BCS-011 : COMPUTER BASICS AND PC SOFTWARE

December 2017

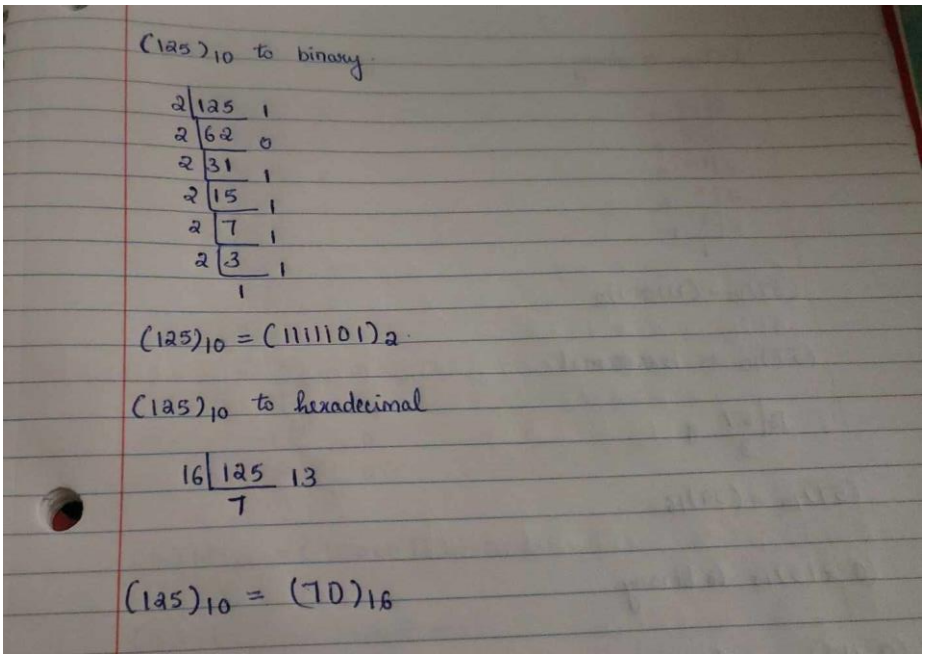
1.

(a) Convert the following decimal numbers to binary number and hexadecimal number : 4

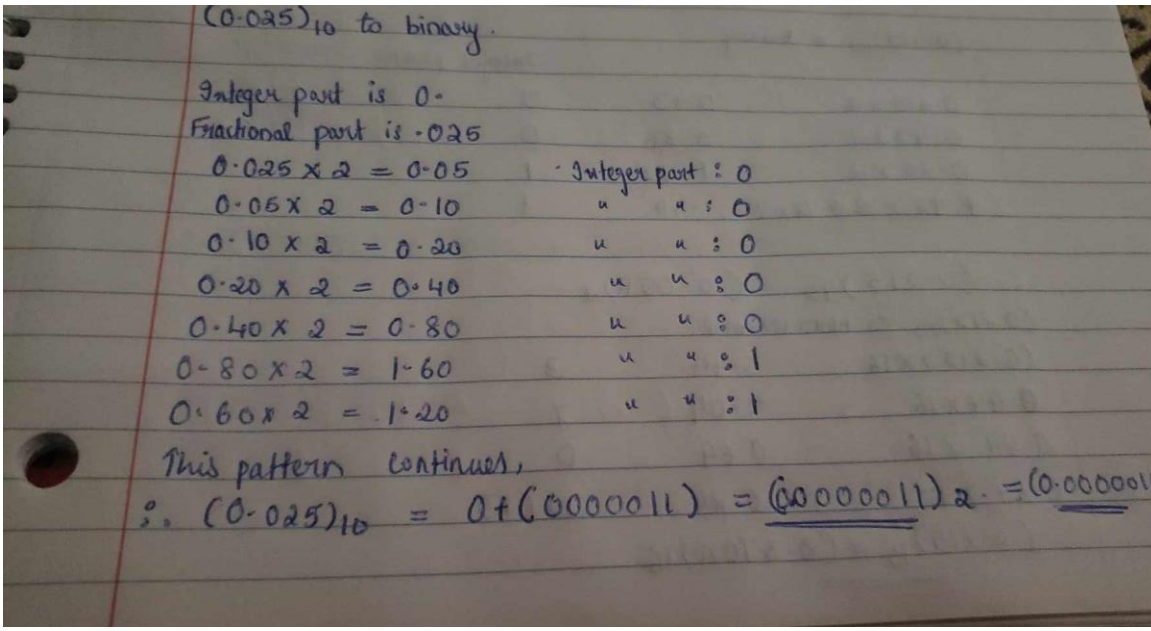
(i) 125 (ii) 0.025

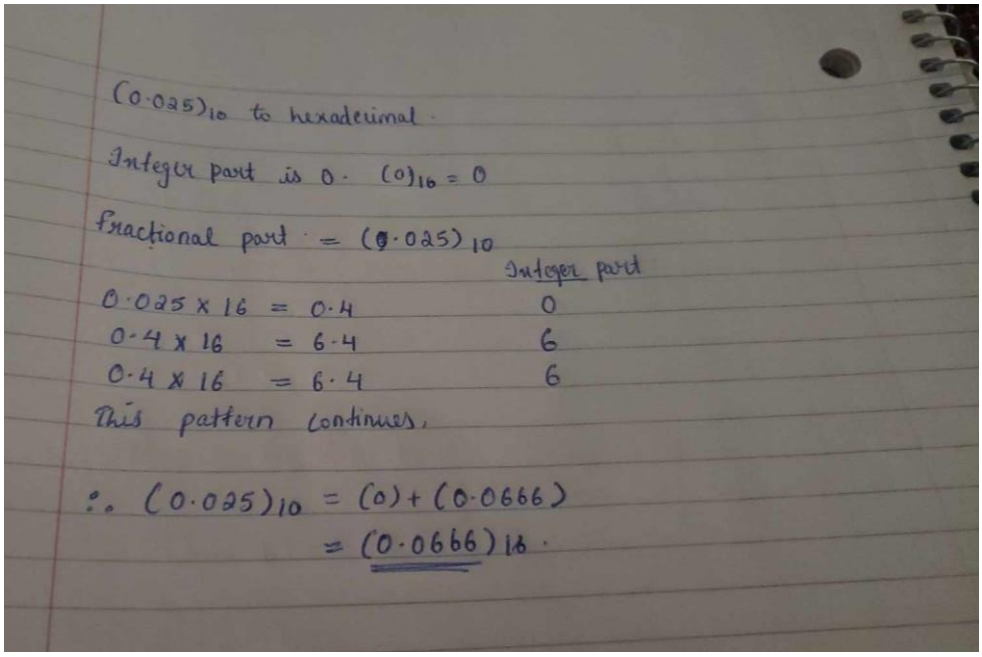
Ans:

(i) 125



(ii) 0.025





(b) Define the term Main Memory. List the differences between RAM and ROM. 4

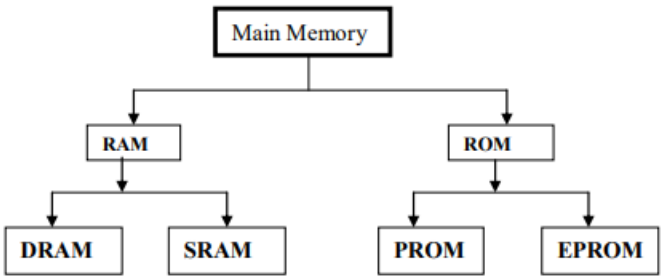
Ans:

Ans: Main memory is also known as primary memory, semiconductor memory or random-access memory. It is a crucial component of a computer system. It stores programs and data which are currently needed by the CPU. The main memory stores the programs and data required by the CPU for carrying out its operations. The primary (main) storage is a semiconductor device that is built using integrated circuits. The data is stored in binary form in main memory.

Another part of main memory is Read Only Memory (ROM). ROMs are those memories on which it is not possible to write the data. They can only be read. Thus RAM and ROM memories are used as the main memory of the computer.

Types of main memory :

Main Memory can be of various types like Random Access Memory (RAM) and Read-Only Memory (ROM). The below diagram shows different types of main memory.



RAM(Random Access Memory): The Read and write memory (R/W memory) of a computer is called a RAM. The user can write information into RAM and read information from it. It is called random access since any memory location can be accessed in a random manner for reading and writing. The access time is the same for each memory location. Random Access Memory (RAM) is really the main store and is the place where the program and software we load gets stored.

It usually refers to “temporary” memory, which means that when the system is shut down, the memory is lost.

RAM is further divided into static RAM and Dynamic RAM.

Read Only Memory: A Read-Only memory (ROM) is a non-volatile memory, i.e., the information stored in it is not lost even if the power supply goes off. Thus a Read Only Memory (ROM) is one in which information is stored permanently. , the information from ROM can only be READ and it is not possible to WRITE fresh information to it. It is much cheaper compared to RAMs when produced in large volumes. ROM is used for storing a special set of instruction, which the computer needs when it starts up (boots up). The contents of ROMs are decided by the manufacturers. The contents are permanently stored in a ROM at the time of manufacture.

ROM is further divided into Programmable ROM (PROM) and Erasable PROM.

RAM vs ROM:

RAM	ROM

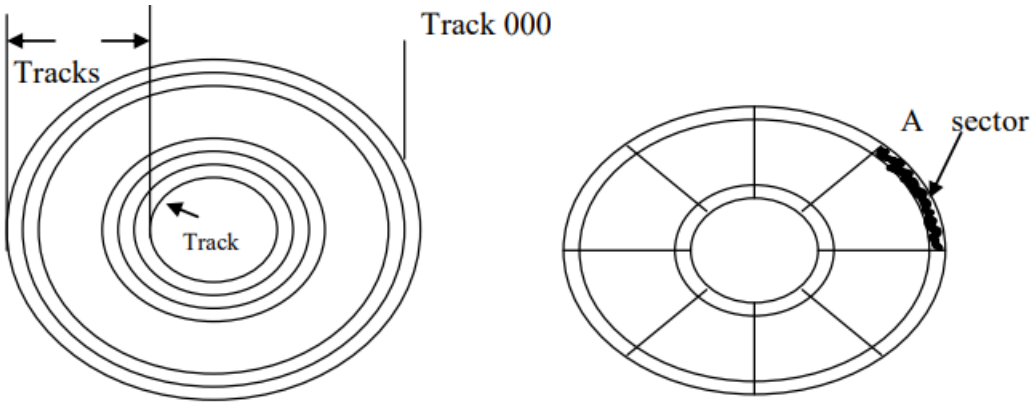
RAM stands for Random Access Memory.	ROM stands for Read Only Memory.
RAM is a temporary memory.	ROM is a permanent memory.
RAM is the memory that stores the data that you're currently working with.	It is typically used to store firmware or microcode, which is used to initialize and control hardware components of the computer.
RAM is a volatile memory that could store the data as lang as the power is supplied.	ROM is a non-volatile memory that the memory could retain the data even when the power is turned off.
Read and Write operations are supported.	Only read operations are supported.
It is a high-speed memory.	It is much slower than RAM.
CPU can easily access data stored in RAM.	CPU cannot easily access data stored in ROM.
RAM is costlier than ROM.	ROM is cheaper than RAM.
RAM has a higher capacity when compared to ROM.	ROM has a lower capacity compared to RAM.
Data in RAM can be modified, erased or read.	Data in ROM can only be read, it cannot be modified or erased.

(c) Define the terms Tracks, Sectors and Cylinders in the context of a hard disk. A disk pack has 12 platters (plates) having 2048 tracks on every surface. It can store 1024 bytes per sector (assume each track has 512 sectors). Calculate the storage capacity of this disk in gigabytes. 6

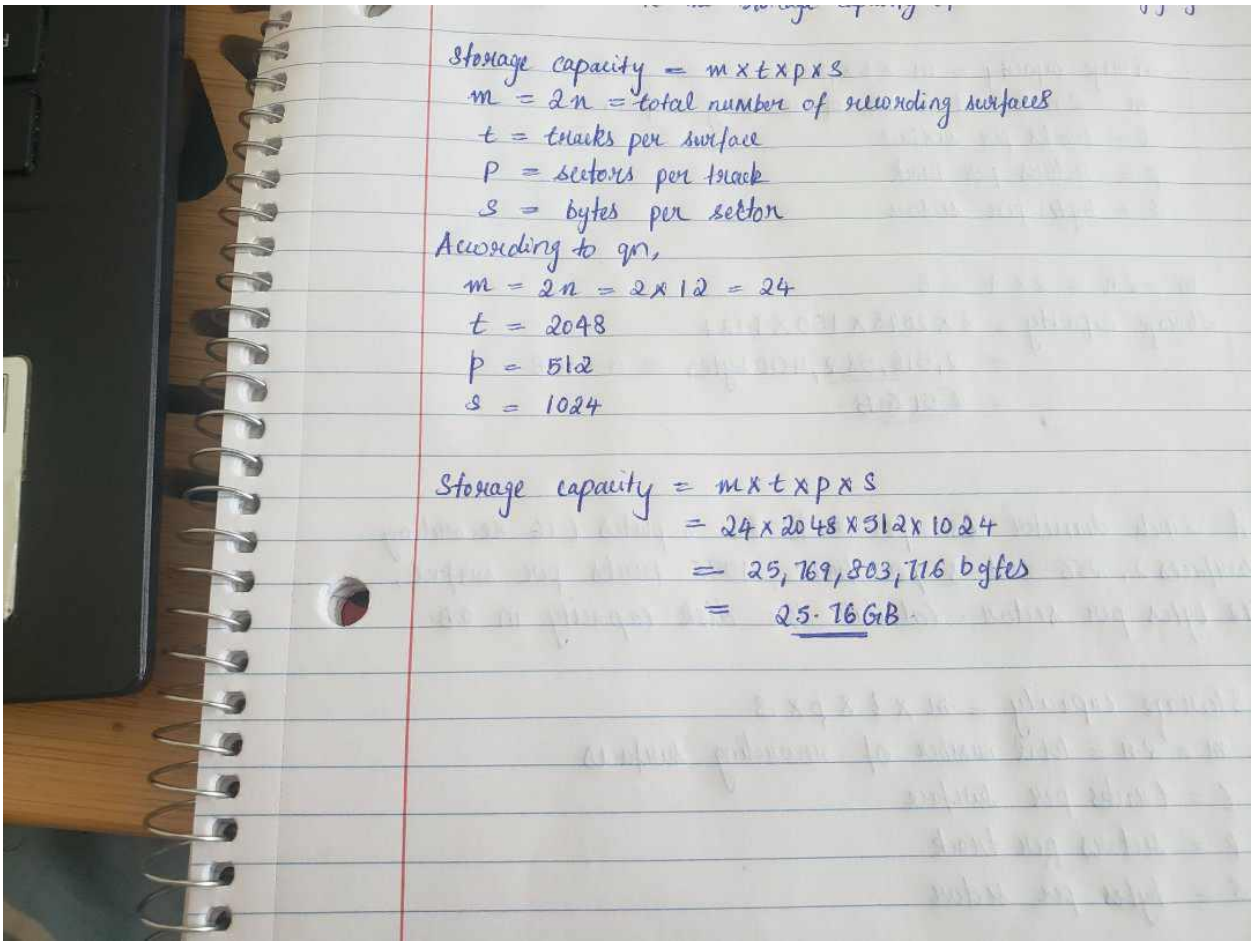
Ans:

Tracks: A magnetic disk is a surface device, which stores data on its Memory System surface. Its surface is divided into circular concentric tracks. The number of tracks on a disk range up to 800.

Sectors: Each track is divided into sectors (normally 10-100). These sectors can be either fixed or variable length sectors.



Cylinders: A set of corresponding tracks in all surfaces of a disk pack (i.e. the tracks with the same diameter on the various surfaces) is called a cylinder.



(d) List two functions of File management and three functions of Memory management systems in the context of Operating systems. 5

Ans:

A file is a collection of related information. A file may be organized internally into records or it may simply be a stream of bytes. A file system is organized into directories for efficient or easy navigation and usage. The file management system provides and maintains the mapping between a file logical storage needs and the physical location where it is stored. Users and programs simply access the files by the name, and the file management system handles the details. The file management system identifies and manipulates files by the names provided by their users determines the physical requirements of the file, allocate space for it, stores it in that space, and maintains the information about the file so that it may be retrieved partially or in full, later. The file management system keeps track of the available space on each device connected to the system. The user and the user's program need not be aware of the underlying physical storage issues. The file management system allows the retrieval and storage of files by name, keeps track of the mappings, allocates and frees space, allows the mounting and unmounting of file structures, and provides other functions required to maintain the structures of the file system.

- Directory structures for each I/O device in the system and tools to access and move around these structures. The directory structure provisions are made to move easily from one structure to another.
- It also protects files and limit file access to authorized users.

File management systems are particularly important in systems in which secondary storage devices are shared in common by multiple users, since they provide a directory system that assures that there is no duplicate use of physical storage.

Memory Management: The operating system manages the Primary Memory or Main Memory. The purpose of the memory management system is to load programs into memory in such a way as to give each program loaded the memory that it requires for execution. An operating system manages the allocation and deallocation of memory to various processes and ensures that the other process does not consume the memory allocated to one process. An operating system performs the following activities for memory management:

1. It keeps track of which parts of the memory are currently being used and by which process into memory together with the space being used and also keeps track of available space.

2. It maintains one or more queues of programs waiting to be loaded into memory as space becomes available, based on such program criteria as priority and memory requirements.

3. When space is available, it allocates memory to the programs that are next to be loaded. It also de-allocates a program's memory space when it completes execution. The de-allocated space is made available for other programs.

(e) What is the role of a Compiler in a computer ? How is a Compiler different from an Interpreter ? 5

Ans: A language processor that converts a program written in high-level language into machine language, entire program at once, is called a compiler. Compilers produce better optimized code that generally runs faster, and compiled code is self-sufficient and can be run on their intended platforms without the compiler present.

A compiler scans whole program and then check it for syntactic and semantic error, once the code is checked for errors, it is converted into an object code. Then, it can be processed by the machine to perform the corresponding task. The common programming languages that use compilers are C, C++, C#, etc..

Compiler vs Interpreter:

Compiler	Interpreter

A language processor that converts a program written in high-level language into machine language.	A language translator that converts a high-level language program into a machine language program.
Compilers scan the entire program in one go.	The program is interpreted/translated one line at a time.
Input of a compiler is a high-level language code (called source code), while its output is a machine language code (called object code).	Interpreters convert the source code into machine code during the execution of the program.
Compilers convert the source code to object code.	Interpreters do not convert the source code into object code.
As and when scanning is performed, all the errors are shown in the end together, not line by line.	One line of code is scanned, and errors encountered are shown.
The execution time of compiler is less, and hence it is preferred.	It is not preferred due to its slow speed. Usually, interpreter is slow, and hence takes more time to execute the object code.
Compiler are larger in size.	Interpreters are smaller in size.
Compilers are not flexible.	Interpreters are relatively flexible.
Compilers are more efficiently.	Interpreters are less efficient.
The common programming languages that compilers use are C, C++, C#, etc..	The common programming languages that use interpreters are Perl, Ruby, Python, METLAB, etc..

(f) List the advantages of using formulae and macros in a spreadsheet software. 3

Ans: Some of the advantages of using formulae and macros in a spreadsheet are:

* Reusability: Formulas and macros can be saved and reused in multiple spreadsheets and workbooks. Users can apply the same formulas and macros to different data sets. It promotes consistency and saves time in future projects.

* It minimizes the risk of errors in data analysis and processing. This decreases the chance of human mistakes and leads to reliable results.

* It enables scalability in handling large volumes of data.

* Users can customize formulas and macros to suit their particular needs and requirements.

* Formulas and macros ensure consistency in calculations and data processing. On using formulas and macros, users can maintain accuracy and uniformity across spreadsheets.

* Formulas and macros streamline complex calculations and data processing tasks. They allow for quick analysis and manipulation of large datasets, improving efficiency in decision-making processes

(g) For the following IPv4 subnet masks, what would be the size of Net ID and Device ID ? 4 (i) 255.255.0.0 (ii) 255.255.255.0

Ans: To determine the size of the Net ID and Device ID for the given IPV4 subnet masks, we need to look at the number of bits allocated for each part in the subnet mask.

255.255.0.0

The subnet mask in binary is : 11111111.11111111.00000000.00000000

In the above subnet mask, the Net ID consists of the first 16 bits and the device ID consists of the remaining 16 bits.

Therefore for the subnet mask 255.255.0.0:

Size of Net ID is 16 bits

Size of Device ID is 16 bits

255.255.255.0

The subnet mask in binary is : 11111111.11111111.11111111.00000000

In the above subnet mask, the Net ID consists of the first 24 bits and the device ID consists of the remaining 8 bits.

Therefore for the subnet mask 255.255.255.0:

Size of Net ID is 24 bits

Size of Device ID is 8 bits

(h) What is LAN ? What are the advantages of LAN ? 5

Ans: A local area network (LAN) is a collection of devices connected together in one physical location, such as a building, office, or home. A LAN can be small or large, ranging from a home network with one user to an enterprise network with thousands of users and devices in an office or school.

Some of the characteristics of LAN are:

- It connects computers in a single building, block or campus, i.e. they work in a restricted geographical area.
- LANs are private networks, not subject to tariffs or other regulatory controls. For the Wireless LANs there are additional regulations in several countries.
- LANs operate at relatively high speed when compared to the typical WAN (.2 to 100 MB /sec).
- There are different types of Media Access Control methods in a LAN, the prominent ones are Bus based Ethernet, Token ring.

- LAN is a low-cost and effective network type capable of connecting multiple devices on a single transmission medium.
- Setting up a LAN network can be done at low costs. If there's a need for expansion, it can be done quickly.

Advantages of LAN:

- It allows sharing of expensive resources such as Laser printers, software and mass storage devices among a number of computers.
- LAN allows for high-speed exchange of essential information.
- It contributes to increased productivity. A LAN installation should be studied closely in the context of its proposed contribution to the long range interest of the organization.
- A LAN connection is relatively inexpensive to set up and maintain.
- The local nature of a LAN also makes troubleshooting quick and cost-effective.
- LAN is very adaptable. You can add or remove devices, move printers and computers to different areas of the building, and modify user information for existing devices with minimum hassle.

(i) What are the features of a browser software ? 4

Some of the features of a browser software are:

- Back/Forward Buttons: Back button can be used by you for going back to the previously visited web page whereas the Forward button is used to visit the next page.
- Tab: It allows you to view multiple web pages in the same browser without opening a new browser session.
- Home: The first web page which loads when we open a browser is called the home page. Home button will bring you back to the home page of your website.
- Stop: It cancels loading of the current web page. This button is used when the page is in the loading state.
- Refresh button: This button is also known as reload button. This button reloads the page the current page and shows updates if any.
- History: This shows the links to the web pages previously visited by you. This feature is a very handy feature to revisit websites.
- Address bar: It is also known as URL. The URL of the website that has to be accessed is entered here. Through this bar user can access different websites or search anything on browser.
- Search: Search box allows any term to be searched by the search engine from the web. It can also used for searching contents from the website visiting.

- Bookmark: This feature of the browser helps in quickly accessing websites. Any important web page can be bookmarked for future easy access.

2.

(a) What is a Parallel port ? How is it different from a Serial port ? For connecting a printer, which of the two (serial/parallel) ports will be preferred ? Justify your answer. 6

Ans: A parallel port is an interface allowing a personal computer (PC) to transmit or receive data down multiple bundled cables to a peripheral device. A parallel port has multiple connectors and allows data to be sent simultaneously down several cables at once.

Various peripherals can be connected through parallel port, which is a parallel communication physical interface. A parallel port transmits 8 bits of a byte of data in parallel. It is used for transmitting fast data over short distances. It is used to connect a printer to a computer.

Since a parallel port transmits an entire byte at a time, it operates I/O devices at a relatively high speed. A Parallel port is primarily used to connect printers to a computer and hence it is often called a printer port.

It's called a parallel port because it transfers multiple bits of data simultaneously through multiple wires. These wires are organized in parallel, meaning they are side by side and each carries a separate bit of information.

Parallel port vs serial port

Parallel port	Serial port
Parallel port is used to achieve parallel transmission.	Serial port is used to achieve serial transmission.
A parallel port transmits 8 bits of a byte of data in parallel.	Serial port transmits one bit of a byte.
A parallel port can transfer multiple data streams.	A serial port can transfer a single data stream.
It is used for transmitting fast data over short distances.	It is meant for transmitting slow data over long distances.
It is a parallel communication physical interface.	It is a serial communication physical interface which transmits one bit at a time.
A Parallel port is primarily used to connect printers to a computer.	Dial-up modems and serial mice use serial ports.
In parallel port communication more number of wires are used as compared to serial port.	In serial port communication less number of wires are used.

Port needed for printer:

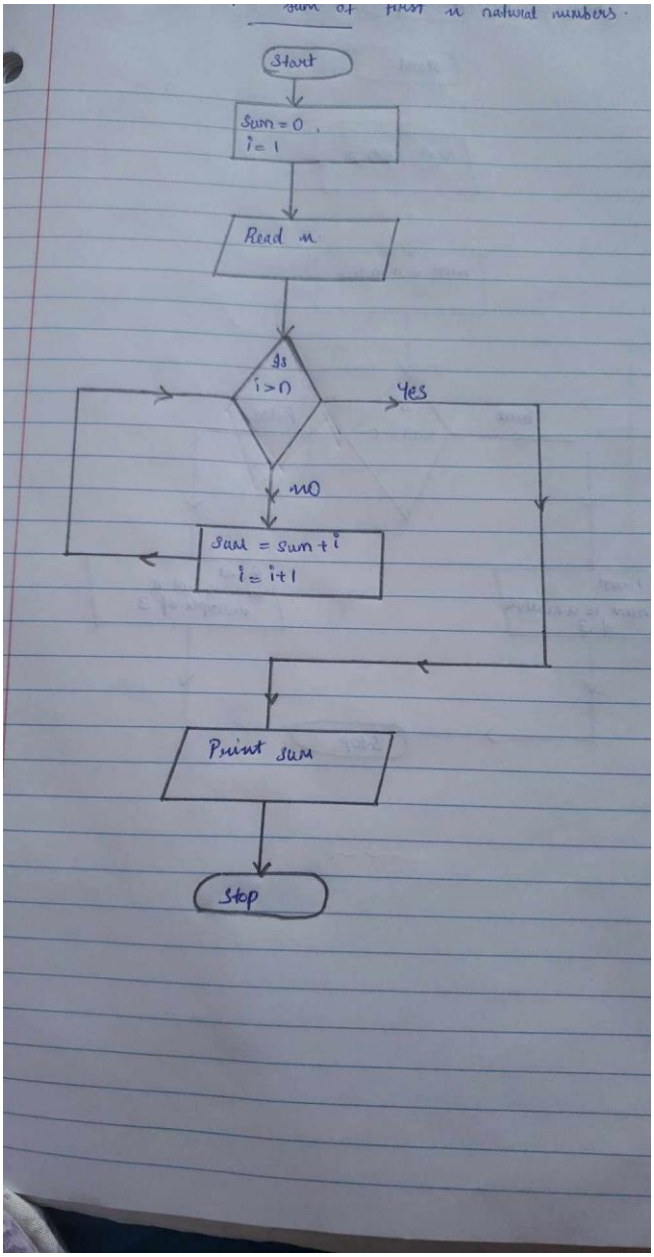
Parallel port is used for connecting printer to a computer.

This is because a parallel port transmits 8 bits of a byte of data in parallel, while a serial port can transmit only one bit of a byte at a time. Since a parallel port transmits an entire byte at a time, it operates devices at a relatively high speed. Printers require high-speed data transfer to print documents efficiently. Hence, parallel port is used.

A Parallel port is primarily used to connect printers to a computer and hence it is often called a printer port.

(b) Draw a flowchart to find the sum of the first n natural numbers. 8

Ans:



(c) What is a Wiki ? What are its characteristics ? How can it be used for educational purposes ? Explain with the help of an example. 6

Ans: Wiki stands for "What I Know Is". Wiki's are a powerful tool for creating collaborative knowledge resources created by the community. A wiki is a page or collection of Web pages designed to create and edit contents. Wiki supports hyperlinks and has simple text syntax for creating new pages. Wiki's are also used to create websites, to enhance the features of community websites and for knowledge management. The collaborative encyclopedia, Wikipedia is one of the best-known wiki's. It contains very large number of articles – all created and moderated by the community. Ward Cunningham developed the first wiki software - WikiWikiWeb in 1995.

Characteristics of Wiki are:

* A wiki invites all registered users to edit any page or to create new pages within the wiki Website.

* Wiki promotes meaningful topic associations between different pages by making page link creation very easy.

* Wiki promotes discussion and also keeps the history of changes of a document.

Documents can be written using a markup language. We can see a wiki page using web browser. Wiki pages are connected through hyperlinks. Therefore, a wiki is database for creating, editing, browsing, and searching through information.

Uses of wiki for educational purposes:

Wiki can be a valuable tool for educational purposes in various ways:

* Collaborative learning: Wikis allow multiple users to contribute and edit content collectively. Students can collaborate on projects, share information, and engage in group discussions on wiki platforms. For example, a group of students working on a research project can use a wiki to compile their findings, share resources and provide feedback to one another.

* Information Sharing: Wikis provide a platform for sharing knowledge and information on a wide range of topics. Students can access wikis to gather information, review content, and deepen their understanding of subjects. For instance, a student studying history can use a wiki to access detailed timeliness, biographies and historical events to enhance their learning.

* Resource repository: Wikis serve as a repository of resources that can support students learning. Educational wikis may contain study guides, reference materials, practice exercises and links to additional resources. For example, a language learning wiki can offer vocabulary lists, grammar tips and interactive exercise to help students improve their language skills.

* Critical thinking and evaluation: Using wikis for educational purposes can help students develop critical thinking skills by evaluating the credibility and accuracy of information.

Training: Wikis may be used to hold all the training and informational resources in an enterprise. Some of the more modern wikis may interface with an LMS. When employees have access to the resources they need, it can reduce the time spent in formal training.

Developing Community: Wikis can potentially develop a sense of community. They typically have a history page that lists the original contributor of an article and those who have edited and made revisions.

3.

(a) What is meant by Open Source Software ? Explain the developmental model and licensing of open source software. 6

Ans: Open Source Software is a computer software which is available along with the source code and software license that permits the code to be studied, modified and improved. It is often developed in public and collaborative manner. Open source development, follows the model of the bazaar. In an open source development model, roles are not clearly defined. The best features and functionality evolve into popular use much as good ideas evolve into popular use in the marketplace of ideas. Development is a collaborative process, resources are not scarce, and no one person or organization directs the project. The users are treated like co-developers and so they should have access to the source code of the software.

There are two competing definitions.

The Free software definition is based on the following four freedoms:

1. The freedom to run the program, for any purpose.

2. The freedom to study how the program works, and adapt it to your needs.

3. The freedom to redistribute copies so you can help your neighbor.

4. The freedom to improve the program, and release your improvements to the public, so that the whole community benefits.

The other definition is the Open source definition promulgated by OSI. This broader definition includes permissive software licenses.

The elements are:

- Free redistribution
- Source code available
- Derivative works permitted
- Integrity of the author's source
- No discrimination against persons or groups
- No discrimination against fields of endeavor
- Distribution of license with derivative works

- License must not be specific to a product
- License must not restrict use of other software
- License must be Technological-natural

Open Source Development Model:

The Open source development model is a collaborative model. It anticipates the participation of many developers in the development of a single product or module. In an open source development model, roles are not clearly defined.

The Open source software development model supports all aspects of various processes like defining requirements, system- level design, detailed design, implementation, integration, field testing, and support in order to produce high quality products implementing client requirements.

Main features of open source development model are:

Features of open source development model are:

* Users should be treated as co-developers. The users are treated like co-developers and so they should have access to the source code of the software.

* Early releases The first version of the software should be released as early as possible so as to increase one's chances of finding co-developers early.

* High modularization: The general structure of the software should be modular allowing for parallel development on independent components.

* Several versions: There should be at least two versions of the software. There should be a buggier version with more features and a more stable version with fewer features. The buggy version (also called the development version) is for users who want the immediate use of the latest features and are willing to accept the risk of using code that is not yet thoroughly tested. The users can then act as co-developers, reporting bugs and providing bug fixes.

* Dynamic decision making structure There is a need for a decision making structure, whether formal or informal, that makes strategic decisions depending on changing user requirements and other factors.

Open Source Software Licensing:

License defines the rights and obligations that a licensor grants to a licensee. Open Source licenses grant licensees the right to copy, modify and redistribute source code (or content). They facilitate free and open-source software development. These licenses may also impose obligations (e.g., modifications to the code that are distributed must be made available in source code form; an author attribution must be placed in a program/ documentation using that Open Source, etc.).

All open source licenses, by definition, freely allow the licensee to exercise all of the rights of copyright with respect to the licensed software. Some open source software licenses contain explicit license grants, and some contain implicit ones.

All open source licenses contain broad warranty disclaimers and limitations of liability. Examples of free software license / open source licenses include Apache License, BSD license, GNU General Public License, GNU Lesser General Public License, MIT License, Eclipse Public License and Mozilla Public License.

(b) Explain the uses and functions of the following networking devices : 8

(i) Modem

Ans: Modem stands for Modulator/Demodulator. The modem is defined as a networking device that is used to connect devices connected in the network to the internet. The word "modulator" means to change and the meaning of word "demodulator" is to restore to an original form.

Function of modem:

It acts as a bridge between your local network and the internet.

The main function of a modem is to convert the analog signals that come from telephone wire into a digital form. The modem can perform both the task of modulation and demodulation simultaneously. A modem is a communication device that converts (i.e., modulates) binary signal into analog signals for transmission over telephone lines and converts (i.e., demodulates) these analog signals back into binary form at the receiving end.

Modem is used to send data and files to other computer users using standard telephone lines. You can transfer data, exchange electronic files, and even carry on a typed conversation in real time.

In addition to modulation and demodulation, modems also perform other functions such as error checking and data compression. Error checking ensures that the data has been transmitted correctly and data compression reduces the amount of data that needs to be transmitted thereby increasing the transmission speed.

Modems implement flow control mechanisms to regulate the data flow between the sender and receiver, preventing data overload and ensuring smooth communication.

Uses of Modem:

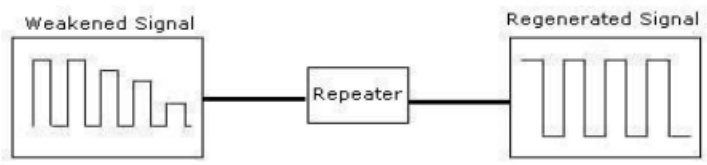
One of the primary uses of modems is to connect to the internet. They allow users to access online services, browse websites, send emails etc. Modem facilitates remote

access to corporate network, enabling employees to work from home or access resources while travelling.

(ii) Repeater

Ans: When a signal travels a network cable (or any other medium of transmission), they lose strength, degrade and become distorted in a process that is called attenuation. Repeater is a device that electrically amplifies the signal it receives and re-broadcasts it. Repeaters work at the physical layer of the OSI model.

A good example of the use of repeaters would be in a local area network using a star topology with unshielded twisted-pair cabling. If a cable is long enough, the attenuation will finally make a signal unrecognizable by the receiver.



The main benefit of repeaters is their capacity for signal amplification. Repeaters renew signals in addition to amplifying them.

Functions of repeaters:

- It prevents boosted signals from weaking before reaching their destination.
- A repeater's main function is to increase signal strength and quality over vast distances.
- They can aid in preventing data loss, minimizing mistakes and ensuring that the signal is strong and of high enough quality when it reaches its intended location.
- They increase signal power, enabling data to travel farther distances without experiencing substantial signal deterioration.

Uses of repeaters:

- Repeaters are frequently used in LANs and WANs to increase the network's performance and dependability.
- They are used when the total length of your network cable exceeds the standards set for the type of cable being used.
- The primary purpose of a repeater is to extend the distance of a network by increasing the strength and quality of signals over long distances or through dense blocks.

(iii) Router

Ans: A router is a networking device that forwards data packets between computer networks. A router translates information from one network to another; it is similar to an intelligent bridge. Router selects the best path to route a message, based on the destination address and origin. The router can direct traffic to prevent head-on collisions, and is smart enough to know when to direct traffic along shortcuts. Routers can even —listen to the entire network to determine which sections are busiest—they can then redirect data around those sections until they are removed. Routers maintain a map of the physical networks on a Internet (network) and forward data received from one physical network to other physical networks. A router operates on the Network layer of the OSI model. It allows the users to connect several LAN and WAN.

Functions of router:

- The router receives the packets from its input ports, checks its header, performs some basic functions and then looks up to the routing table to find the appropriate output port to dump the packets onto and forwards the packets onto that output port.
- Routing is the process by which the router ascertains what is the best path for the packet to reach the destination.
- Routers can be used to manage the network bandwidth by controlling the amount of data that is allowed to flow though the network.
- The router serves as the translator between the information on your LAN and the internet.

Uses of router:

- Routers are frequently used by internet service providers to transfer data, such as audio, video, image, and email from one location to another.
- Routers are also used by software testers for WAN communications.

(iv) Gateway

Ans: A gateway is a network device that connects two networks that use different transmission protocols. Gateway, also called d protocol converters, can operate at any layer of the networking model. The main function of a gateway is to convert protocols among communications networks. It accepts data formatted for one protocol and convert it to data formatted for another protocol before forwarding it. A gateway can be implemented in hardware, software or both, but they are usually implemented by the software installed within a router. A gateway must understand the protocols used by each network linked into the router. Gateways are slower than bridges, switches and (non-gateway) routers. A gateway usually supports address mapping from one network to another, and may also provide transformation of the data between the environments to

support end-to-end application connectivity. A gateway on the other hand can accept a packet formatted for one protocol and convert it to packet formatted for another protocol before forwarding it.

Functions of Gateway:

Gateway Interconnects networks at higher layers than bridges or routers. A gateway usually supports address mapping from one network to another, and may also provide transformation of the data between the environments to support end-to-end application connectivity. The main functionality of a gateway is to convert protocols among communications networks. A gateway on the other hand can accept a packet formatted for one protocol and convert it to packet formatted for another protocol before forwarding it. Gateways work on all seven OSI layers.

- The main functionality of a gateway is to convert protocols among communications networks.
- It is responsible for routing data packets to different networks because it knows about the routing path of different networks that are in communication with its network.

Uses of Gateway:

- They are used to provide a connection to the internet. It's used to connect computers and devices to the internet via a wired or wireless connection.
- It is used to communicate between two networks that may be using different protocols.

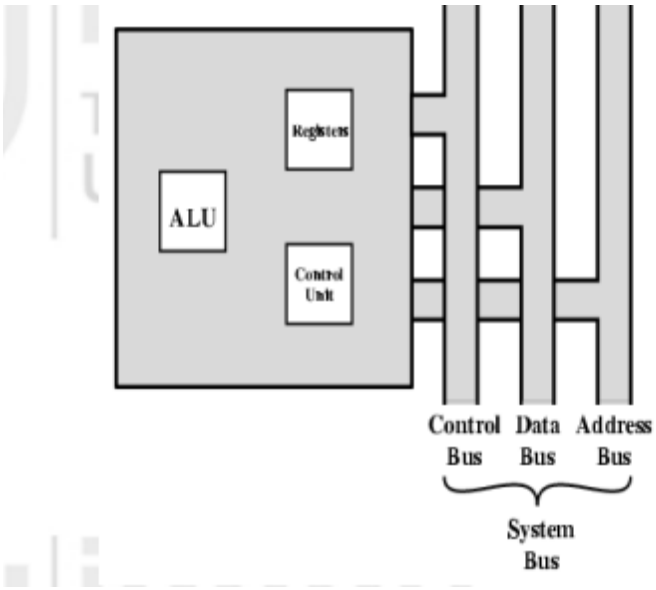
(c) What are the various components of a CPU ? Explain the role of each component. How is a CPU interfaced with memory ? Explain.

Ans:

Components of a CPU:

CPU contains Arithmetic Logic Unit (ALU) and Control Unit(CU). ALU and CU are jointly known as the central processing unit (CPU).

CPU has three major identifiable parts: Control Unit (CU), Arithmetic & logic Unit (ALU) and a set of Registers. The below figure presents the components of a computer:



Arithmetic Logic Unit(ALU) : The Arithmetic and Logic Unit is that part of the CPU that actually performs arithmetic and logical operations on data. It performs the basic arithmetic, logical operations specified by the instructions. Arithmetic operations includes addition, subtraction, multiplication, and division. Logical operations includes comparison, selection and merging of data. The CU, CPU registers and memory help in bringing the data into the ALU and then taking the results back.

Control Unit: - The CU controls the execution of instructions by decoding the instruction and generating micro-operations to be performed for executing that instruction. It controls the operation of other parts of the computer. Control Unit (CU) is the unit which manages and coordinates the entire operation of a computer system. It controls the operation of the other components of a computer system. The Control Unit of the processor is that unit which controls and coordinates the execution of instructions by the processor. It is responsible for defining and controlling the instruction cycle. In essence, it causes things to happen in the processor. It issues control signals external to the processor to cause data exchange with memory and I/O modules. It also issues control signals internal to the processor to move data between registers, to cause the ALU to perform a specified function, and to regulate other internal operations. It generates timing signals and initiates the Fetch cycle of instruction execution. When the instruction is fetched, it generates the sequence of micro-operations which need to be executed in order to execute the

instruction. CU also generates timing signals for executing set of micro-operations. There are three different ways in which CU can generate these micro-operations: through a hardwired logic, by reading a programmable Array (PLA) table or by reading a Programmable Read Only Memory (PROM).

Functions of CU:

* It controls transfer of data and instructions among other units of computer.

* It does not store or process data.

* It fetches the instructions from the memory, decodes them, and executes them.

CPU has a set of Registers which is used to store some data temporarily. Register lies above Cache and Main memory in memory hierarchy of the system. The registers in CPU perform two roles:

- User-visible registers: used to store temporary data items and other user accessible information useful for machine or assembly language programmers.
- Control & Status Registers: used by control unit to control and coordinate the operation of the processor.

The CPU chip is interfaced with other components of the computer through a system bus which has three sets wires forming Control Bus, Data Bus and Address Bus.

CPU and Memory :

The CPU communicates with primary memory through the system bus, which carries data, addresses, and control signals.
The Central Processing Unit (CPU) and primary memory (also known as main memory or RAM) are two critical components of a computer system. They work together to execute programs and process data. The communication between these two components is facilitated by the system bus, a set of physical connections (wires, optical fibres, etc.) that carry data, addresses, and control signals.
he system bus is divided into three main types: the data bus, the address bus, and the control bus. The data bus carries the actual data that is being processed. The width of the data bus (i.e., the number of wires it contains) determines how much data can be transported at once. The address bus carries the addresses of memory locations where data is stored or from where it is retrieved. The control bus carries signals that coordinate and control the activities of the computer, such as read or write commands.

When the CPU needs to read data from or write data to the primary memory, it sends a signal over the control bus. This signal specifies whether a read or write operation is to be performed. The CPU then sends the address of the memory location to be accessed over the address bus. If it's a read operation, the data stored at that memory location is sent back to the CPU over the data bus. If it's a write operation, the CPU sends the data to be written over the data bus.

4.

(a) Differentiate between the following: 6

(i) Packet and Circuit switching

Ans: Packet vs Circuit switching:

Packet Switching	Circuit Switching
Packet switching is a communication method where data is divided into smaller units called packets and transmitted over the network.	Circuit switching is a communication method where a dedicated communication path, or circuit, is established between two devices before transmission begins.
It is mainly used for data transmission.	It is ideal for voice communication.
In packet switching, packets can follow any route.	Each packet follows the same route.
Packet switching is implemented at the data link layer and network layer.	The circuit switching network is implemented at the physical layer.
It requires complex protocols for delivery.	It requires simple protocols for delivery.
No call setup is required in packet switching.	Call setup is required in circuit switching.
In packet switching there is no physical path between the source and the destination.	In circuit switching, there is a physical path between the source and the destination.
Less wastage of resources as compared to circuit switching.	Wastage of resources is more in circuit switching.
In packet switching, congestion can occur on every packet.	In circuit switching, congestion can occur at setup time.
Other packets from an unrelated source may utilize unused bandwidth.	Bandwidth is fixed, unused bandwidth on an allocated circuit is wasted.
In packet switching, low reliability, subject to congestion.	Circuit switched is highly reliable.
Packet switching networks have high installation costs.	Circuit switching's initial cost is low.

(ii) Full-duplex and Half-duplex data transmission

Ans:

Full duplex transmission	Half duplex transmission
It is a bidirectional communication in which both the devices can send and receive data at the same time.	It is a bidirectional communication although in only one direction at a time.
Both devices can send and receive data at the same time.	Both the devices can send and receive data but not at the same time.
Uses two channels for the transmission of data.	Uses one channel for the transmission of data.
It provides better performance than half duplex transmission.	It provides less performance than full duplex transmission.

It requires more complex hardware and software to manage data's simultaneous transmission and reception.	It requires less complex hardware and software since they use the same path for both data transmission and reception.
It is more expensive compared to half duplex transmission.	It is less expensive.
Collisions are less likely as both devices can transmit data simultaneously.	Collisions can occur when two devices try to transmit data at the same time.
Example for full duplex transmission is telephone	Example for half duplex transmission is walkie-talkie

(iii) Twisted pair and Optical fibre cable

Ans: Twisted pair cable vs optical fiber cable:

Twisted Pair Cable	Optical Fiber Cable
The transmission of signals takes place through the metallic conducting wire.	The transmission of signals happens via glass fiber.
It is easy and simple to install and implement.	The installation and implementation of optical fiber cables are extremely tough.
It is comparatively inexpensive.	It is expensive as the cables and interfaces used are relatively expensive.
Supports low bandwidth.	Supports very high bandwidth.
It can be affected by the external magnetic field.	It cannot be affected by the external magnetic field.
In twisted pair cables, attenuation is very large.	While in optical fiber cables, attenuation is very small.
Transmission of the signal takes place in electrical form.	Transmission of the signal takes place in the form of light.
It is very effective for relatively short distances.	It is generally suited for long-distance networks among cities and countries.
Transmission of data at a relatively low speed.	Transmission of data at fast speed.

(b) Explain the advantages of source data-entry devices. Describe the features of any three source data-entry devices. 8

Ans: Entry of data into a computer system directly from the source, without transcription is called source data entry.

Advantages of source data-entry devices:

- Accuracy: Source data entry devices have a lower probability of errors since data is entered directly entered into the system without the need for manual transcription.
- Efficiency: These devices are usually designed for quick and efficient data input, saving time and increasing productivity.
- Scalability: These devices can handle large volumes of data without significant manual effort, allowing one to process more data in less time.
- Processing time: These devices can help eliminate the need for manual data entry and manipulation. These tasks once took hours or days to complete, but with automation, they can now be completed in a matter of minutes or seconds.
- Overhead costs: These devices can reduce our reliance on manual labor, thus employee salaries and benefits that need to be paid.

Features of any 3-source data entry device:

* Barcode Reader: A barcode reader is an electronic device which is used to read printed barcodes. Barcodes represent alphanumeric data which is a combination of vertical lines (bars) that vary in width and length. It is a fast and effective way to input data. A Barcode reader uses a laser beam to read the series of thick and thin lines which represent the bar code number.

A bar code reader is an optical hardware input device that is used to read the information from the barcode posted on the product and decode the information in a human-readable format. It is also used to upload the details of the product in the database.

The bar code is 13 digits long and it has four main divisions. The First two digits of a bar code represent the country, the second part represents the manufacturer's code (five digits) the third part represents the product code (five digits) and the last digit is a check digit.

An example of a barcode reader is a supermarket barcode scanner that reads and logs the price of a product.

*Digital Camera: A Digital camera is an electronic device which takes video or still photographs or both, digitally by recording images via an electronic image sensor. Digital cameras can e display images on screen immediately after they are recorded.

Images recorded on a digital camera can be cropped for editing, deleted and various types of special effects can be created by using Photoshop software.

Digital cameras look like ordinary cameras but have sufficient memory in the form of chips to store thousands of images, rather than using photographic films. Most digital cameras allow users to choose the resolution needed for a picture. Most of those can connect directly to a computer to transfer data. A USB port is generally used for this purpose. A Wireless connection can also be used for connecting to a computer via Bluetooth.

The joint photographing expert's group standard (JPEG) is the most common file format used for storing data in a camera. Other formats include raw image format, DNG format etc.

*Magnetic Ink Character Recognition (MICR): Magnetic Ink Character Recognition is a character recognition system that uses special ink and characters. When a document that contains this ink needs to be read, it passes through a machine, which magnetizes the ink and then translates the magnetic information into characters.

MICR technology is used by banks for faster processing of large volumes of cheques. Numbers and characters found on the bottom of checks (usually containing the check number, sort number, and account number) are printed using Magnetic Ink. To print Magnetic Ink codes, we need a laser printer that accepts MICR toner.

MICR provides a secure, high-speed method of scanning and processing information. This technology is used for processing large volume of data. It speeds up data input for the bank because cheques can be directly fed into the input device as it also ensures accuracy of data entry. The most commonly used character set by MICR devices are known as E13B font which consists of the numerals 0 to 9, and four special characters.

(c) Explain the features of Procedural Programming Languages with the help of an example. How is Object Oriented Programming different from Procedural Programming? 6

Ans: Procedural programming could also be called linear programming as one thing happens and then the next. Each instruction is executed in order from the top of the file to the bottom. It focuses on the idea that all algorithms are executed with functions and data that the programmer has access to and is able to change. Some languages which support procedural programming are C, FORTRAN, VB, etc.

Features of Procedural Programming Languages:

- Predefined functions: A predefined function is a function available in a procedural programming language from a library of available functions.
- Local Variables: A local variable is a programming variable that has a local scope of use. This means the variable only functions in the function in which the developer defines it.
- Global variables: It increases functionality when local variables are insufficient. Developers can use global variables in nearly all functions.
- Parameter passing: Parameters are the data values that transfer from each function within a code sequence.
- Modularity: It is a structure in which a developer divides the functionality of its code into a series of smaller blocks.
- Top-down approach: Procedural programming relies on a top-down approach to design and creation. In this approach, a developer first defines the primary goal of the grogram, then assesses the components required to complete it.

Example: to create forms for online inventory system for an automobile parts manufacturer. To design two separate forms: one to process information about cars and other about trucks.

For cars, information required are:

- Color
- Engine Size
- Transmission Type
- Number of doors
- Make

For trucks, the inform required are:

- Color
- Engine Size
- Transmission Type
- Cab Size
- Towing Capacity
- Make

```
/*Declare the Global variables*/

Var Color

Var EngineSize

Var Transmission Type

Var Make

MainProg()

Begin

        If requested for car

        Call CarProcedure()

        If requested for Truck

        Call TruckProcedure()

End

CarProcedure()

Begin

/*Declare the Local variables*/
```

```
Var NumberOfDoors

Process Car Information

End

TruckProcedure()

Begin

        /*Declare the Local variables*/

        Var CabSize

        Var TowingCapacity

        Process Truck Information

End
```

Difference between Object Oriented Programming and Procedural Programming:

Object Oriented Programming	Procedural Programming
Object oriented Programming follows a bottom-up approach.	Procedural programming follows a top-down approach.
In object-oriented programming, the program is divided into small parts called objects.	In procedural programming, the program is divided into small parts called functions.
It provides data hiding so it is more secure.	It does not have any proper way of hiding data, so it is less secure.
Overloading is possible in object-oriented programming.	In procedural programming, overloading is not possible.
The concept of data hiding and inheritance is used.	There is no concept of data hiding and inheritance.
In object-oriented programming, data is more important than function.	In procedural programming, the function is more important than the data.
It is based on the real world.	It is based on the unreal world.
Object-oriented programming uses the concept of data abstraction.	Procedural programming uses the concept of procedure abstraction.
Code reusability is present in object oriented programming.	Code reusability is absent in procedural programming.
Examples: C++, Java,Python,C#	Examples: C,FORTRAN,Pascal, Basic etc..

5.

(a) Disk Defragmenter

Ans: Disk defragmenter is a utility provided with windows operating system. It re-arranges the files stored on the disk so that it can occupy contiguous memory locations. This process is known as defragmentation.

The main benefits of defragmentation are that it minimizes the head movements of the hard disk , in turn which reduces the time taken to read files from and write files to the disk. It increases the access speed. With this process files are stored in contiguous locations. The defragmenter reduces the fragmentation in the file systems. Fragmentation of the memory slows the performance of the system. Large number of files and some larger files contribute to fragmentation. When files are stored neatly it speeds up reading and writing to the disks. One should run defragmenter in the PC at regular intervals. It keeps the computer running quickly and efficiently.

Running Defragmenter

* Click Start button, select All Programs, click on Accessories click System Tools, and then click Disk Defragmenter.

* In the Disk Defragmenter dialog box, click the drives that you want to defragment and then click the Analyze button. After the disk is analyzed, a dialog box appears, letting you know whether you should defragment the analyzed drives.

*To defragment the selected drive or drives, click the Defragment button.

*After the defragmentation is complete, Disk Defragmenter displays the results.

* If you want to view the detailed report about the defragmented disk, click on View Report.

(b) Workstation

Ans: Workstations are crucial in professional and workstations are crucial in professional and business settings, offering enhanced performance, reliability, and specialized features A workstation is a high-performance computer which is used for scientific and technical tasks such as computer graphics, scientific simulation, computer-aided-design (CAD), image processing, engineering calculations etc. It is a computer system that is basically designed for a single user and has advanced graphics capabilities, large storage capacity, and a powerful central processing unit. It is generally used in such applications which require a moderate amount of computing power. Hence, the configuration of workstation used to be high. UNIX and Windows NT are the most common Operating System for workstations. Workstations are generally single user system however they can be connected together to form a LAN.

A workstation is a high-performance computer that can handle heavy workloads.

In the context of networking, workstations are sometime referred to as any computer/terminal attached to a LAN. Workstations are a part of a network in this setup, sharing sources and data with different computers and servers. This allows for collaboration and efficient data management within a professional environment.

In networked workstation, system administrator tracks and controls the activities of the user. The term workstation is also used for high capacity mainframe computer terminal or a PC connected to a network and working in client server mode. A workstations has superior processing and storage capabilities than a normal PC , especially with respect to providing multitasking capability. With a large central processing unit (CPU) and massive storage space, a workstation can run multiple applications simultaneously at much faster speeds.

Typical Configuration of a Workstation

Processor: Intel Core Processor (3.20 GHz)

Memory: 4GB 1333MHz

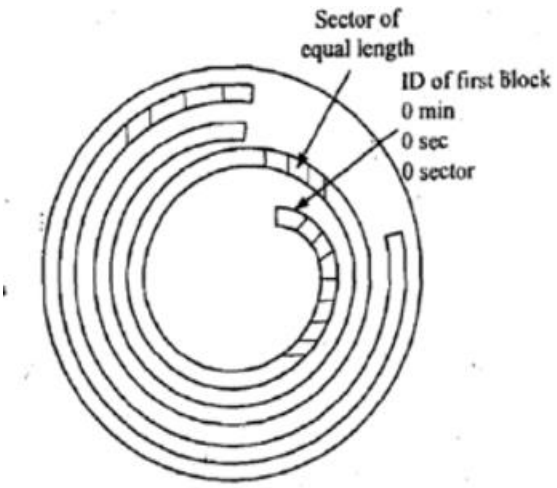
Hard Disk: 500GB,

RAM – 2GB

Here GHz is known as gigahertz. The speed of the processor is generally measured in gigahertz. 1 GHZ equals to 1 billion cycles per second. Similarly MHz is called as megahertz. 1 MHZ is equal to 1 million cycles per second. GB or Gigabyte is the measurements of the digital data in a computer. 1 GB is equal to 1024 Megabytes (MB).

(c) CD-ROM Disk Layout

Ans:



CD-ROMs use long spiral tracks to store data serially. The sectors of CD-ROM aren't arranged like sectors in hard disks . The track is divided into blocks of same size as shown in the figure. A CD-ROM disk rotates at a variable speed so that the pits are read by the laser at a constant linear speed. The speed of the disk is adjusted in such a way that the track passes under the read/write head at a constant linear velocity.

(d) Advantages of e-mail

Ans: Electronic mail is commonly known as email. It is a communication method that uses electronic devices to deliver messages across computer networks. It is one of the most popular methods of digital communication. It is mostly used in business, education, technical communication, and document interactions. It allows communication with people all over the world without bothering them. It is a communication that happens in real time and can get important data across to people in various geographies. An email is a record of the communications that have happened and is stored on the server of the organization. Internet based E-mail system was designed by a computer engineer - Ray Tomlinson in late 1971 while working with ARPANET.

The advantages of e-mail are:

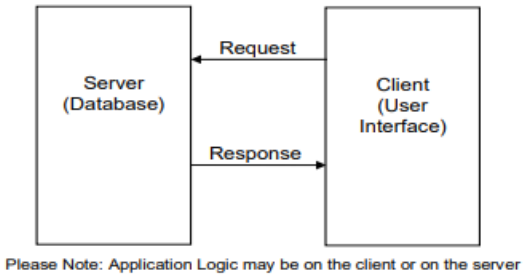
- E-mail is faster than postal mail.
- E-mail cannot be lost like letters and can be stored for life long.
- It can be edited and forwarded to other users.
- Emails are not affected by distances.
- It can be sent anywhere in world in seconds unlike postal mails.
- You can add video and audio with the e-mail.
- Email allows for easy referencing. Messages that have been sent and received can be stored and searched through safely and easily.
- It is a lot easier to go through old email messages rather than old notes written on paper.
- Email is accessible from anywhere-as long as you have an internet connection.
- It is paperless and therefore, beneficial for the planet. It reduces the cost of paper and even reduces the damage paper usage does to the environment.

(e) Two-Tier Client-Server Architecture

Ans: Two-tiered architecture:

It is also known as two-layer architecture or client server architecture, is a software architecture model that divides an application into two distinct parts or tiers: the client tier and the server tier. The client tier sends a request to the server tier and the server tier responds with the desired information. In this approach a database server was introduced to replace a file server. Each tier has specific responsibilities and functions within the overall application, and they communicate with each other to provide the desired functionality. The emergence of relational database management systems and graphical user interface applications led to database server which could be accessed through the GUI based client applications. Since, the clients query the database over the network and only the relevant data is supplied to the client, the network traffic is greatly reduced in comparison to the file server system.

In two-tier, the application logic resides either in the User Interface on the client or within the database on the server. Since, clients and server interact over the network, increases in the number of users often lead to network congestion. Also, maintenance of the application becomes difficult with more users. This lack of scalability (Ability of a system to support increased demands of work, usage or service levels almost instantly, without any change and with no significant drop in cost effectiveness or quality of service) and flexibility gave rise to 3-tiered and n-tiered architectures.



Two tier client server architecture

(f) Features of Project Management Software

Ans: Features of Project Management System:

(i) Scheduling: One of the most common purposes is to schedule a series of events or tasks. The complexity of this schedule can vary considerably depending on how the tool is used. Some common challenges include:

1. Events which depend on one another in different ways

2. Scheduling team members tasks along with the resources required by them commonly termed resource scheduling.

3. Dealing with uncertainties in the estimates of the duration of each task.

ii) Timesheet Management

Ans: A good timesheet management system is essential both for the customer projects as well as internal activities within the organization. Timesheets not only help the Project Manager in managing the project in a better manner but is also useful for maintaining employee records for payroll calculations as well as helps in improving the overall productivity of the organization.

A timesheet is a record of the number of hours an employee spends in completing a certain task. This task could be associated with a customer project or with internal business activities. The timesheet not only provides the number of actual hours that the employee

may have spend on the task but also mentions details of the task involved and the kind of operations that the task involved completing. Another benefit of a good timesheet management system is that it can help management track the efficiency of employees and find ways in which they can improve the productivity in various areas.

Timesheet management systems can also help employees evaluate their own performances and understand how they can perform their tasks better.

(iii)

Calculating critical path

In many complex schedules, there will be a critical path, or series of events which depend on each other, and whose durations directly determine the length of the whole project. Some software applications (for example, Dependency Structure Matrix solutions) can highlight these tasks, thus helping in optimization of effort.

(g) Moodle

Ans: Moodle stands for Modular Object-Oriented Dynamic Learning Environment. MOODLE is a free and open-source e-learning software platform. It provides feature for Learners and content management. It is an open-source Learning Management System used to create and manage online courses.

The popularity of MOODLE may be attributed primarily to the fact that it is free and it allows dynamic content creation facilities. It has a number of tools available for managing a number of students online. In addition to content management, MOODLE provides a number of tools for building interaction among the learning community. Thus, allowing collaboration and peer to peer learning in the learning communities. Moodle is the world's most recognized learning management system (LMS). Its flexibility makes it suitable for traditional, hybrid and distance learning.

Moodle is an open-source software platform that serves as a Learning Management System (LMS) widely used in educational institutions. Designed to facilitate online learning and communication. It supports various interactive activities such as forums, quizzes, and assignments making it a two-way communication tool that actively engages students.

Moodle is a free, online Learning Management system enabling educators to create their own private website filled with dynamic courses that extend learning, any time anywhere. Moodle meets the needs of a teacher, student or administrator. Learners can access course materials and complete assignments with ease while instructors can create and manage courses, deliver content ,set up assessments and track student progress. It provides a single robust, secure and integrated system to create personalized learning

environments. Moodle can be used as a tool for delivering content to students and can be used to build rich collaborative learning communities.

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(h) DNS

Ans: The Domain Name System is the phonebook of the Internet. DNS translates domain names to IP addresses so browsers can load Internet resources. Domain Name System (DNS) should keep track of address of each computer or any other internet device and email addresses. The name servers translates the web address or email address to respective IP address.

DNS is a fundamental component of the internet that translates human-friendly domain names into IP addresses. This process allows users to access websites using easy-to-remember names instead of having to remember complex addresses.

DNS follows a hierarchical naming scheme that is supported by distributed database system to ensure no duplicate names are issued at all.

DNS allows users to easily navigate the web without needing to memorize complex addresses, which in turn makes internet usage more comfortable.

Working of DNS for identifying web addresses:

Steps for identifying web addresses:

1. First step is to enter a URL or equivalent Domain name as the address of the website that you want to access through the web browser.

2. The Web browser tries to resolve the IP address of the website by the information available in its own cache memory. If the IP address is not cached, the browser sends a request to a DNS servers. The DNS server tells the browser about the IP address of the website.

3. Once the web browser knows the IP address of the website, it then requests the web page from the web server.

4. The web server responds by sending back the requested web page. If the requested page does not exist then it will send back the appropriate error message.

5. Your web browser receives the page from the web server and displays it as per the display requirements of the web page.

For example, if we want to visit www.abc.ac.in , the following steps take place:

1. We first enter www.abc.ac.in in your browser.

2. The browser finds the IP address using DNS resolution.

3. It connects to the web server at that IP address.

4. The server sends the webpage data back to your browser.

5. The browser displays the webpage for you to see.