level programming languages required a lot of time and effort that affected the productivity of a programmer. The fourth generation programming languages were designed and developed to reduce the time, cost and effort needed to develop different types of software applications.

Examples: SOL, CSS, coldfusion

5. Fifth generation language (Artificial Intelligence Language)

The programming languages of this generation mainly focus on constraint programming. The major fields in which the fifth generation programming language are employed are Artificial Intelligence and Artificial Neural Networks.

Examples: mercury, prolog, OPS5

Lecture 33

Structured Programming Language

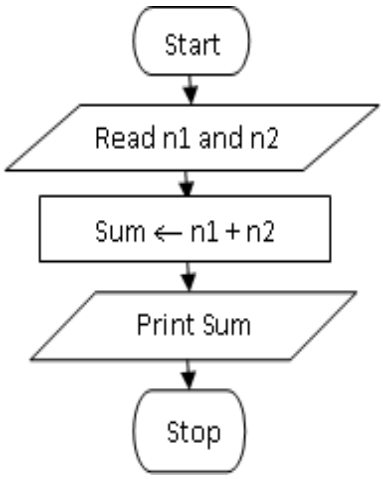
It can be defined as a programming approach in which the program is made as a single structure. It means that the code will execute the instruction by instruction one after the other. It doesn't support the possibility of jumping from one instruction to some other with the help of any statement like GOTO, etc. Therefore, the instructions in this approach will be executed in a serial and structured manner. The languages that support Structured programming approach are:

Example: Pascal, ALGOL, C, Modula-2, etc.

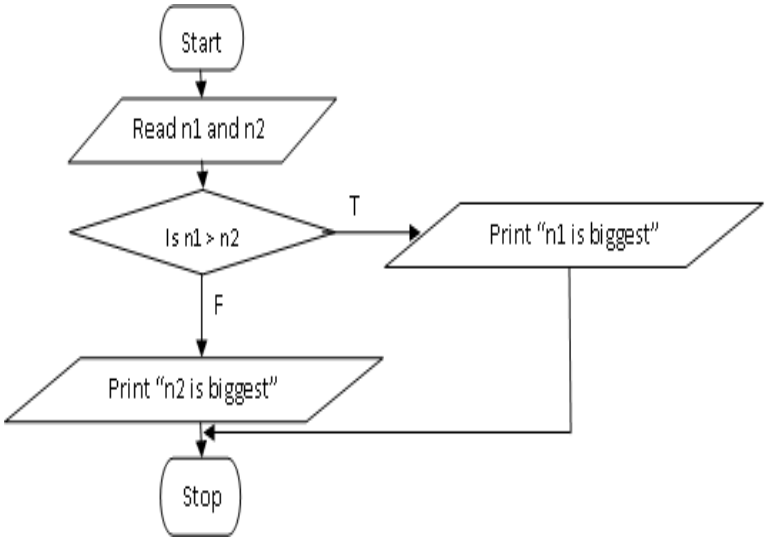
Lecture 34

Examples of Problem solving through Flowchart

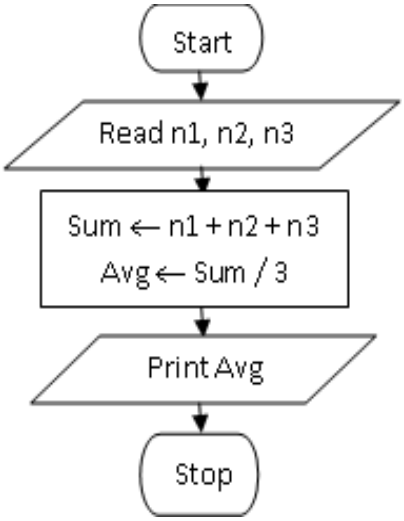
1. Flowchart to find sum of two numbers.



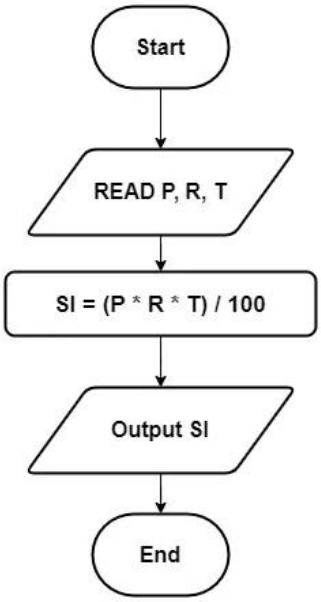
2. **Flowchart to find greater among two numbers.**



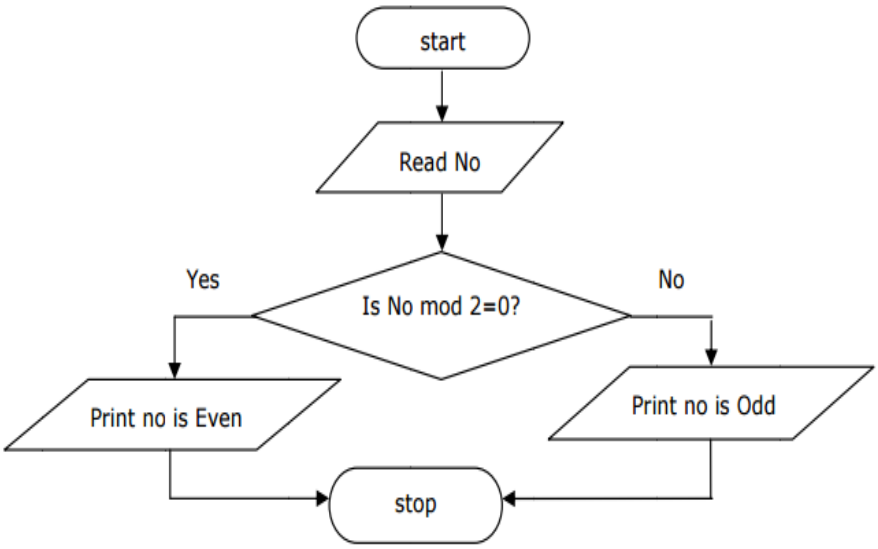
3. Flowchart to find average of three numbers.



4. Flowchart to find simple interest.



5. Flowchart to check whether a number is even or odd.



Lecture 35

Revision

Lecture 36

Chapter-6

OVERVIEW OF C PROGRAMMING LANGUAGE

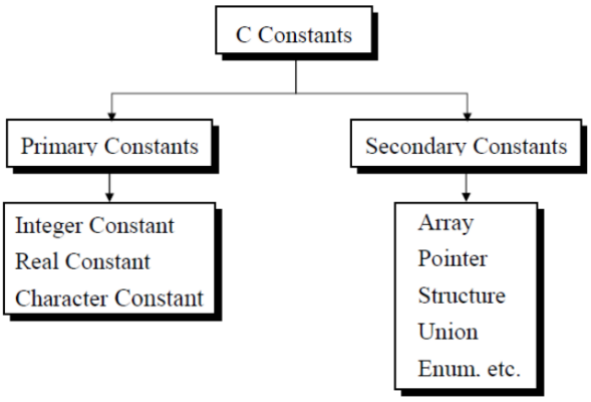
Introduction to C

C is a programming language developed at AT & T's Bell Laboratories of USA in 1972. It was designed and written by a man named Dennis Ritchie.

Lecture 37

Constants

- Constant is a value that cannot be changed during program execution. In C, any number, single character, or character string is known as a constant.
- These constants are further categorized as



Numeric constant:

- Numeric constant consists of digits. It required minimum size of 2 bytes and max 4 bytes. It may be positive or negative but by default sign is always positive.
- It is categorized into **integer constant** and **real constant**.

Integer constants

These are whole number which has no decimal point. Types of integer constants are:

- ✓ **Decimal constant:** 0-------9(base 10)
- ✓ **Octal constant:** 0-------7(base 8)
- ✓ **Hexa decimal constant:** 0----9, A------F(base 16)

- ✓ In decimal constant first digit should not be zero unlike octal constant first digit must be zero(as 076, 0127) and in hexadecimal constant first two digit should be 0x/ 0X (such as 0x24, 0x87A).

Real constant

- ✓ It is also called floating point constant. It could be either positive or negative.
- ✓ Default sign is positive.
  Ex.: +325.34 426.0 -32.76

Character constant:

- Character constant represented as a single character enclosed within a single quote. These can be single digit, single special symbol or white spaces such as '9','c','$', ' ' etc.
- Every character constant has a unique integer like value in machine's character code as if machine using ASCII (American standard code for information interchange).
- Some numeric value associated with each upper and lower case alphabets and decimal integers are as:

  A---------- Z ASCII value (65-90)

  a----------z ASCII value (97-122)

  0----------9 ASCII value (48-59)

  ; ASCII value (59)

String constant

- Set of characters are called string and when sequence of characters are enclosed within a double quote (it may be combination of all kind of symbols) is a string constant.
- String constant has zero, one or more than one character and at the end of the string null character (\0) is automatically placed by compiler.
- Example: "sarathina" , "908", "3"," ", "A" etc.

Keywords

- The keywords are also called 'Reserved words' In C Language.
- Keywords are the words whose meaning has already been explained to the C compiler and their meanings cannot be changed.
- There are 32 keyword in Turbo C :

auto	double	int	struct
break	else	long	switch
case	enum	register	typedef
char	extern	return	union
continue	for	signed	void
do	if	static	while
default	goto	sizeof	Volatile
const	float	short	Unsigned

Variables

- ✓ A variable is a data name that may be used to store a data value.
- ✓ A variable may take different values at different times of execution and may be chosen by the programmer in a meaningful way.
- ✓ It may consist of letters, digits and underscore character.

Rules for defining variables

- Should not be a reserved word like int etc.
- Should start with a letter or an underscore(_).
- Can contain letters, numbers or underscore.
- No other special characters are allowed including space.
- Variable names are case sensitive i.e. A and a are different.

Variable Declaration:

Syntax: <Data type> <variable name>;

E.g. int a;

Variable Definition:

<variable name>=<value>;

E.g. a=10;

Lecture 38

Data Types

The data type specifies the size and type of information the variable will store.

Data Type	Size	Description	Example
`int`	2 or 4 bytes	Stores whole numbers, without decimals	`1`
`float`	4 bytes	Stores fractional numbers, containing one or more decimals. Sufficient for storing 6-7 decimal digits	`1.99`
`double`	8 bytes	Stores fractional numbers, containing one or more decimals. Sufficient for storing 15 decimal digits	`1.99`
`char`	1 byte	Stores a single character/letter/number, or ASCII values	`'A'`

Format Specifier

Format specifiers in C are used to take inputs and print the output of a type. The symbol we use in every format specifier is %.

Format specifier	Description
%d	Integer Format Specifier
%f	Float Format Specifier
%c	Character Format Specifier
%s	String Format Specifier
%u	Unsigned Integer Format Specifier
%ld	Long Int Format Specifier

Structure of C Program:-

// Documentation section

// Preprocessor directives / Header files

#include<stdio.h>

// Global variables

int global_var;

```
// Main function
int main() {
    // statements and expressions
    return 0;
}
// Other functions
void otherFunction() {
    // statements and expressions
}
```

Example:

```
// Documentation section
// Program to calculate the area of a circle
// Header files
#include <stdio.h>
// Global variable
#define PI 3.14159
// Function to calculate the area of a circle
double calculateArea(double radius) {
    return PI * radius * radius;
}
// Main function
int main() {
    double radius, area;
    printf("Enter the radius of the circle: ");
    scanf("%lf", &radius);
    area = calculateArea(radius);
    printf("The area of the circle is: %.2lf\n", area);
```

```
    return 0;
}
```

Lecture 39

Managing Input and Output operations

In C, input refers to providing it with some information or data to be utilised in the program. On the other hand, output refers to writing the data and information on any printer file and displaying it on the screen. A standard library is available in the C language for reading any input and generating the output to be displayed on the console. There are mainly two types of these functions available in the C language:

Formatted

The formatted functions basically present or accept the available data (input) in a specific format. The standard library in C contains various functions for the input-output operations. The scanf() and printf() out of these functions help a programmer format the functions in their desired format. The program can use these functions for reading any form of data, like a real number, an integer, a character, and many more.

Unformatted

The unformatted functions are not capable of controlling the format that is involved in writing and reading the available data. Thus, these functions constitute the most basic forms of output and input. The supply of input or the display of output isn't allowed in the user format – thus, we call these functions *unformatted* functions for input and output.

The unformatted input-output functions further have two categories:

- The character functions
- The string functions

We use the character input functions for reading only a single character from the input device (the keyboard). On the other hand, we use the character output functions for writing just a single character on the output source (the screen). Here, the getchar(), getche(), and the getch() refer to the input functions of unformatted type, while the putchar() and putch() refer to the output functions of unformatted type.

Now, let's come to the string output and input. In any programming language, the character array or string refers to the collection of various characters. Now, various types of input and output functions are present in C programming that can easily read and write these strings. The puts() and gets() are the most commonly used ones. Here, the gets() refers to the input function used for reading the string characters while the puts() refers to the output function used for writing the string characters (in unformatted forms).

Lecture 40

The C Standard Files

All the C language programs treat all of the devices in the program in the form of files. Thus, every display device is also addressed the same way the program addresses a file. In such a case, when a program starts executing, the following three files get opened up automatically for providing the program with access to the device's screen and computer.

Device	File Pointer	Standard File
Screen	stdout	Standard output
Keyboard	stdin	Standard input
Your screen	stderr	Standard error

The C language uses the file pointer as a means for accessing the available files for reading and writing them.

Showing Output with Printf() Function

It is one of the most used functions in C. The printf() function basically gets defined in the header file stdio.h, and we use it for showing the standard output (the output available on the console).

The programmers use the printf() function for printing the value of the variable or any simple sentence (text). These variables can be of float, char, int, or the other data types.

Examples of printf()

Printing of a Sentence

```
#include <stdio.h>

int main() {

// with the use of printf()

printf("Let us go home tonight");

return 0;

}
```

The Output generated here would be:

Let us go home tonight

Printing of an Integer

Here, we use the format specifier %d or %i.

```
#include <stdio.h>

int main() {

int q = 50;

// with the use of printf()

printf("The given value of q is: %d", q);

return 0;

}
```

The Output generated here would be:

The given value of q is 50

Printing of a Character

Here, we use the format specifier %c.

```
#include <stdio.h>

int main() {

// with the use of printf()

char age = '43';

printf("Today is Clara's birthday and she is: %c", age);

return 0;

}
```

The Output generated here would be:

Today is Clara's birthday and she is 43

Printing of Double and Float

Here, we use the format specifier %f for the float value and the format specifier %lf for the double value.

```
#include <stdio.h>

int main() {

// with the use of printf()

double num_11 = 15556522.0978678;

float num_22 = 15.50;

printf("The value of the num_11 is: %f \n", num_11);

printf("The value of num_22 is: %lf", num_22);

return 0;

}
```

The Output generated here would be:

The value of the num_11 is 15556522.0978678

The value of the num_22 is 15.50

Printing of Multiple Outputs

```
#include <stdio.h>

int main() {

// with the use of printf() for multiple outputs in the program

int year = 1997;

int month = 08;

int day = 18;

printf("Today's date is: %d-%d-%d", year, month, day);

return 0;

}
```

The Output generated here would be:

Today's date is 1997-08-18

Taking Input with Scanf() Function

We make use of the scanf() function whenever we want the program to receive inputs from us. Thus, when the program receives input from the user, it stores those input values into any variable.

In short, we use the scanf() function to receive inputs of all data types from a user. The only thing that we must take care of is that those variables in which we store the input values have a similar data type.

Examples of scanf()

Taking Input of Integer Value

Here, we must perform the definition of the integer variable before using the scanf() function in the program.

```
#include <stdio.h>

int main() {

// with the use of scanf()

int input_from_user;

printf("Hello, please enter a digit here: ");

scanf("%d", &input_from_user);

printf("The digit that you entered is: %d", input_from_user);

return 0;

}
```

The Output generated here would be:

```
Hello, please enter a digit here: 25

The digit that you entered is: 25
```

Notice that we have made use of the format specifier %d for informing the scanf() function here that the input received from the user will be of the integer type. We have also used the symbol '&' here before the variable name because the &input_from_user would refer to the address of the input_from_user variable where any user would store their input values.

Taking Input of Float Value

```
#include <stdio.h>
```

```
int main() {

// with the use of scanf()

float input_from_user;

printf("Hi, please enter a decimal value: ");

scanf("%f", &input_from_user);

printf("The value that you have entered is: %f", input_from_user);

return 0;

}
```

The Output generated here would be:

```
Hi, please enter a decimal value: 8.016

The value that you have entered is: 8.016
```

Here, note that we are making use of the format specifier %f and also defined the float variable type. If we try to do the same when taking the input in the form of a double data type, in this case, the %lf will be the format specifier.

Taking Input of Character Value

```
#include <stdio.h>

int main() {

// with the use of scanf()

char gender;

printf("Hi, we would like you to enter your gender (F, M or O): ");

scanf("%c", &gender);

printf("Thanks, your gender is: %c", gender);

return 0;

}
```

The Output generated here would be:

```
Hi, we would like you to enter your gender (F, M or O): F
```

Thanks, your gender is: F

Taking Input of Multiple Values

```
#include <stdio.h>

int main() {

// with the use of scanf() for multiple numbers of inputs

int age;

char gender;

printf("Please enter your gender and then age(F, M or O): ");

scanf("%d %c", &gender, &age);

printf("The information that you entered is: %c and %d", gender, age);

return 0;

}
```

The Output generated here would be:

Please enter your gender and then age(F, M or O): 24 M

The information that you entered is: 24 M

Extra Information about Input-Output Functions

The scanf() function assists in returning the total number of characters that it reads. On the other hand, the printf() function assists in returning the total number of characters that it prints.

```
int x = printf("chocolate");

printf("Value of x is: %d", x);
```

The Output generated here would be:

chocolateValue of x is: 9

In the program given above, the program printf("chocolate"); would generate 9 as the output/ result. This will then be stored in the available variable x. It is because the word chocolate has a total of 9 characters. As a matter of fact, the first printf() statement here will also print the statement chocolate on the output/ result.

The putchar() & getchar() Functions

The putchar() function in a program displays all the characters that are passed to this function on the screen. After that, it returns the very same character. The putchar() function also displays one single character at any given time.

We can also utilise the putchar() method in any given loop if we are willing to display multiple characters.

The getchar() function in a program basically reads the characters available from the terminal. It then returns these characters in the form of integers. The getchar() function is capable of reading just a single character at any given time. A programmer can easily use this method in the case of a loop if they are willing to read more than a single character.

```
#include <stdio.h>

void main( )

{

int x;

printf("Please enter a character here");

/*

We are taking a character in the form of input and storing it in the variable x

*/

x = getchar();

/*

we are displaying the character stored in the variable x

*/

putchar(x);

}
```

The Output generated here would be:

Please enter a character here: Chocolate C

The compilation of the code mentioned above will ask the programmer to enter their desired value. Whenever we enter the available value, the program will generate an output displaying the value that we have entered in the program.

Chocolate C

Lecture 41

OPERATORS IN C

An operator is a symbol that specifies an operation to be performed on the operands.

E.g.: a + b where + is an operator and a, b are operands.

Operator Types:

- Arithmetic operators
- Relational operators
- Logical operators
- Bitwise operators
- Assignment operators
- Increment/Decrement operators
- Conditional operators

Arithmetic operators:

Arithmetic Operators

An arithmetic operator performs mathematical operations such as addition, subtraction, multiplication, division etc on numerical values (constants and variables).

ARITHMETIC OPERATORS	OPERATION	EXAMPLE
+	Addition	10 + 2 = 12
–	Subtraction	10 – 2 = 8
*	Multiplication	10 * 2 = 20
/	Division	10 / 2 = 5
%	Modulus	10 % 2 = 0 (Here remainder is zero). If it is 10 % 3 then it will be 1.

Relational Operators

Relational operators are symbols that are used to compare two values and determine the relationship between them.

Operator	Meaning of Operator	Example
==	Equal to	5 == 3 is evaluated to 0
>	Greater than	5 > 3 is evaluated to 1
<	Less than	5 < 3 is evaluated to 0
!=	Not equal to	5 != 3 is evaluated to 1
>=	Greater than or equal to	5 >= 3 is evaluated to 1
<=	Less than or equal to	5 <= 3 is evaluated to 0

Logical operators

An expression containing logical operator returns either 0 or 1 depending upon whether expression results true or false.

Operator	**Meaning**	**Example**
&&	Logical AND. True only if all operands are true	If c = 5 and d = 2 then, ((c==5) && (d>5)) = 0.
||	Logical OR. True only if either one operand is true.	If c = 5 and d = 2 then, ((c==5) || (d>5)) = 1.
!	Logical NOT. True only if the operand is 0	If c = 5 then, expression !(c==5)=0

Bitwise operators

Operator	**Symbol**	**Description**
Bitwise AND	&	Compares each bit of two operands and returns 1 if both bits are 1, otherwise it returns 0.
Bitwise OR	|	Compares each bit of two operands and returns 1 if either bit is 1, otherwise it returns 0.
Bitwise XOR	^	Compares each bit of two operands and returns 1 if the bits are different, otherwise it returns 0.

Bitwise Complement	~	Flips all the bits of an operand, converting each 0 bit to 1 and each 1 bit to 0.
Left shift	<<	Moves the bits of an operand to the left by a specified number of positions, filling in the empty positions with 0.
Right shift	>>	Moves the bits of an operand to the right by a specified number of positions, filling in the empty positions with 0 or 1 depending on the sign of the original value.

Example:

```
a = 1100; // (12 in decimal)
b = 1010; // (10 in decimal)
c = a & b;
c = 1000; // (8 in decimal)
c = a | b;
c = 1110; // (14 in decimal)
c = a ^ b;
c = 0110; // (6 in decimal)
a = 1010; // (10 in decimal)
```

If we left shift 'a' by 2 positions, the resulting value is:

c = a << 2;
c = 101000; // (40 in decimal)
`a = 1100; // (12 in decimal)`
If we right shift 'a' by 2 positions, the resulting value is:

c = a >> 2; // (3 in decimal)
c = 11;

Assignment operators

An assignment operator is used for assigning a value to a variable.

Operator	Example	Same as
=	a = b	a = b
+=	a += b	a = a+b
-=	a -= b	a = a-b
*=	a *= b	a = a*b
/=	a /= b	a = a/b
%=	a %= b	a = a%b

Increment/Decrement operators

Increment Operator (++) : Increases the operand's value by one.

Decrement Operator (--) : Decreases the operand's value by one.
Both of these operators can be used in two forms:

Prefix: The operator is placed before the variable. The variable's value is updated before the expression is evaluated.

Postfix: The operator is placed after the variable. The variable's value is updated after the expression is evaluated.

Example:

```
int x = 5;
int y = ++x;   // Prefix (y = 6, x = 6)
int z = y--;   // Postfix (z = 6, y = 5)
```

Conditional Operators

The conditional operator is also known as a **ternary operator**. The conditional statements are the decision-making statements which depend upon the output of the expression. It is represented by two symbols, i.e., '?' and ':'.

Syntax of a conditional operator
Expression1? expression2: expression3;
Example:

```
X=3;
(x%2==0)?printf("even"):printf("odd");
```

Output: odd

Expressions

An expression in C is defined as 2 or more operands are connected by one operator and which can also be said to a formula to perform any operation.

Example:

```
x = 9/2 + a-b;
a+b = = x+y
```

Lecture 42

Type conversion

The type conversion is the process of converting a data value from one data type to another data type automatically by the compiler. Sometimes type conversion is also called **implicit type conversion**. The implicit type conversion is automatically performed by the compiler.

Example:

```
int i = 10 ;
float x = 15.5 ;
char ch = 'A' ;

i = x ; ========> x value 15.5 is converted as 15 and assigned to variable i.

x = i ; ========> Here i value 10 is converted as 10.000000 and assigned to variable x.

i = ch ; ========> Here the ASCII value of A (65) is assigned to i.
```

Typecasting

Typecasting is also called an **explicit type conversion**. Compiler converts data from one data type to another data type implicitly.

Example:

```
int totalMarks = 450, maxMarks = 600 ;
float average ;

average = (float) totalMarks / maxMarks * 100 ;
```

In the above example code, both totalMarks and maxMarks are integer data values. When we perform totalMarks / maxMarks the result is a float value, but the destination (average) datatype is a float. So we use type casting to convert totalMarks and maxMarks into float data type.

Lecture 43

Programs related to above concept.

Lecture 44

Decision Control Statements

Using decision control statements we can control the flow of program in such a way so that it executes certain statements based on the outcome of a condition (i.e. true or false). In C Programming language we have following decision control statements.

1. if statement
2. if-else statement
3. if-else-if statement
4. switch statement

if statement:

The statements inside the body of "if" only execute if the given condition returns true. If the condition returns false then the statements inside "if" are skipped.

```
if (condition)
{
    //Block of C statements here
    //These statements will only execute if the condition is true
}
```

If else statement

If condition returns true then the statements inside the body of "if" are executed and the statements inside body of "else" are skipped.
If condition returns false then the statements inside the body of "if" are skipped and the statements in "else" are executed.

Syntax

```
if(condition) {
  // Statements inside body of if
}
else {
  //Statements inside body of else
```

}

if-else-if statement:

if else if ladder in C programming is used to test a series of conditions sequentially. Furthermore, if a condition is tested only when all previous if conditions in the if-else ladder are false. If any of the conditional expressions evaluate to be true, the appropriate code block will be executed, and the entire if-else ladder will be terminated.

Syntax:

```
// any if-else ladder starts with an if statement only
if(condition) {


}
else if(condition) {
 // this else if will be executed when condition in if is false and
 // the condition of this else if is true
}
.... // once if-else ladder can have multiple else if
else { // at the end we put else
}
```

switch statement

The switch case statement is an alternative to the if else if ladder that can be used to execute the conditional code based on the value of the variable specified in the switch statement. The switch block consists of cases to be executed based on the value of the switch variable.

Syntax of switch

```
switch (expression) {
   case value1:
      statements;
   case value2:
      statements;
   ....
   ....
   ....
```

```
    default:
        statements;
}
```

Lecture 45, 46 & 47

Programs related to Control statement

Lecture 48

Looping Statements

Looping Statements in C execute the sequence of statements many times until the stated condition becomes false. C supports the following looping statements:

1. The while loop
2. The do-while loop
3. The for loop

while Loop

In while loop, a condition is evaluated before processing a body of the loop. If a condition is true then and only then the body of a loop is executed. After the body of a loop is executed then control again goes back at the beginning, and the condition is checked if it is true, the same process is executed until the condition becomes false. Once the condition becomes false, the control goes out of the loop.

Syntax:

```
while (condition) {
        statements;
}
```

Do-while loop in C

In the do-while loop, the body of a loop is always executed at least once. After the body is executed, then it checks the condition. If the condition is true, then it will again execute the body of a loop otherwise control is transferred out of the loop.

Syntax:

```
do {

    statements;
} while (expression);
```

For loop:

The initial value of the for loop is performed only once. The condition is a Boolean expression that tests and compares the counter to a fixed value after each iteration, stopping the for loop when false is returned. The incrementation/decrementation increases (or decreases) the counter by a set value.

Syntax

```
for (initial value; condition; incrementation or decrementation )
{
  statements;
}
```

Break

When a break statement is encountered inside a loop, it immediately terminates the loop, and control is transferred to the next statement outside the loop. Similarly, when a break statement is encountered inside a switch block, it terminates the block, and control is transferred to the next statement outside the block.

Continue

When the continue statement is encountered inside a loop, the control of the program immediately goes to the loop's increment/decrement part, skipping the remaining statements in the current iteration. The loop then continues with the next iteration.

goto

The goto statement is used to jump to a certain location within a function from any other location. The program control is moved to a labeled statement inside the same function using this technique.

Lecture 49 & 50

Programming Assignments

1. Write a C program to accept two integers and check whether they are equal or not.
Test Data : 15 15
Expected Output : Number1 and Number2 are equal

2. Write a C program to check whether a given number is even or odd.
Test Data : 15
Expected Output :15 is an odd integer

3. Write a C program to check whether a given number is positive or negative.
Test Data : 15
Expected Output :15 is a positive number

4. Write a C program to find whether a given year is a leap year or not.
Test Data : 2016
Expected Output :
2016 is a leap year.

5. Write a C program to read the age of a candidate and determine whether he is eligible to cast his/her own vote.
Test Data : 21
Expected Output :Congratulation! You are eligible for casting your vote.

6. Write a C program to read the value of an integer m and display the value of n is 1 when m is larger than 0, 0 when m is 0 and -1 when m is less than 0.
Test Data : -5
Expected Output :The value of n = -1

7. Write a C program to accept the height of a person in centimeters and categorize the person according to their height.
Test Data : 135
Expected Output :The person is Dwarf.

8. Write a C program to find the largest of three numbers.
Test Data : 12 25 52
Expected Output :1st Number = 12, 2nd Number = 25, 3rd Number = 52
The 3rd Number is the greatest among three

9. Write a C program to accept a coordinate point in an XY coordinate system and determine in which quadrant the coordinate point lies.

Test Data : 7 9

Expected Output :The coordinate point (7,9) lies in the First quadrant.

10. Write a C program to determine eligibility for admission to a professional course based on the following criteria:

Eligibility Criteria : Marks in Maths >=65 and Marks in Phy >=55 and Marks in Chem>=50 and Total in all three subject >=190 or Total in Maths and Physics >=140 ---------- Input the marks obtained in Physics :65 Input the marks obtained in Chemistry :51 Input the marks obtained in Mathematics :72 Total marks of Maths, Physics and Chemistry : 188 Total marks of Maths and Physics : 137 The candidate is not eligible. Expected Output :The candidate is not eligible for admission.

Lecture 51

Revision

Lecture 52

Chapter-7

ADVANCED FEATURES OF C

Functions

- A function is a block of code which only runs when it is called.
- You can pass data, known as parameters, into a function.
- Functions are used to perform certain actions, and they are important for reusing code: Define the code once, and use it many times.

Types of Functions

Functions in C programming are classified into two types:

1. Library Functions

Library functions are already defined in the C libraries. This means that we do not have to write a definition or the function's body to call them. We can simply call them without defining them as they are already defined. However, we need to include the library at the beginning of the code for calling a library function. We can then use the proper syntax of the function to call them.

Example: printf(), scanf(), ceil(), and floor()

2. User-Defined Functions

These are the functions that a developer or the user declares, defines, and calls in a program. This increases the scope and functionality, and reusability of C programming as we can define and use any function we want. A major plus point of C programming is that we can add a user-defined to any library to use it in other programs.

Example:

```
add(){

        statements defined by user;
```

```
}
```

Example of a function

```
//program to add two umbers
#include <stdio.h>
/* function declaration */
int add(int a, int b);
/* function definition */
int add(int a, int b) {
   return a + b;
}
int main() {
   int result = add(2, 3); //function call
   printf("The result is %d\n", result);
   return 0;
}
```

Output

The result is5

Passing Parameters to the Function

Parameters are the data values that are passed from calling function to called function. In C, there are two types of parameters and they are as follows.

- Actual Parameters
- Formal Parameters

The **actual parameters** are the parameters that are specified in calling function. The **formal parameters** are the parameters that are declared at called function. When a function gets executed, the copy of actual parameter values is copied into formal parameters.

In C Programming Language, there are two methods to pass parameters from calling function to called function and they are as follows:

- Call by Value
- Call by Reference

Lecture 54

Quiz Test

Lecture 55

Call by Value

In **call by value** parameter passing method, the copy of actual parameter values are copied to formal parameters and these formal parameters are used in called function. **The changes made on the formal parameters does not affect the values of actual parameters**. That means, after the execution control comes back to the calling function, the actual parameter values remains same.

Call by Reference

In **Call by Reference** parameter passing method, the memory location address of the actual parameters is copied to formal parameters. This address is used to access the memory locations of the actual parameters in called function. In this method of parameter passing, the formal parameters must be **pointer** variables.

That means in call by reference parameter passing method, the address of the actual parameters is passed to the called function and is received by the formal parameters (pointers). Whenever we use these formal parameters in called function, they directly access the memory locations of actual parameters. So **the changes made on the formal parameters effects the values of actual parameters**.

Scope of Variables

The scope of a variable in C is the block or the region in the program where a variable is declared, defined, and used. Outside this region, we cannot access the variable and it is treated as an undeclared identifier.

- C scope rules can be covered under the following two categories:

1. Global Scope
2. Local Scope

Global Scope

- ✓ The global scope refers to the region outside any block or function.
- ✓ The variables declared in the global scope are called global variables.
- ✓ Global variables are visible in every part of the program.

Local Scope

- ✓ The local scope refers to the region inside a block or a function. It is the space enclosed between the { } braces.
- ✓ The variables declared within the local scope are called local variables.
- ✓ Local variables are visible in the block they are declared in and other blocks nested inside that block.
- ✓ Local scope is also called Block scope.

Storage Classes

Storage classes in C are used to determine the lifetime, visibility, memory location, and initial value of a variable. There are four types of storage classes in C

- Automatic
- External
- Static
- Register

Storage Classes	Storage Place	Default Value	Scope	Lifetime
auto	RAM	Garbage Value	Local	Within function
extern	RAM	Zero	Global	Till the end of the main program Maybe declared anywhere in the program
static	RAM	Zero	Local	Till the end of the main program, Retains value between multiple functions call
register	Register	Garbage Value	Local	Within the function

Recursion

Recursion is the process of a function calling itself repeatedly till the given condition is satisfied. A function that calls itself directly or indirectly is called a recursive function and such kind of function calls are called recursive calls.

Types of Recursion:

The following are the different types of recursion in C programming language:

1. Direct Recursion
2. Indirect Recursion
3. Tail Recursion
4. No Tail/ Head Recursion
5. Linear recursion
6. Tree Recursion

Direct Recursion: A function calls itself within the definition of the function through direct recursion.

Indirect Recursion: At least two functions that call each other repeatedly in a cycle constitute indirect recursion.

Tail Recursion: When a recursive function calls itself in a loop and that looping statement is the final one the function performs, the function is said to be "tail-recursive."

Non-Tail / Head Recursion: The non-tail or head recursion of a function The initial statement in a function will be the recursive call if it does one on its own.

Linear Recursion: If a function only makes one call to itself each time it is executed and expands linearly as a function of the size of the problem, the function is said to be linear recursive.

Tree Recursion: When a recursive function in C calls itself more than once, the result is a branching structure that resembles a tree.

Lecture 56

One Dimensional Array

- An array is a systematic arrangement of similar objects, usually in rows and columns.
- One-dimensional arrays, also known as single arrays, are arrays with only one dimension or a single row.

Declaration: Datatype arrayname[arraysize];

Initialization: Datatype arrayname[arraysize]={value1,value2,…};

Example:

```
#include <stdio.h>
int main() {
    int numbers[5] = {10, 20, 30, 40, 50};
   for(int i=0; i<5; i++) {
   printf("numbers[%d] = %d\n", i, numbers[i]);
  }
return 0;
}
```

Output:

```
numbers[0] = 10
numbers[1] = 20
numbers[2] = 30
numbers[3] = 40
numbers[4] = 50
```

Multidimensional Array

A multidimensional array is basically an array of arrays.

A 2D array is also known as a matrix (a table of rows and columns).

Declaration and Initialization:

```
int matrix[2][3] = { {1, 4, 2}, {3, 6, 8} };
```

	COLUMN 0	COLUMN 1	COLUMN 2
ROW 0	1	4	2
ROW 1	3	6	8

Example:

//Program to Add Two Matrices

```
#include <stdio.h>
```

```
int main() {
  int r, c, a[100][100], b[100][100], sum[100][100], i, j;
  printf("Enter the number of rows (between 1 and 100): ");
  scanf("%d", &r);
  printf("Enter the number of columns (between 1 and 100): ");
  scanf("%d", &c);
  printf("\nEnter elements of 1st matrix:\n");
  for (i = 0; i < r; ++i)
    for (j = 0; j < c; ++j) {
      printf("Enter element a%d%d: ", i + 1, j + 1);
      scanf("%d", &a[i][j]);
    }
  printf("Enter elements of 2nd matrix:\n");
  for (i = 0; i < r; ++i)
    for (j = 0; j < c; ++j) {
      printf("Enter element b%d%d: ", i + 1, j + 1);
      scanf("%d", &b[i][j]);
    }
  // adding two matrices
  for (i = 0; i < r; ++i)
    for (j = 0; j < c; ++j) {
      sum[i][j] = a[i][j] + b[i][j];
    }
  // printing the result
  printf("\nSum of two matrices: \n");
  for (i = 0; i < r; ++i)
    for (j = 0; j < c; ++j) {
```

```
      printf("%d   ", sum[i][j]);
      if (j == c - 1) {
        printf("\n\n");
      }
    }
  return 0;
}
```

Output

```
Enter the number of rows (between 1 and 100): 2
Enter the number of columns (between 1 and 100): 3
Enter elements of 1st matrix:
Enter element a11: 2
Enter element a12: 3
Enter element a13: 4
Enter element a21: 5
Enter element a22: 2
Enter element a23: 3
Enter elements of 2nd matrix:
Enter element b11: -4
Enter element b12: 5
Enter element b13: 3
Enter element b21: 5
Enter element b22: 6
Enter element b23: 3
Sum of two matrices:
-2   8   7
10   8   6
```

Lecture 57

String Operations

- Strings are used for storing text/characters.
- For example, "Hello World" is a string of characters.

Creating a string:

```
1. char greetings[] = "Hello World!";
   printf("%s", greetings);

2.char greetings[] = {'H', 'e', 'l', 'l', 'o', ' ', 'W', 'o', 'r', 'l', 'd', '!', '\0'};
  printf("%s", greetings);
```

String Functions

- C also has many useful string functions, which can be used to perform certain operations on strings.

- To use them, you must include the <string.h> header file in your program:#include <string.h>

String Length

To get the length of a string, you can use the strlen() function:

Example:

```
char alphabet[]= "ABCDEFGHIJKLMNOPQRSTUVWXYZ";
printf("%d", strlen(alphabet));
```

Concatenate Strings

- To concatenate (combine) two strings, you can use the strcat() function:

Example:

```
char str1[20] = "Hello ";
char str2[] = "World!";
// Concatenate str2 to str1 (result is stored in str1)
strcat(str1, str2);
// Print str1
printf("%s", str1);
```

Copy Strings

To copy the value of one string to another, you can use the strcpy() function:

Example:

```
char str1[20] = "Hello World!";
char str2[20];
// Copy str1 to str2
strcpy(str2, str1);
// Print str2
printf("%s", str2);
```

Compare Strings

- To compare two strings, you can use the strcmp() function.
- It returns 0 if the two strings are equal, otherwise a value that is not 0:

Example

```
char str1[] = "Hello";
char str2[] = "Hello";
char str3[] = "Hi";

// Compare str1 and str2, and print the result
printf("%d\n", strcmp(str1, str2));  // Returns 0 (the strings are equal)

// Compare str1 and str3, and print the result
printf("%d\n", strcmp(str1, str3));  // Returns -4 (the strings are not equal)
```

Lecture 58

Pointers

- A **pointer** is a variable that **stores** the **memory address** of another variable as its value.
- A **pointer variable points** to a **data type** (like int) of the same type, and is created with the * operator.
- The address of the variable you are working with is assigned to the pointer.

Example:

```
int myAge = 43;     // An int variable
int* ptr = &myAge;  // A pointer variable, with the name ptr, that stores the address of myAge

// Output the value of myAge (43)
printf("%d\n", myAge);

// Output the memory address of myAge (0x7ffe5367e044)
printf("%p\n", &myAge);

// Output the memory address of myAge with the pointer (0x7ffe5367e044)
printf("%p\n", ptr);
```

Pointer Expression

- Like other variables pointer variables can be used in expressions.

1) If p1 and p2 are properly declared and initialized pointers, then the following statements are valid:

```
Y=*p1**p2;
Sum=sum+*p1;
Z=5*-*p2/ *p1;
*p2=*p2+10;
*p1=*p1+*p2;
*p1=*p2-*p1;
```

Pointer Arithmetic

Following arithmetic operations are possible on the pointer in C language:

- Increment
- Decrement
- Addition
- Subtraction
- Comparison

Programming Assignments

1. Write a program in C to find the square of any number using the function.
Test Data: Input any number for square : 20
Expected Output : The square of 20 is : 400.00

2. Write a program in C to swap two numbers using a function.
Test Data :Input 1st number : 2
Input 2nd number : 4
Expected Output :Before swapping: n1 = 2, n2 = 4

After swapping: n1 = 4, n2 = 2
3. Write a program in C to check if a given number is even or odd using the function.
Test Data :Input any number : 5
Expected Output : The entered number is odd.

4. Write a program in C to store elements in an array and print them.
Test Data :Input 10 elements in the array :
element - 0 : 1
element - 1 : 1
element - 2 : 2
.....
Expected Output :Elements in array are: 1 1 2 3 4 5 6 7 8 9
5. Write a program in C to read n number of values in an array and display them in reverse order.
Test Data :Input the number of elements to store in the array :3
Input 3 number of elements in the array :
element - 0 : 2
element - 1 : 5
element - 2 : 7
Expected Output :The values store into the array are :
2 5 7
The values store into the array in reverse are :
7 5 2
6. Write a program in C to find the sum of all elements of the array.
Test Data :Input the number of elements to be stored in the array :3
Input 3 elements in the array :

element - 0 : 2
element - 1 : 5
element - 2 : 8
Expected Output :Sum of all elements stored in the array is : 15

7. Write a program in C to add two numbers using pointers.
Test Data : nput the first number : 5
Input the second number : 6
Expected Output :The sum of the entered numbers is : 11

8**.** Write a program in C to add numbers using call by reference.
Test Data :Input the first number : 5
Input the second number : 6
Expected Output :The sum of 5 and 6 is 11

9. Write a program in C to find the maximum number between two numbers using a pointer.
Test Data :Input the first number : 5
Input the second number : 6
Expected Output :6 is the maximum number.

10. Write a program in C to store n elements in an array and print the elements using a pointer.
Test Data :Input the number of elements to store in the array :5
Input 5 number of elements in the array :
element - 0 : 5
element - 1 : 7
element - 2 : 2
element - 3 : 9
element - 4 : 8
Expected Output :The elements you entered are :

element - 0 : 5
element - 1 : 7
element - 2 : 2
element - 3 : 9
element - 4 : 8

Lecture 59

Structure

Structure (struct) is a user-defined data type in a programming language that stores different data types' values together. The **struct** keyword is used to define a structure data type in a program.

Syntax of struct

```
struct [structure_name]
{
   type member_1;
   type member_2;
   . . .
   type member_n;
};
```

Union

In "c," programming union is *a user-defined data type* that is used to store the different data type's values. However, in the union, one member will occupy the memory at once. In other words, we can say that the size of the union is equal to the size of its largest data member size. Union offers an effective way to use the same memory location several times by each data member. The **union** keyword is used to define and create a union data type.

Syntax of Union:

```
union [union name]
   {
type member_1;
   type member_2;
   . . .
   type member_n;
   };
```

Difference Between Structure and Union in C

Parameter	Structure	Union
Definition	Defined using the keyword "struct"	Defined using the keyword "union"
Memory	Separate memory for each member	Shared memory for all

		members
Size	Equal to or greater than sum of members' sizes	Size equal to the largest member's size
Access	Multiple members can be accessed simultaneously	Only one member can be accessed at a time
Size determination	Determined by the sum of individual members' sizes	Determined by the size of the largest member
Member effects	Changing the value of one member does not affect others	Change the value of one member affects others

Lecture 60

Discussion of previous year questions