BCS-011 : COMPUTER BASICS AND PC SOFTWARE

June 2016

1.

(a) What are the features available in fifth generation computers ? 5

Ans: They are also known as modern computers, are still in the development stage and are based on artificial intelligence. Artificial Intelligence is the branch of computer science concerned with making computers behave like humans and allow the computer to take its own decision. There are several programming languages that are known as AI languages because they are used almost exclusively for AI applications. The two most common are LISP and Prolog. Computers of this generation are based on microelectronic technology with high computing power and parallel processing. This generation introduced machines with hundreds of processors that could all be working on different parts of a single program.

Artificial intelligence and parallel processing hardware are at the heart of this generation of computers, and is hottest in the areas of neural networks, robotics, etc. It has been predicted that such a computer will be able to communicate in natural spoken language with its user, store vast knowledge databases, search rapidly through these databases, making intelligent inferences, drawing logical conclusions, image processing and see objects in the way that humans do.

Features of fifth generation computer:

Following are some features of fifth generation computers:

* In this generation's computers, artificial intelligence has progressed. This makes the computers more powerful.

* Parallel processing has advanced on these computers.

* FGC are more portable and powerful.

* FGC are dependable and less expensive.

* These PC's can be purchased for a lower price.

* The fifth-generation computer includes more user-friendly interfaces and multimedia functions.

* Natural language processing is now in its fifth phase of development.

* These computers are far quicker than previous generations.

* These computers are substantially smaller in size than other generation computers.

* They are lightweight and easy to move.

* Another feature is the use of optical fibre in circuits.

(b) What is a subroutine ? How is it different from a function ? 6

Ans: A subroutine is a type of subprogram, a piece of code within a larger program that performs a specific task and is relatively independent of the remaining code. Another definition is, a set of instructions that are used repeatedly in a program can be referred to as a subroutine. It is also called a procedure, routine or a method. Only one copy of this instruction is stored in the memory. A subroutine has no value associated with its name. All outputs are defined in terms of arguments; there may be any number of outputs.

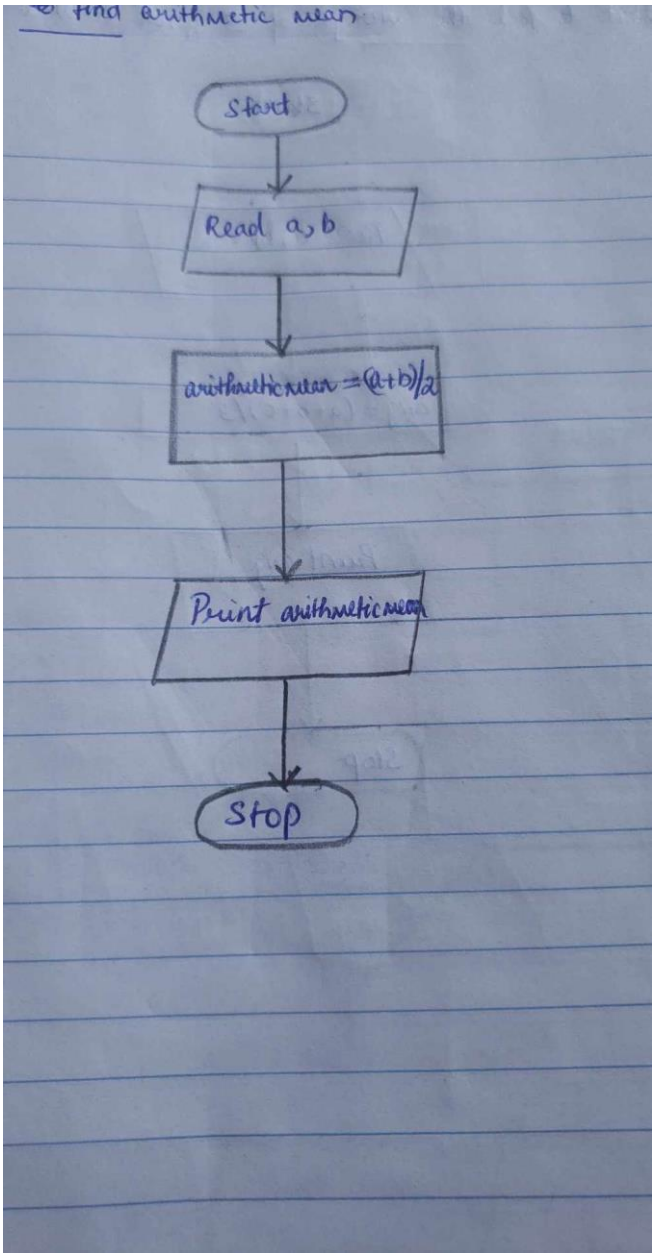
subroutine to find the sum of three numbers:

```
SUBROUTINE sub1(a,b,c,sum)

REAL a,b,c,sum

Sum=a+b+c

RETURN

END
```

Difference between subroutine and function:

Subroutine	Function
A subroutine is a sequence of program instructions that performs a specific task within a larger program.	A function is a named block of code that performs a specific task and returns a value.
A subroutine is used when a desired task is needed but no value is returned.	A function is used when a value is returned to the calling routine.
A subroutine could change the actual arguments.	A function should not change the values of actual arguments.
Subroutines are designed to be reusable.	Functions are not reusable.
Subroutines can be called multiple times from different parts of the program.	Functions are designed to be modular and can be called from different parts of the program to achieve a specific purpose.

(c) Draw a flow chart to input two numbers and print their arithmetic mean. 6

Ans: 

(d) Describe the different kinds of computer monitors. 5

Ans:

Classification of monitors on the basis of signal:

Computer monitor can be divided into two categories on the basis of the type of signal which they accept.

These are:

1. Analog Monitor

2. Digital Monitor

Analog Monitor: The Electronic signal that is sent by signals of varying frequency, amplitude or phase instead of being sent as an ON or OFF data transmission is called an analog signal. Analog signals allow equipment to handle information that continuously changes such as voltage, current, etc. These are the traditional type of color monitors and are based on CRT technology. These work like the television screen and accept analog signals.

Digital Monitor: An electronic signal that is sent as binary digits of either ON or OFF is called a Digital signal. The digital monitor receives digital signals and can use CRT technology. The data in these monitors is received from the video adapter. These are of different types such as CGA (Color Graphics Adapter), EGA (Enhanced Graphics Adapter), VGA (Video Graphics Array), and SVGA (Super Video Graphics Array). These are fast and produce clear images.

Classification of monitors on the basis of Resolution:

The resolution of a monitor means the number of pixels per inch appearing on its surface. In general the greater the number of pixels the sharper is the images. Most modern monitors can display 1024 by 768 pixels. Some high-end models of computer monitors can display 1280 by 1024, or even 1600 by 1200 pixels. Even 3280 by 2048 resolution monitors are available for special purposes. While CRTs provide variability in resolution LCDs monitor have a fixed resolution.

Classification of monitors on the basis of size:

The Size of computer screen is measured in diagonal inches and is given by measuring the distance from one corner to the opposite corner (diagonally). The smallest size for VGA monitors is 14 inches, which is also the entry level monitor for most computer systems. The Larger size landscape monitors can display two full pages side by side at a time. Other typical monitor sizes are 17 inches, 20 inches, 23 inches etc.

Classification of monitors on the basis of color:

In terms of color capabilities, monitors can be divided into the following groups:

1. Monochrome : These monitors display the result in two colors, i.e., black/white, green/black, amber/black. One color is for the background of the screen and other for the foreground.

2. Gray Scale: It is a monochrome type of monitor. But it displays the output by using different shades of gray, made by a combination of black and white.

3. Color Monitor: It can display the output in many colors, ranging from 16 to over 1 million different colors. These are also called as RGB monitors, because they accept three separate signals, which are red, green, and blue.

Classification of monitors on the basis of technology:

1.Cathode Ray Tube Monitors (CRT): are those monitors that were used in earlier versions of computer. They are heavier, require lot of space for installation and consume more energy.

The main components of a CRT monitors are the electron gun, the electron beam controlled by an electromagnetic field and phosphor coated display screen. These monitors produce images through manipulation of electronic beams. To precisely direct the electron beams, copper steering coils are used to create a magnetic field inside the tube. By applying varying voltages to the copper coils a beam can be positioned at any point on the screen.

2. Liquid Crystal Displays (LCD): These monitors are thinner as compared to Cathode Ray Tubes. It was first used in clocks and watches and later on used in laptops. Active matrix structure is used by most of the modern LCD monitors and television sets. In this technology, a matrix of thin-film transistors (TFT) is added to the polarizing and color filters. It enhances the display to make it look brighter and sharper. It can also produce much better images and have quicker response times.

They have higher resolution, consume energy ,take up less space and portable. Images produced by these monitors are of better quality than that of old CRT monitors. The LCD monitors have very high resolution and emit less radiation than CRT monitors. The screen is also flicker free.

3. Thin Film Transistor Liquid Crystal Display (TFT LCD)

It is type of monitor which used thin film transistor technology to enhance the image quality of LCD Monitors. These are used as monitor in television set, desktop computer, laptop computer and mobile phones etc.

4. Light Emitting Diodes Monitors (LED)

Light Emitting Diodes (LED) is the latest technology which is being used now a days for making high definition TV screens and monitors. It is a semi-conductor light source. In this technology diodes are used to light up the screen instead of liquid crystal Diodes. LED is

known as light emitting diode. It is an electronic device that lights up when electricity is passed through it. LEDs are usually red. They are good for displaying images because they can be relatively small, and they do not burn out. However, they require more power than LCD monitors. LED is light weight monitors and is used in laptop computers and in TV. The Life of LED monitors is three times than that of LCD monitors and they have less warm up time than that of CRT or LCD monitors. These monitors require less space on the desk, less power consumption and have flicker free screen.

5. Projection Displays

These are normally used for large group presentations. These systems can be connected to a computer and whatever appears on the computer terminal gets enlarged and projected on a large screen. Video projector receives video signals and projects the corresponding image on a projection screen. It uses a lens system for this projection.

These are popularly used for seminars, class room lectures, marketing presentations and conference room presentations etc.

(e) What is a DNS ? How can an address like www.xyz.ac.in be interpreted and accessed using web ? 6

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.

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

1. We first enter www.xyz.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.

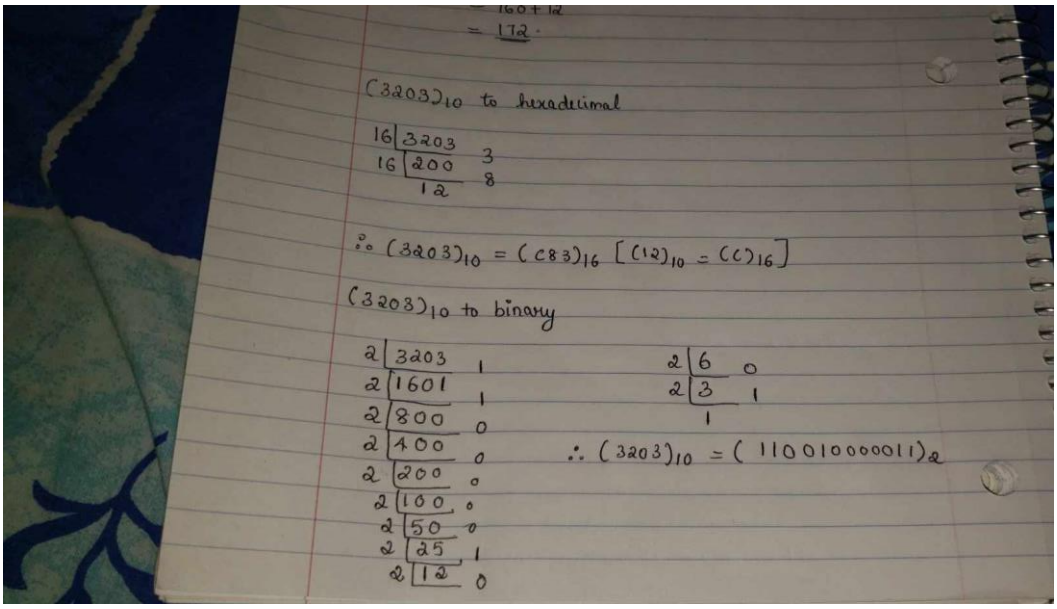
4. The server sends the webpage data back to your browser.

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

(f) Convert the following decimal numbers to hexadecimal numbers as well as binary numbers 6

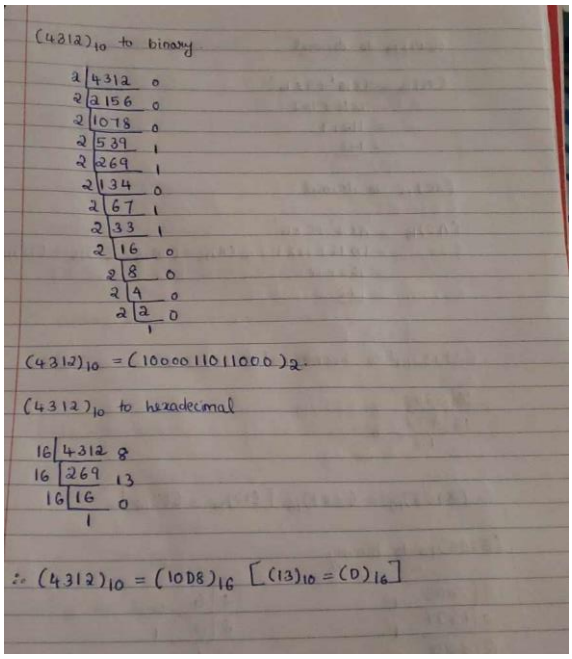
(i) $(3203)_{10}$

Ans:



(ii) $(4312)_{10}$

Ans:



(g) A company has an office at Delhi and another at Mumbai. It has a good link that delivers 2 Mbps between them. It is required to transfer 8.5 GB of data urgently from Delhi to a computer at Mumbai. A courier can reach the airport and board a flight in 2 hours. The flight time to Mumbai is another 2 hours and he can reach the Mumbai office from the airport in another 2 hours. Which method would be faster — use the link or send a courier ? 6

Time taken to send a courier= 2hrs+2hrs+2hrs

= 6hrs

Link delivers 2Mbps between them.

To transfer 8.5GB=8704mb (1GB=1024mb)

Time taken to deliver using link in minutes= 8704/60

=145min

Time taken to deliver using link in hrs=2hrs 25mns

Therefore, using link is better than courier as it saves 3hrs 35mns

2.

(a) What is open-source software ? What is open-source software licensing ? Describe the open-source development model. 8

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 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.

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.

(b) List with reasons any six precautions you would take while browsing a website. 6

Ans:

- Do not click all the links without considering the risks of your actions.

Some web page addresses may be disguised and may be very close to address of a site you want to visit but they may take you to an unexpected site.

- Do not download or install plug-in from the unknown party.

Cybercriminals can trick you into downloading malware-programs or apps that carry malware or try to steal information.

- Do not visit unsolicited websites, those add to your computer vulnerabilities.
- Do not login to a critical application if it does not have https://.

If someone is inputting sensitive data such as payment information or even just their name and address into an unprotected web page, then there's a possibility this data could be accessed by someone else and misused.

- Do not visit unsolicited websites, those add to your computer vulnerabilities.

When visiting unsafe sites, a user may inadvertently be redirected to other, even more malicious sites that may automatically attempt to install malware on the device.

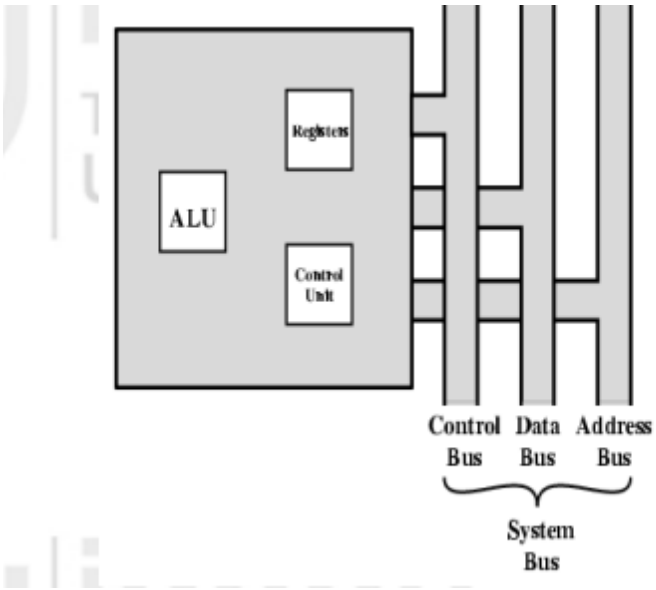
- Use a separate user account for accessing internet on your computer. Restrict the rights of this user account.

(c) Describe the constituents and functions of the Central Processing Unit of a computer. 6

Ans: Constituents 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.

Functions of CPU:

Central Processing Unit (CPU) is considered as one of the most important component of a computer system. It is also known as the brain of a computer. It contains all the circuitry needed to process input, store data, and other results. The main function of a CPU is to execute a series of instructions called as program in a specific sequence. Normally there are four steps that all CPU use in order to perform their operation these are: fetch, decode, execute and output. The CPU is constantly following instructions of computer programs that tell it which data to process and how to process it. Without a CPU, we could not run

programs on a computer. The CPU performs arithmetic, logic, and other operations to transform data input into more usable information output.

3. (a) What is a search engine ? Describe how different actions allow you to conduct a search on any given topic. 8

Ans: A search engine can be defined as a tool to search diverse and disorganized sources of information available on the Internet. It is a software program that helps people find the information they are looking for online using keywords or phrases. Search engines have some automated programs that need to continuously keep visiting the web pages about the content they have and organize the information about web pages in some format. These programs are called spiders, robots, crawlers, wanderers and worms. Search engines finds, classifies and stores information about the contents of various websites on the Internet.

Search engines are very useful to find information about anything quickly and easily. Using more keywords or different keywords improves the results of searches.

Different types of search engines available are:

a. Primary Search Engines: Such search engines use web crawlers or spiders to traverse the web and scan websites for key words, phrases, to generate database of web pages having some indexing or classification. Google and Alta Vista are examples of primary search engines.

Web directory: Web directories organize information into categories and subcategories or directories. You can search a web directory for all those entries that contain a particular set of keywords. Directories differ from search engines in the way they organize information. Yahoo is an example of web directory.

c. Meta search engines: This type of search engine does not compile databases. Instead, they search various individual search engines simultaneously on behalf of the user and retrieve hits from each of those databases. It passes your queries to many search engines and web directories and presents summarized results to the users. Some of the examples of meta search engines are — Dogpile, Infind, Metacrawler, Metafind and Metasearch.

A search engine performs, the following three actions:

1. Spidering or Web crawling

2. Indexing

3. Searching

Spidering: Spidering is also known as web crawling. Spider or Web crawler is a computer program that browses the web pages of WWW in a systematic, automated manner. They may do this every few days, so it is possible for content to be out-of-date until they crawl your website again. Search Engines use spider for getting up-to-date data on web sites. They are used to create a copy of the pages visited by them for later processing to create Index. These programs are also useful in validating HTML code to a particular standard like XHTML or checking or validating the hyperlinks.

Indexing: Once, the spiders have completed the task of finding information about Web pages, the search engine must store the information in such a way that you are able to use it. The search engine may provide some information relating to relevance of information may be in the form of Ranking. The search engine will try to understand and categorize the content on a web page through keywords. Thus, a search engine may store the keywords of a web page, the number of times that word appeared on the page, the URL of the page. A weighting factor that gives more weightage in case a word is found at the top of the document. Each commercial search engine uses a different formula for assigning weight to the keywords in its index. This is one of the reasons that a search for the same word on different search engines will produce different results. Since the data that is to be stored for indexing is large, therefore, search engine may encode it. The Index is created with the sole purpose, that is, it allows you to find information on the Internet quickly. In general, Index uses hashing.

Searching: When a user enters a query into a search engine, the engine examines its index and provides a listing of best-matching web pages according to its ranking criteria. This short list, usually, have a short summary containing the title of the document and small part of the text. Most search engines support Boolean search.

(b) What are the limitations of a computer ?

Ans: Following are the limitations of a computer:

Programmed and Supervised by Human : Though the computer is programmed to work efficiently, fast and accurately but it is programmed by human beings to do so. Without a program, a computer is nothing. Computers only follow these instructions. If the instructions are not accurate the working of computer will not accurate. Without supervision, computers will operate poorly when dealing with unexpected circumstances, such as information or instructions that are incorrect or incomplete.

No Intelligence: Although computers are faster, more diligent, accurate and versatile than human beings, they cannot replace them. Unlike human beings, computers do not have any intelligence. Its performance depends on instructions given to it. It cannot carry out any task on its own and can't take any decision on its own.

Self-Care : Computer cannot care for itself like a human. A computer is dependent still to human beings for this purpose.

Emotionless: Computers are emotionless. They do not have emotions and feelings. A computer cannot feel something like a human. A computer cannot compete with humans in respect of relations. Computers are simply machines which work as per the instruction given to them.

Thinking : Computer can not think itself. The concept of artificial intelligence shows that the computer can think. But still this concept is dependent on set of instructions provided by the human beings.

Retrieval of Memory : Computer can retrieve data very fast but this technique is linear. A human being's mind does not follow this rule. A human mind can think randomly which a computer machine can not.

High Cost: Computers are expensive.

(c) Describe three key distinguishing features of Object Oriented Languages. 6

Ans:

* Inheritance: It is an important pillar of OOP. It is the process by which a new class is created using an existing class. It is a way to compartmentalize and reuse code since it allows classes to inherit commonly used state and behavior from other classes. The new classes are called the derived classed and the main class is called the parent class.

* Encapsulation: is a mechanism through which a protective wrapper is created to hide the implementation details of the object and the only thing that remains externally visible is the interface of the object. (i.e.: the set of all messages the object can respond to). Encapsulation prevents code and data from being arbitrarily accessed by other code defined outside the wrapper.

* Polymorphism: Polymorphism is the characteristic of being able to assign a different meaning specifically, to allow an entity such as a variable, a function, or an object to have more than one form. It is the ability to process objects differently depending on their data types and to redefine methods for derived classes.

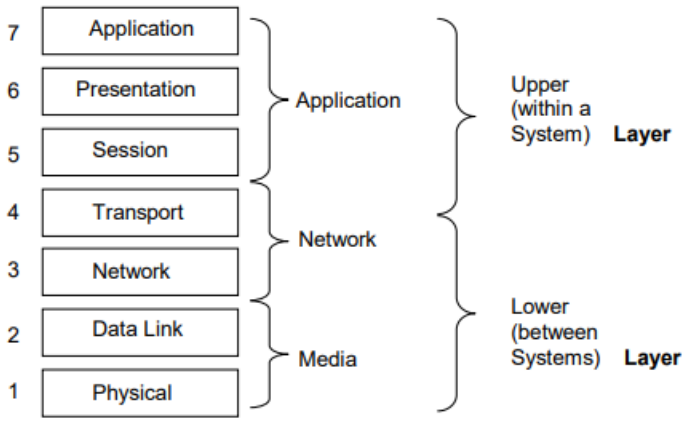
4.

(a) Explain, with the help of a diagram, the 7-layer OSI networking model. Indicate the function of each layer with an example. 8

Ans: OSI stands for Open Systems Interconnection. It was developed by ISO (International Organization for Standardization) in 1984. The OSI model is an abstract description for layered communications and computer network protocol design open system means that it can communicate with any other system that follows the specified standards, formats and semantics. Protocols specify how the different parties may communicate. It is a seven-layer architecture with each layer having specific functionality to perform. All these 7 layers work together to transmit data from one person to another across the globe. It is also referred to as the OSI Seven Layer Model.

A layer is a collection of conceptually similar functions that provide services to the layer above it and receives service from the layer below it. On each layer an instance provides services to the instances at the layer above and requests service from the layer below

The following are the layers of OSI model:



The OSI model is divided into two layers: upper layers and lower layers.

The upper layer of the OSI model mainly deals with the application related issues, and they are implemented only in the software. The application layer is closest to the end user. Both the end user and the application layer interact with the software applications.

The lower layer of the OSI model deals with the data transport issues. The data link layer and the physical layer are implemented in hardware and software. The physical layer is the lowest layer of the OSI model and is closest to the physical medium. The physical layer is mainly responsible for placing the information on the physical medium.

In its most basic form, it divides network architecture into seven layers which from top to bottom are the Application, Presentation, Session, Transport, Network, Data Link, and Physical Layers. In transmission side data flows from layer 7 to layer 1, then to cabling or suitable medium. When data reaches the reception side, it flows from layer 1 to layer 7.

Application Layer:It is the top-most layer of the OSI reference model. This layer is the layer for user interaction. We must have application software for dealing with the data.

Presentation Layer: It converts the data into suitable format. It does tasks like compression, decompression, encryption and decryption.

Session Layer: This layer manages connections between different application layers. This layer is responsible for the establishment of connection, maintenance of sessions, and authentication and ensures security.

Transport Layer: The transport layer provides services to the application layer and takes services from the network layer. This layer converts data into segments and reassembles the data stream. TCP and UDP are the protocols used in this layer. In this layer, data is converted into so called segments. It is responsible for the end-to-end delivery of the complete message. The transport layer also provides the acknowledgement of the successful data transmission and re-transmits the data if an error is found.

Network Layer: This layer translates logical address into physical address. This layer also fixes the route for data path. Router works in this layer. In this layer data is called a packet.

Data-Link Layer: This layer provides physical identification of a device using Media Access Control Address. The data link layer is responsible for the node-to-node delivery of the message. The main function of this layer is to make sure data transfer is error-free from one node to another, over the physical layer. It adds source and destination address to packets and convert them into frames. This is the layer that provides error free transmission.

Physical Layer: The lowest layer of the OSI reference model is the physical layer. This layer provides the functional requirements for activating a physical link. In this layer, data is carried from one device to another.

Functionality of each layer with an example:

To send a word document to a different network or through internet, the following are the process that will take place in each layer:

Application layer: In the APPLICATION LAYER, the user can edit the file by using application software like a word processor.

Presentation layer: In the PRESENTATION LAYER, user can compress the word file by using WINRAR or WINZIP and convert the data into different format for example.zip or .rar. We can also convert the word document into different formats.

Session layer: In the SESSION LAYER, the particular file has to be integrated with browser for attaching it to email or likewise clients.

Transport layer: In the TRANSPORT LAYER, data is converted to segments. Source IP and destination IP are added to each packet. Frame checks and parity bits are also added in this layer.

Network layer: In the NETWORK LAYER, the data is handed over to a router. The router calculates the best path for data transmission.

Data-link layer: In the DATA-LINK LAYER, transmission errors are handled and also flow of data is regulated so that receivers are not swamped by fast senders.

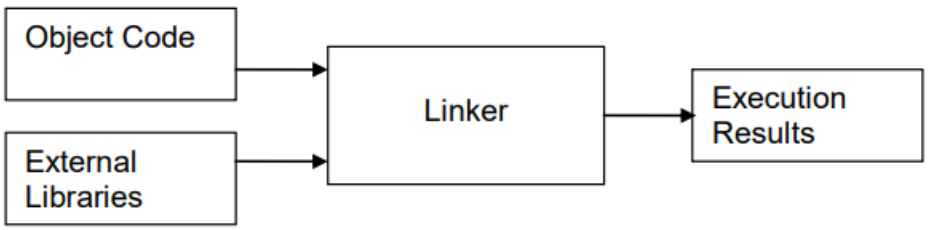
Physical layer: In the PHYSICAL LAYER, frames are transmitted as bits through media such as Optical fiber.

(b) Describe the functions and features of the following : 12

(i) Linker

Ans: Linkers: A linker is a program that takes one or more Object file codes generated by a compiler and combine them into a single executable program. Linker is a program in a system which helps to link object modules of a program into a single object file. Linkers are also called as link editors.

When large software, involving many programmers is to be developed, then the modular approach is adapted. The software is divided into functional modules and separate source programs are written for each module. Each of these source files can then be compiled independent of each other to create a corresponding object file. Eventually, linker is used to combine all the object files and convert them into a final executable program.



Linker

(ii) Debugger

Ans:

Features of debugger: A debugger is a tool that allows you to examine the state of a running program. Debugging is the process of locating and then removing bugs or error in a program. the primary advantage of debugging is that it helps identify and fix errors in software code. Debugging also helps to improve the overall quality of code. Debugging can be a time-consuming process, especially if the issue is complex or difficult to reproduce. Debugging can provide valuable insights into how software behaves under different conditions.

Functions of a debugger:

- It is used to test and debug other programs.
- Debuggers allow you to pause a running program at a specific point by means of a breakpoint in the code and examine the current state (values of variables, memory and CPU registers).
- Another function debugger offers are, one can control the program's execution line by line, stepping through the code to see how it executes and what's happening at each step.
- Debuggers can modify the state of the program while it is running rather than observing it.

(iii) Device Driver

Ans: Features of device driver:

Device drivers are shared computer programs that provide an interface between the hardware devices and operating system or other higher level programs.

Device drivers are essential for a computer system to work properly because without a device driver the hardware fails to work accordingly, which means it fails in doing the function/action it was created to do. Instead of writing the same code for a device in multiple applications you share the code between applications. To ensure that the shared code is not compromised, you protect it from users and programs. Such a piece of code is called the device driver.

Device drivers are hardware dependent and operating system specific. They allow you to add and remove devices conveniently from your computer system without changing any of the applications using that device.

Devices which require device drivers:

* Keyboards

* Mouse

* Printers

* Graphics cards

Functions of a device driver:

- The primary purpose of a device driver is to control or drive a device that is attached to your computer.
- It is a piece of software that enables communication between an operating system or application and hardware or peripheral devices.
- It serves as a bridge between the different components of a computer, allowing them to interact with each other.
- It is essential for the proper functioning of hardware components within a computer system. Without the appropriate drivers, the operating system may not be able to recognize or utilize the features of connected devices.
- The device driver also optimizes the performance of the device, such a adjusting the speed, resolution, or quality, depending on the system requirements and user preferences.

5.

(a) Uniform Resource Locator

Ans: A URL, which stands for Universal Resource Locator. URL is the global address of a document or resource on the WWW .It is the unique web address of a website, image, document or any other resources on the web. A UPL is a type of uniform resource identifier (URI) that provides a way to access information from remote computers, like a web server and cloud storage.

Parts of a URL:

A URL consists of three parts:

The first part is used to tell the browser what kind of server it will connect to. This component of the URL is called protocol. Every URL begins with a protocol. For web pages, this is usually http or https. Other protocols that we can use in this field of an URL are FTP, smtp etc. the protocol is always followed by ”://”.

The second part of the URL is a fully Qualified Domain Name. The fully qualified domain name identifies the site running the server. The domain name (or the domain) is the name of the computer on which the data you are looking for is located (the server). Web servers use port 80 by

default, but some servers has been set up to use other ports. The range of Well-Known Ports is in between 0–65535.

The first two parts of an URL are used to identify the web server of the website. Each web server has a home page and a directory to store the entire document related to the web page like images, audio, video files.

The third component of URL is an optional pathname for a particular document itself. File path is used to find the exact location of the resource we want to access.

Example: https://www.exampleurl.com/path/result.html

In the above example, the browser will connect to a web server using Hypertext Transfer Protocol Secure (HTTPS). The fully qualified domain name is www.exampleurl.com. The above is the address of the file result.html.

(b) ROM

Ans:

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.

From the programming mode point of view, we have

- Masked-programmed
- User-programmed

ROMs in which contents are written at the time of IC manufacture are called mask-programmed ROMs. PROM, EPROM and EEPROM or any other kind of PROM are user programmable ROMs. If we simply write (or say) ROM it means masked programmed.

An example of a ROM is the Toshiba mask ROM, TCS 534000.

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

PROM (Programmable ROM):

A variation of ROM chip is programmable read only memory (PROM). A PROM is a memory chip on which data can be written only once.

ROM chips are supplied by computer manufacturer and it is not possible for a user to modify the programs stored inside the ROM chip. However, in case of PROM, it is possible for a user to customize a system by storing own program in a PROM chip. Once a program has been written on to a PROM chip, the recorded information cannot be changed i.e., the PROM becomes a ROM and it is only possible to read the stored information. PROM is also a non-volatile memory i.e. the stored information remains even if power is switched off. The basic difference between PROM and a ROM is that a PROM is manufactured as blank memory, whereas a ROM is programmed during the manufacturing process.

To write data on a PROM chip, you need a special device called a PROM programmer or a PROM burner. The process of programming a PROM is sometimes called burning the PROM.

EPROM (Erasable Programmable Read Only Memory): An EPROM is a type of programmable read-only memory chip that retains its data when its power supply is switched off.

(c) Memory Management in an Operating System

Ans: 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.

(d) Client-Server Architecture

Ans: Client-Server Architecture is a computing model where tasks are divided between clients and servers. The need to share the processing demands between the host server

and the client workstation is increased because of the improved capacity and power of personal computers.

In client/server architecture, the tasks or workloads are divided into:

* server programs-server programs are providers of a resource or service. They respond to client requests, process data and send back the results.

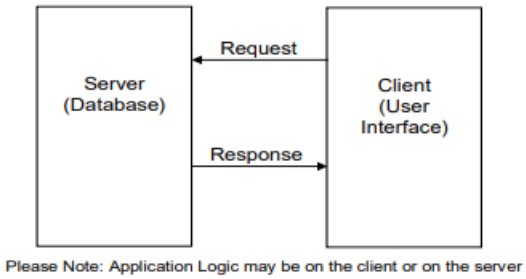
* client programs- client programs are requester of a resource or service. They initiate communication with servers to access data, files or perform tasks.

Clients and servers may reside in the same machine or they typically reside in separate pieces of hardware and communicate over a computer network. A server machine is a host that runs one or more server programs which share their resource with clients. A client does not share any of its resources, but requests a server function or service. The server program fulfills the client request. Clients initiate a communication session with the server. Client-server architecture enables efficient sharing of resources and centralized management of data and applications.

The client/ server system may be two-tiered, three-tiered or n-tiered.

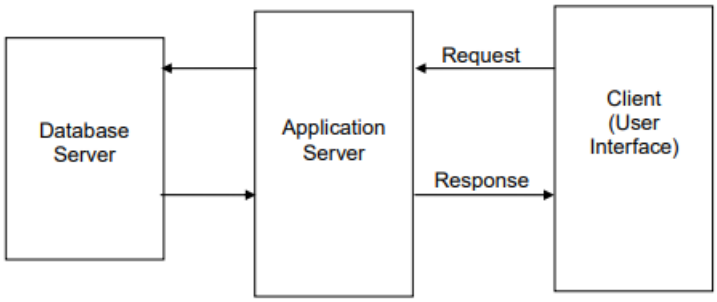
Two-tiered architecture: In this approach a database server was introduced to replace a file server. The emergence of relational database management systems and graphical user interface applications led to database server which could be accessed through the GUI based client applications. Since, the clients 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.



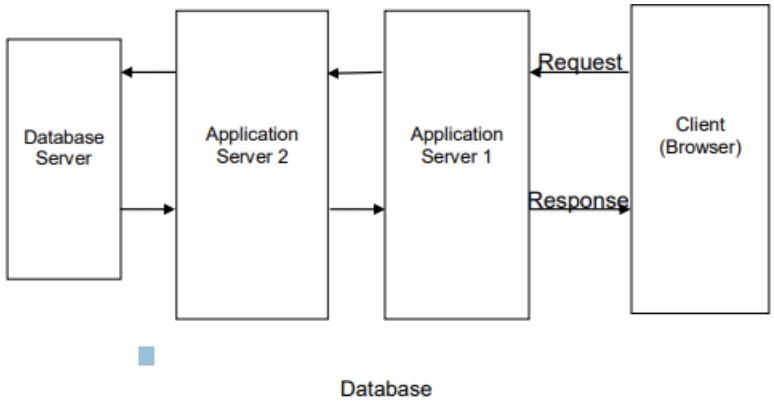
Two tier client server architecture

Three-tiered architecture: A new generation of client/server implementation takes a step further and adds a middle tier in between client and server to achieve —3-tier‖ architecture. The 3-tier architecture attempts to overcome some of the limitations of 2-tier schemes by separating presentation (user interface), processing (business functionality) and data into separate distinct entities. This leads to enhanced network performance and improved extensibility of business systems. In three-tier architecture, the application logic or process lives in the middle-tier, it is separated from the data and the user interface.



Three tier client server architecture

N-tiered architecture: The 3-tier architecture can be extended to N-tiers when the middle tier provides connections to various types of services, integrating and coupling them to the client, and to each other. Partitioning the application logic among various hosts can also create an N-tiered system. Encapsulation of distributed functionality in such a manner provides significant advantages such as reusability, and thus reliability (Ability of a computer program to perform its intended functions and operations for the specified period of time, in the specified system‘s environment, without experiencing any failure).

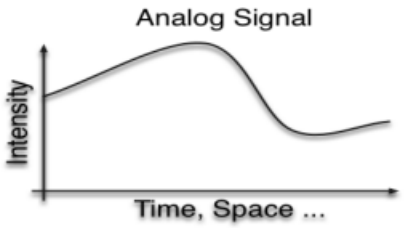


n-tiered architecture

(e) Analogue and Digital Signals

Ans: Analogue and digital signals are two types of signals used to transmit information.

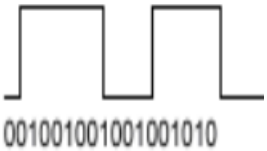
Analogue signals: Analogue signal is a continuous signal whose amplitude can take any value in a continuous range. It can have infinite number of values. Analog signals reproduce real world data. Analog signals vary smoothly over time. Examples of analog signals are sound waves, light waves etc.



Graph for analog signal

Analog signals are susceptible to noise interference and quality degradation over long distances. It requires a higher bandwidth for transmission. Analog signals are used in electric fan, landlines etc.

Digital signals: Digital signal is a discrete time signal that has a discrete number of levels. It can only assume one of the two values 0 or 1. Digital signals reproduce binary data. Examples of digital signals are data transmitted over internet and digital television.



Graph for digital signal

Digital signal are less susceptible to noise interference and can be easily regenerated to maintain quality. It requires less bandwidth for transmission compared to analog signals. Digital signals have better error detection and correction capabilities when compared with analog signals. Digital signals are used in computers, smartphones etc.

(f) Disk Checkers:

Ans: Disk Checkers are used to check the integrity of the hard disk and Pen Drive/ Flash Drive. CHKDSK is a command which is used for this purpose. This command can be used on a computer running Windows operating system. It fixes the logical file system errors found in the disk/drive. It is a command line tools which is used to check the volumes for any potential errors. This command can be used to repair the problems related to bad sectors, lost clusters, directory errors etc.

We can run CHKDSK command from either My computer or windows explorer and from command prompt.

Once CHKDSK finishes the checking, it returns exit codes whose description is as My Personal Computer below:

Exit Code	Description
0	No errors found
1	Errors found and corrected
2	Disk cleanup was performed or disk cleanup was not performed because /f was not specified
3	Could not check the disk, errors could not be corrected or errors were not corrected because /f was not specified.

Running CHKDSK from My Computer :

* Double-click my computer and then right-click the disk drive you want to check.

* Click properties there and then click Tools.

* Under Error-checking, click Check Now button. It will open a dialog-box which shows Check disk options.

Running CHKDSK from Command Prompt:

- Click Start and then click Run.
- In Open type cmd and then press enter key, then use one of the following options:

* If you want to run CHKDSK in read-only mode, type CHKDSK at command prompt and press enter.

*If you want to repairs the error without scanning the volumes for bad sectors, type CHKDSK volume:/f at command prompt and press enter.

*If you want to repair errors, locate bad sectors, and recover readable information, type chkdsk volume:/r at command prompt and then press ENTER.