

For 100% Result Oriented IGNOU Coaching and Project Training Call CPD: 011- 65164822, 08860352748

Q1.--What is the role of Central Processing Unit in a Computer? Find the details of CPU of present computers. What are the different types of Computers? Give one example of each type.

Ans:--

The role of the central processing unit (CPU) is to control the functions of the electronic product in which it is found. It accepts input data, processes information and sends it to whatever component that is in charge of executing the action. CPUs are also known as microprocessors and are at the centre of any computer system. The speed of the CPU is measured in either Megahertz (MHz) or more commonly now in Gigahertz (GHz). A 1 MHz CPU can carry out one million instructions per second. A 1 GHz CPU can carry out 1 billion instructions per second!

A typical CPU installed in a computer today would run at around 3 GHz.

The Details of Cpu in present Computer.

- 2010: AMD Opteron 4000 series
- 2010: AMD Opteron 6000 series (8 core and 12 core processors)
- 2010: AMD Opteron 6100 series (8 core and 12 core processors)
- 2011: AMD Fusion series (CPU and GPU on a single die)
- 2011: Intel 2nd Generation Core i3
- 2011: Intel 2nd Generation Core i5
- 2011: Intel 2nd Generation Core i7
- 2012: Intel 3rd Generation Core i3
- 2012: Intel 3rd Generation Core i5
- 2012: Intel 3rd Generation Core i7 -

The Types Of Computers: Analog and Hybrid (classification based on operational principle)

- **Analog Computers:** The analog computer is almost an extinct type of computer these days. It is different from a digital computer in respect that it can perform numerous mathematical operations simultaneously. It is also unique in terms of operation as it utilizes continuous variables for the purpose of mathematical computation. It utilizes mechanical, hydraulic, or electrical energy or operation.
- **Hybrid computers:** These types of computers are, as the name suggests, a combination of both Analog and Digital computers.

The Digital computers which work on the principle of binary digit system of “0” and “1” can give very precise results. But the problem is that they are too slow and incapable of large scale mathematical operation. In the hybrid types of computers the Digital counterparts convert the analog signals to perform Robotics and Process control. Apart from this, computers are also categorized on the basis of physical structures and the purpose of their use. Based on Capacity, speed and reliability they can be divided into three categories of computers:

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1. The Mainframe Computer - These are computers used by large organizations like meteorological surveys and statistical institutes for performing bulk mathematical computations. They are core computers which are used for desktop functions of over one hundred people simultaneously.

2. The Microcomputer - These are the most frequently used computers better known by the name of “Personal computers”. This is the type of computer meant for public use. Other than Desktop Computer the choice ranges as follows:

- Personal Digital Computer
- Tablet PC
- Towers
- Work Stations
- Laptops
- Hand Held Computer

3. The Mini computer - Mini computers like the mainframe computers are used by business organization. The difference being that it can support the simultaneous working of up to 100 users and is usually maintained in business organizations for the maintenance of accounts and finances.

Yet another category of computer is the Super Computers. It is somewhat similar to mainframe computers and is used in economic forecasts and engineering designs. Today life without computers is inconceivable. Usage of different types of computers has made life both smooth and fast paced.

Q-1.(b).

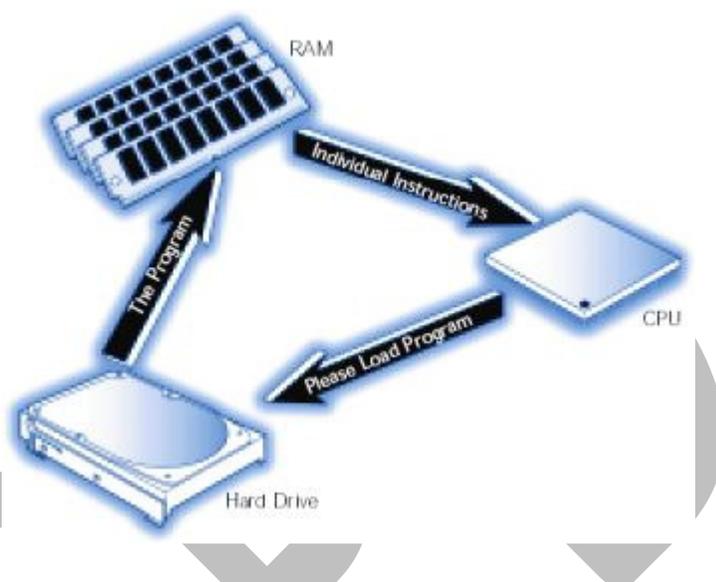
What is the role of memory in a computer? What are the different types of memories used in a Computer? Explain the uses of each type of memory. Find size range of these memories?

Ans:--

People in the computer industry commonly use the term “memory” to refer to RAM (Random Access Memory). A computer uses RAM to hold temporary instructions and data needed to complete tasks. This enables the computer’s CPU (Central Processing Unit), to access instructions and data stored in memory very quickly.

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A good example of this is when the CPU loads an application program – such as a word processing or page layout program – into memory, thereby allowing the application program to work as quickly and efficiently as possible. In practical terms, having the program loaded into memory means you can get work done more quickly with less time spent waiting for the computer to perform tasks.



The process begins when you enter a command from your keyboard. The CPU interprets the command and instructs the hard drive to load the command or program into memory. Once the data is loaded into memory, the CPU is able to access it much more quickly than if it had to retrieve it from the hard drive.

This process of putting things the CPU needs in a place where it can get at them more quickly is similar to placing various electronic files and documents you're using on the computer into a single file folder or directory. By doing so, you keep all the files you need handy and avoid searching in several places every time you need them.

the different types of memories used in a Computer

Read only memory

[Read only memory](#) (ROM) is the [permanent](#) memory which is used to store important control programs and systems software to perform a variety of functions, such as [booting](#) up or starting up programs. ROM is non-volatile. That means the contents are not lost when the power is

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switched off. Its contents are written at the time of manufacture, but in modern (2012) computers may be changed using special software.

Random access memory

Random access memory (RAM) is used as the working memory of a computer system. It stores input data, intermediate results, programs, and other information temporarily. It can be read and written. It is usually volatile, that is all data will be lost when the power is turned off.

a) Q1.(c). Convert the following numbers as stated

- (i) Decimal 372.125 to binary
- (ii) Decimal 6400 to hexadecimal
- (iii) Octal 754 to hexadecimal
- (iv) Octal 345 to decimal

Ans:-- Plz write on Step And Check The Same Ans then You write in ur Ans. In Assigment Sheet.

- (i) Decimal 372.125 to binary ---101110100.001
- (ii) Decimal 6400 to hexadecimal—1900
- (iii) Octal 754 to hexadecimal --- 1EC
- (iv) Octal 345 to decimal--- 229

Q1.(d). What is an instruction in the context of a Computer? Explain with the help of an example. How is an instruction executed by a computer?

Ans:--

A self-learning technique, usually offline/online, involving interaction of the student with programmed instructional materials.

Computer-assisted instruction (CAI) is an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place.

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CAI uses a combination of text, graphics, sound and video in enhancing the learning process. The computer has many purposes in the classroom, and it can be utilized to help a student in all areas of the curriculum.

CAI refers to the use of the computer as a tool to facilitate and improve instruction. CAI programs use tutorials, drill and practice, simulation, and problem solving approaches to present topics, and they test the student's understanding.

- 1. Drill-and-practice** Drill and practice provide opportunities for students to repeatedly practice the skills that have previously been presented and that further practice is necessary for mastery.
- 2. Tutorial** Tutorial activity includes both the presentation of information and its extension into different forms of work, including drill and practice, games and simulation.
- 3. Games** Game software often creates a contest to achieve the highest score and either beat others or beat the computer.
- 4. Simulation** Simulation software can provide an approximation of reality that does not require the expense of real life or its risks.
- 5. Discovery** Discovery approach provides a large database of information specific to a course or content area and challenges the learner to analyze, compare, infer and evaluate based on their explorations of the data.
- 6. Problem Solving** This approach helps children develop specific problem solving skills and strategies.

Computer-managed instruction is an instructional strategy whereby the computer is used to provide learning objectives, learning resources, record keeping, progress tracking, and assessment of learner performance. Computer based tools and applications are used to assist the teacher or school administrator in the management of the learner and instructional process.

Q 1.(e). Differentiate between the following:

- (i) Random Access vs. Serial Access**
- (ii) Parallel port vs. Serial port**

Ans:--(i)

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Comparing random versus sequential operations is one way of assessing application efficiency in terms of disk use. Accessing data sequentially is much faster than accessing it randomly because of the way in which the disk hardware works. The seek operation, which occurs when the disk head positions itself at the right disk cylinder to access data requested, takes more time than any other part of the I/O process. Because reading randomly involves a higher number of seek operations than does sequential reading, random reads deliver a lower rate of throughput. The same is true for random writing. You might find it useful to examine your workload to determine whether it accesses data randomly or sequentially. If you find disk access is predominantly random, you might want to pay particular attention to the activities being done and monitor for the emergence of a bottleneck.

For workloads of either random or sequential I/O, use drives with faster rotational speeds. For workloads that are predominantly random I/O, use a drive with faster seek time.

For workloads that have high I/O rates, consider using stripe sets because they add physical disks, increasing the system's ability to handle concurrent disk requests. Notice, however, that stripe sets enabled in software can cause an increase in consumption of the processor. Hardware-enabled RAID sets eliminate this impact on the processor but increase the consumption of processing cycles on the hardware RAID adapter.

Ans(ii)....

Parallel ports are easy to program and faster compared to the serial ports. But main disadvantage is it needs more number of transmission lines. Because of this reason parallel ports are not used in long distance communications. Let us know the basic difference between working of parallel port and serial port. In serial ports, there will be two data lines: One transmission and one receive line. To send a data in serial port, it has to be sent one bit after another with some extra bits like start bit, stop bit and parity bit to detect errors. But in parallel port, all the 8 bits of a byte will be sent to the port at a time and a indication will be sent in another line. There will be some data lines, some control and some handshaking lines in parallel port. If three bytes of data 01000101 10011100 10110011 is to be sent to the port, parallel port communication is faster then serial port.

Q1.(F)List the features of the following:

- (i) Scanner**
- (ii) LCD Monitors**
- (iii) MICR**
- (iv) Net book**

Ans:--

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(i). **Scanner :-the Main Feature ;--**

Scanner image sensors determine the quality of your scans. It's their job to convert the light reflected onto the object you're scanning and turn it into a clear digital image. Scanners typically use one of the three following types of image sensors.

Charge-Coupled Device (CCD): CCD scanners work in conjunction with a bright light that illuminates the image. Then, the CCD uses its rows of pixels to capture the image. CCD scanners usually produce better image quality than CIS scanners.

Contact Image Sensor (CIS): In CIS scanners, the image sensors lie directly underneath the document and pick up the reflected light directly from the document. CIS scanners tend to be more compact and durable than CCD scanners.

Photomultiplier Tubes (PMT): In drum scanners, three photomultiplier tubes are often used to capture red, blue, and green light individually. PMTs are more sensitive than CCDs and CISs, so they create more refined scans.

(ii). **LCD Monitors:-**

Cost_Effective
Energy_Efficient
Space_Economy
Reduced_radiation
Lighter_weight
Lesseye_strain
Improved_imagequality/contrast
Better_screen_privacy
Longlife
Easy options and features

(iii). **MICR:--** The MICR driver provides additional security to the end user if they require it. The printer's firmware has MICR security and related MICR features. The driver has MICR related security feature selections. The following are the main features of the driver:

- The driver is a variant of the standard PCL driver. It has all the features of the standard PCL driver, plus the MICR features.
- The driver installation is independent from the standard PCL driver, and will not interfere with the installation of the standard PCL driver.

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- During installation, the printer will show: "TallyGenicom 9035 MICR (PCL)"
- At print time, the driver will query the printer to see if a MICR Toner Cartridge is installed:
 - If no MICR Toner Cartridge is installed, the printer will print without MICR resource usage (MICR tab does not appear).
 - If the MICR Toner Cartridge is installed, the dialog box will prompt the user for a password (MICR tab will appear). A valid password allows the user to print with access to MICR resources.
 - The driver will then query the printer to see if a valid password has been entered.
 - If the password is invalid, it will ask the user again for valid password. If it is still invalid, the user can only print in standard mode.

(iv). **Net book** :--

A netbook is a shrunk-down, lightweight laptop that often has these key features:

- 3 pounds (more or less)
- 10-inch or smaller [screen](#)
- Intel Atom [processor](#)
- 1GB [RAM](#)
- 10/100 [Ethernet port](#)
- 802.11 b/g [wireless](#) card (some models support 802.11 n)
- Audio-in jack (microphone)
- Audio-out jack (headphones or [speakers](#))
- Built-in speakers (many models feature a built-in microphone)
- SD card reader
- Touchpad
- [USB](#) ports (2 or 3)
- [VGA](#) out (for external [monitor](#) or projector)

Netbooks with additional features such as [Bluetooth](#), larger [hard drives](#), longer life batteries, and so on cost more than basic models.

Q.1(g).List the configuration of a latest Laptop machine. Describe each component of the configuration.

Ans:--

The term "laptop" can refer to a number of classes of small portable computers:[\[10\]\[11\]](#)

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- **Full-size Laptop:** A laptop large enough to accommodate a "full-size" keyboard (a keyboard with the minimum [QWERTY key layout](#), which is at least 13.5 keys across that are on $\frac{3}{4}$ (0.750) inch centers, plus some room on both ends for the case). The measurement of at least 11 inches across has been suggested as the threshold for this class.^[12] The first laptops were the size of a standard U.S. "A size" notebook sheet of paper (8.5 × 11 inches)^[citation needed], but later "A4-size" laptops were introduced, which were the width of a standard [ISO 216](#) A4 sheet of paper (297 mm, or about 11.7 inches), and added a vertical column of keys to the right and wider screens. It can also be laid sideways when not in use.
- **Netbook:** A smaller, lighter, and therefore more portable laptop with less computing power than traditional laptops. It is usually cheaper than a full-size laptop, and has fewer features. The smaller keyboards of a netbook can be more difficult to operate. There is no definitive demarcation between netbooks and inexpensive small laptops, some 11.6" models are marketed as netbooks. Since netbook laptops are quite small in size and designed to be light and inexpensive they typically do not come with an internal [optical drive](#). The Asus [Eee PC](#) launched this product class, while the term was coined later by Intel. Most netbooks feature cheaper, slower, but more energy efficient CPUs, as compared to traditional laptops, such as the Intel Atom CPU.
- **Tablet PC:** These have [touch screens](#). There are "convertible tablets" with a full keyboard where the screen rotates to be used atop the keyboard, a "hybrid tablet" where the keyboard can be detached from the screen, and "slate" form-factor machines which are usually touch-screen only (although a few older models feature very small keyboards along the sides of the screen.)
- **Ultra-mobile PC:** An ultra-mobile PC (ultra-mobile personal computer or UMPC) is a small form factor version of a pen computer, a class of laptop whose specifications were launched by Microsoft and Intel in spring 2006. Sony had already made a first attempt in this direction in 2004 with its Vaio U series, which was only sold in Asia. UMPCs are smaller than subnotebooks, have a TFT display measuring (diagonally) about 12.7 to 17.8 cm, and are operated like tablet PCs using a touchscreen or a stylus. This term is commonly (if inaccurately) used for small notebooks and/or netbooks.
- **Handheld PC:** A Handheld PC, or H/PC for short, is a term for a computer built around a form factor which is smaller than any standard laptop computer. It is sometimes referred to as a Palmtop. The first handheld device compatible with desktop IBM personal computers of the time was the Atari Portfolio of 1989. Other early models were the Poqet PC of 1989 and the Hewlett Packard HP 95LX of 1991. Other DOS compatible hand-held computers also existed.
- **Rugged:** Engineered to operate in tough conditions (mechanical shocks, extreme temperatures, wet and dusty environments, etc.)
- **Ultrabook:** A very thin version of a laptop by definition less than 0.8 inches thick. Most versions of Ultrabooks contain [SSD](#), or Solid-State Drives, instead of the common

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Laptop Hard Disk Drives. Although this term (like Netbook) was coined and popularized by Intel, one of the most prominent examples is Apple's [Macbook Air](#).

Question:2 (Covers Block2)

- a) a). Explain the concept of client-server architecture. How is it different than File sharing Architecture? Explain different types of client-server architectures.

Ans:---

The **client-server model** is a [distributed application](#) structure in computing that partitions tasks or workloads between the providers of a resource or service, called [servers](#), and service requesters, called [clients](#).^[1] Often clients and servers communicate over a [computer network](#) on separate hardware, but both client and server may reside in the same system. A server is a host that is running one or more server programs which share their resources with clients. A client does not share any of its resources, but requests a server's content or service function.

. In a file-server solution, when your solution needs data, Access and the Jet database engine (which are running locally on a user's workstation) determine how to directly access the network drive, which files should be read, and what data to retrieve. Because retrieving data from the database file may require a series of requests and responses that must be sent between the server and the workstation, network traffic is increased. For example, to edit a record on a file-server database, the Jet database engine must read an index, retrieve the data, read and write to the *locking file* (a file that is used to coordinate requests to edit records between multiple users), and then update the index and the database itself

There are two types of client server architectures:

- **2-tier architectures:** In this architecture, client directly interact with the server. This type of architecture may have some security holes and performance problems. Internet Explorer and Web Server works on two tier architecture. Here security problems are resolved using Secure Socket Layer(SSL).
- **3-tier architectures:** In this architecture, one more software sits in between client and server. This middle software is called middleware. Middleware are used to perform all the security checks and load balancing in case of heavy load. A middleware takes all requests from the client and after doing required authentication it passes that request to the server. Then server does required processing and sends response back to the middleware and finally middleware passes this response back to the client. If you want to implement a 3-tier architecture then you can keep any middle ware like Web Logic or WebSphere software in between your Web Server and Web Browsers.

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Q.2(b). Explain the features of Object Oriented programming languages. How is object oriented programming different than that of procedural programming?

Ans:--

OOP stands for Object Oriented Programming and the language that support this Object Oriented programming features is called Object oriented Programming Language. An example of a language that support this Object oriented features is C++.

Features of Object oriented Programming

The Objects Oriented programming language supports all the features of normal programming languages. In addition it supports some important concepts and terminology which has made it popular among programming methodology.

The important features of Object Oriented programming are:

- Inheritance
- Polymorphism
- Data Hiding
- Encapsulation
- Overloading
- Reusability
- **Encapsulation** – Encapsulation is capturing data and keeping it safely and securely from outside interfaces.
- **Inheritance**- This is the process by which a class can be derived from a base class with all features of base class and some of its own. This increases code reusability.
- **Polymorphism**- This is the ability to exist in various forms. For example an operator can be overloaded so as to add two integer numbers and two floats.
- **Abstraction**- The ability to represent data at a very conceptual level without any details.

Programs are made up of modules, which are parts of a program that can be coded and tested separately, and then assembled to form a complete program. In procedural languages (i.e. C) these modules are procedures, where a procedure is a sequence of statements. In C for example, procedures are a sequence of imperative statements, such as assignments, tests, loops and invocations of sub procedures. These procedures are functions, which map arguments to return statements.

The design method used in procedural programming is called Top Down Design. This is where you start with a problem (procedure) and then systematically break the problem down into sub problems (sub procedures). This is called functional decomposition, which continues until a sub

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problem is straightforward enough to be solved by the corresponding sub procedure. The difficulties with this type of programming, is that software maintenance can be difficult and time consuming. When changes are made to the main procedure (top), those changes can cascade to the sub procedures of main, and the sub-sub procedures and so on, where the change may impact all procedures in the pyramid.

One alternative to procedural programming is object oriented programming. Object oriented programming is meant to address the difficulties with procedural programming. In object oriented programming, the main modules in a program are classes, rather than procedures.

Q.2.(c)..

Explain the concept of process, process management and memory management in the context of operating system.?

Ans:--

Process;-

process is a program in execution. To understand the importance of this definition, let's imagine that we have written a program called my_prog. C in C. On execution, this program may read in some data and output some data. Note that when a program is written and a file is prepared, it is still a script. It has no dynamics of its own i.e, it cannot cause any input processing or output to happen. Once we compile, and still later when we run this program, the intended operations take place. In other words, a program is a text script with no dynamic behavior.

Process Management

The operating system manages many kinds of activities ranging from user programs to system programs like printer spooler, name servers, file server etc. Each of these activities is encapsulated in a process. A process includes the complete execution context (code, data, PC, registers, OS resources in use etc.).

It is important to note that a process is not a program. A process is only ONE instant of a program in execution. There are many processes can be running the same program. The five major activities of an operating system in regard to process management are

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- Creation and deletion of user and system processes.
- Suspension and resumption of processes.
- A mechanism for process synchronization.
- A mechanism for process communication.
- A mechanism for deadlock handling.

Memory Management

Memory management is the process of controlling and coordinating computer [memory](#), assigning portions called [blocks](#) to various running [programs](#) to optimize overall system performance. Memory management resides in [hardware](#), in the [OS](#) (operating system), and in programs and [applications](#).

Primary-Memory or Main-Memory is a large array of words or bytes. Each word or byte has its own address. Main-memory provides storage that can be accessed directly by the CPU. That is to say for a program to be executed, it must be in the main memory.

The major activities of an operating system in regard to memory-management are:

- Keep track of which part of memory is currently being used and by whom.
- Decide which processes are loaded into memory when memory space becomes available.
- Allocate and deallocate memory space as needed.

Q.2(D).

What are the uses of Arrays in programming? Explain with the help of an example. Also explain how functions and subroutines are different to each other?

Ans:-

In C programming, one of the frequently arising problems is to handle similar types of data. For example: If the user wants to store marks of 100 students. This can be done by creating 100 variables individually but, this process is rather tedious and impracticable. These types of problems can be handled in C programming using arrays.

An array is a sequence of data items of homogeneous value (same type).

Arrays are of two types:

1. One-dimensional arrays
2. [Multidimensional arrays](#) (will be discussed in next chapter)

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Declaration of one-dimensional array

```
data_type array_name[array_size];
```

For example:

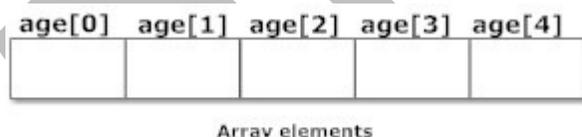
```
int age[5];
```

Here, the name of array is *age*. The size of array is 5, i.e., there are 5 items (elements) of array *age*. All elements in an array are of the same type (int, in this case).

Array elements

Size of array defines the number of elements in an array. Each element of array can be accessed and used by user according to the need of program. For example:

```
int age[5];
```



Note that, the first element is numbered 0 and so on.

Here, the size of array *age* is 5 times the size of int because there are 5 elements.

Suppose, the starting address of `age[0]` is 2120d and the size of int be 4 bytes. Then, the next address (address of `a[1]`) will be 2124d, address of `a[2]` will be 2128d and so on.

Initialization of one-dimensional array:

Arrays can be initialized at declaration time in this source code as:

```
int age[5]={2,4,34,3,4};
```

It is not necessary to define the size of arrays during initialization.

```
int age[]={2,4,34,3,4};
```

In this case, the compiler determines the size of array by calculating the number of elements of an array.

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age[0]	age[1]	age[2]	age[3]	age[4]
2	4	34	3	4

Initialization of one-dimensional array

Accessing array elements

In C programming, arrays can be accessed and treated like variables in C.

For example:

```
scanf("%d",&age[2]);  
/* statement to insert value in the third element of array age[]. */  
  
scanf("%d",&age[i]);  
/* Statement to insert value in (i+1)th element of array age[]. */  
/* Because, the first element of array is age[0], second is age[1], ith is age[i-1] and (i+1)th is  
age[i]. */  
  
printf("%d",age[0]);  
/* statement to print first element of an array. */  
  
printf("%d",age[i]);  
/* statement to print (i+1)th element of an array. */
```

Example of array in C programming

```
/* C program to find the sum marks of n students using arrays */  
  
#include <stdio.h>  
int main(){  
    int marks[10],i,n,sum=0;  
    printf("Enter number of students: ");  
    scanf("%d",&n);  
    for(i=0;i<n;++i){  
        printf("Enter marks of student%d: ",i+1);  
        scanf("%d",&marks[i]);  
        sum+=marks[i];  
    }  
    printf("Sum= %d",sum);  
    return 0;  
}
```

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Output

```
Enter number of students: 3
Enter marks of student1: 12
Enter marks of student2: 31
Enter marks of student3: 2
sum=45
```

Suppose, you declared the array of 10 students. For example: arr[10]. You can use array members from arr[0] to arr[9]. But, what if you want to use element arr[10], arr[13] etc. Compiler may not show error using these elements but, may cause fatal error during program execution.

Q.2.(E).

What is the model of development of Open source software? Explain the Open Source licensing policy?

Ans:--

Open-source software (OSS) is [computer software](#) with its [source code](#) made available and licensed with a [license](#) in which the [copyright](#) holder provides the rights to study, change and distribute the software to anyone and for any purpose.^[1] Open-source software is very often developed in a public, [collaborative](#) manner. Open-source software is the most prominent example of [open-source](#) development and often compared to (technically defined) [user-generated content](#) or (legally defined) [open-content](#) movements.^[2]

In the traditional model of development, which he called the *cathedral* model, development takes place in a centralized way. Roles are clearly defined. Roles include people dedicated to designing (the architects), people responsible for managing the project, and people responsible for implementation. Traditional software engineering follows the cathedral model. [Fred P. Brooks](#) in his book [The Mythical Man-Month](#) advocates this model. He goes further to say that in order to preserve the architectural integrity of a system, the system design should be done by as few architects as possible. ^[citation needed]

The bazaar model, however, is different. In this model, roles are not clearly defined. Gregorio Robles^[18] suggests that software developed using the bazaar model should exhibit the following patterns:

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. Furthermore users are encouraged to submit additions to the software, code fixes for the software, bug reports, documentation etc. Having more co-

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developers increases the rate at which the software evolves. [Linus's law](#) states, "Given enough eyeballs all bugs are shallow." This means that if many users view the source code, they will eventually find all bugs and suggest how to fix them. Note that some users have advanced programming skills, and furthermore, each user's machine provides an additional testing environment. This new testing environment offers that ability to find and fix a new bug.

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.

Frequent integration

Code changes should be integrated (merged into a shared code base) as often as possible so as to avoid the overhead of fixing a large number of bugs at the end of the project life cycle. Some open source projects have nightly builds where [integration is done automatically](#) on a daily basis.

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.

High modularization

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

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