

INTRODUCTION TO COMPUTERS

UNIT – 1: INTRODUCTION TO COMPUTERS

1. **Definition of Computer:** Electronic Data Processing device capable of receiving input, storing sets of instructions for solving problems and generating output with high speed and accuracy.
2. **Five Generations of Computers:**
 - 2.1 **First Generation** - employed Vacuum Tubes
 - 2.2 **Second Generation** - employed transistors and others solid state devices
 - 2.3 **Third Generation** - employed Integrated Circuits
 - 2.4 **Fourth Generation** - employed Large Scale Integrated Circuit (LSI)
 - 2.5 **Fifth Generation** - employed Artificial Intelligence and Parallel Data Processing (PDP)
3. **Various Types of Computer based on the working principal, size and data processing capability**
 - 3.1 **Analog Computer** - It is a form of computer that uses continuous physical phenomena such as electrical, mechanical, or hydraulic quantities to model the problem being solved.
 - 3.2 **Digital Computer** - A computer that performs calculations and logical operations with quantities represented as digits, usually in the binary number system.
 - 3.3 **Hybrid Computer** - A combination of computers those are capable of inputting and outputting in both digital and analog signals.
 - 3.4 **Super Computer** - Largest and fastest computer used in specialized areas such as in Defense, Aircraft design, Movies, Weather research. Examples are CRAY, CDC, and PARAM 10000.

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- 3.5 **Mainframe Computer** - Big general purpose computer capable of handling scientific and business applications which can support more than 10000 terminals.
- 3.6 **Mini Computer** - Perform Data Processing activities on a smaller scale and were developed for process control and system monitoring. Examples are Data General Nova, DEC, PDP-11 and IBM Series/1.
- 3.7 **Micro Computers** - Use Microprocessor as its CPU i.e. a small silicon chip on Circuit board in computer system. Examples are IBM PC, APPLE II, PS/2.

Other Types of Computer Systems

- 3.8 **Workstations** – Workstation is a high-end microcomputer designed for technical or scientific applications. It is based on the architecture of CPU called Reduced Instructions Set Computing (RISC) and are used by scientists and engineers.
- 3.9 **Server-** Provide services to other computing system called clients over a network.

4. Advantages and Limitations of Computer

- 4.1 **Advantages of Computer:** Speed, Accuracy, Reliability, Storage, Automation, Versatility, Communication, Diligence, No Feeling, Consistency, Precision.
- 4.2 **Disadvantages of Computer:** Programmed by human, No Intelligence, No decision making power, Emotionless, Curtail human capabilities.

5. Components of Computer System - CPU

5.1 CPU: Microprocessor

5.1.1 **Control Unit** – Manages the resources of computer system by executing set of instructions that the CPU can perform.

5.1.2 **ALU** – Arithmetic operations include addition, multiplication, subtraction and division. Logical operations include comparison such as equal to, greater than or less than.

5.2 **Features of CPU:** Clock speed, Cache, Architecture, Slot, Density, MMX.

6. Mother Board – A Printed Circuit Board (PCB) that acts as a direct channel for the various components to interact and communicate with each other.

6.1 **Components of Mother Board:** Processor Slot, Expansion Slots and Boards, Cards, Ports and Connectors, Bus.

7. Storage Device: A block of space which helps computer in processing arithmetical and logical operations by holding programs and data being manipulated.

- 7.1 **Types of Storage:** Primary storage, Secondary storage, Tertiary and off-line storage, Network storage.
- 7.2 **Characteristic of storage:** Volatility of information, Ability to access non-contiguous information, Ability to change information, Addressability of information, Capacity and performance.
- 7.3 **Primary Storage**
 - 7.3.1 **Semi Conductor Memory:** The number of transistors are integrated or combined together on a thin silicon wafer to form a complete set of circuits that can hold data.
 - 7.3.2 **Random Access Memory (RAM):** Volatile memory constructed with Metal-Oxide Semi Conductor Storage elements (MOS) that temporarily store dynamic data to enhance computer performance. Two types of RAM are - Dynamic and Static RAM.
 - 7.3.3 **Read Only Memory:** Perform the basic control and supervisory operation of the computer. Three types of ROM are - PROM, EPROM, and EEPROM.
 - 7.3.4 **Bubble Memory:** Small magnetic bubbles formed on a thin single crystal film of synthetic garnet are used to store the data permanently.
 - 7.3.5 **Flash Memory:** Non-Volatile memory, where data can be erased electrically or reprogrammed. They primarily used in memory cards, USB flash drives, and solid-state drives for general storage and transfer of data between computers and other digital products.
 - 7.3.6 **Video RAM:** Used to accelerate the display of graphics on the screen.
- 7.4. **Secondary Storage Devices:** Stores the data permanently in millions and billions of bytes.
 - 7.4.1 **Tape Device:** Magnetic tape is an external storage device that can be used for making copies of audio, video, and data. It is a secondary storage device that is capable of storing and accessing data sequentially.
 - 7.4.1.1 **Two types of Tape devices:** Detachable Reel Magnetic Tape and Tape Cartridge System.
 - 7.4.2 **Floppy Diskette:** 3.5 inches, 1.44 MB diskette has a total of 2880 sectors (80 tracks per side x 2 sides x 18 sectors per track).
 - 7.4.3 **Magnetic Disc:** Direct access medium known as Hard Disk, is a stack of one or more metal platters that spin on one spindle like a stack of rigid diskette.

7.4.3.1 Various operations of Magnetic Disc: Data storage consists of 3 components namely Seek Time, Rotational Time, and Data Transfer Time.

7.4.4 Optical Laser Disk: Store vast amount of data using optical laser beam that writes to the recording surface by scoring macroscopic pits in disk and another laser reads the data from the light sensitive recording surface.

7.4.4.1 Five categories of optical laser: CD-ROM Disk, WORM Disk, Magneto–Optical Disk, Digital Video Disk, Blu Ray Disc.

UNIT – II: INPUT AND OUTPUT DEVICES

1. **Definition of Input Device:** A device that is used to feed the data or information from outside world into the computer system.
2. **Types of Input Devices**
 - 2.1 **ON-LINE ENTRY:** Key board, Mouse, Touch Screen, Light Pen, Track Ball, Joy Stick, Scanner, Camera, Microphone & Speech recognition, Digitizing Tablets, MIDI Devices, Display devices.
 - 2.1.1 **Types of Display Devices - Monitors and Terminals.**
 - 2.1.1.1 **Five types of Terminals:**
 - **Dumb Terminal:** Provides for data entry and information exit.
 - **Intelligent Terminal:** Having built-in processing capability storage area through Microprocessor.
 - **Smart Terminal:** Having Microprocessors and some internal storage. It has data editing capability and can consolidate input data.
 - **Remote Job Terminal:** Groups data into blocks for transmission to a computer from remote site.
 - **Keyboard Printer Terminal:** Consists of a key board for sending information to the computer and a printer, for providing a copy of the input and for receiving information from the computer.
 - 2.1.1.2 **Features of Display Devices:** Screen resolution, Text and Graphics, CRT Versus Flat-Panel.
 - 2.2 **DIRECT DATA ENTRY:** Entry of data directly into the computer through machine readable source documents.
 - 2.2.1 **Types of DDE:**
 - 2.2.1.1 **Magnetic Ink Character Recognition (MICR):** Vertical bars containing magnetizable material.
 - 2.2.1.2 **Optional Character Reading (OCR):** Light scanning technique used to produce light dark pattern.

- 2.2.1.3 Optical Mark Recognition (OMR):** Use photo-electric device, which recognizes character by absorption on the document. It is commonly used for scoring tests.
- 2.2.1.4 Smart Card System:** It contains a microprocessor chip and memory to store the data.
- 2.2.1.5 Bar Code Reader:** A light sensitive detector identifies the bar code image using laser beam.
- 2.2.1.6 Image Processing:** It captures an electronic image of data to be stored and shared. It includes Data Capturing, Indexing, Storage, Retrieval, and Output.

3. Types of Output Devices

- 3.1 Monitor:** are video display terminal that displays the processed data, which the users can view on screen of different sizes. Two types of computer monitors are - CRT and Flat panel.
- 3.2 Printer:** are devices that produce hard copies of information stored in computer on to the papers or on transparencies or on other media.
 - 3.2.1 Impact Printer -** A printer which utilizes some form of striking device to transfer ink from an inked ribbon onto the paper being printed to form images or characters.
 - 3.2.1.1 Serial Printers:** Dot-matrix printer, Daisywheel printer.
 - 3.2.1.2 Line Printers:** Chain Printer, Drum printer.
 - 3.2.2 Non-Impact Printer -**A Printer do not strike a print head on the ribbon and form the character by chemical or electronic means.
 - 3.2.2.1 Types of Non-Impact Printer:** Thermal printer, Ink-Jet printer, Laser printer.
 - 3.2.2.2 Other types of Printer: Multifunctional Printer (MFP)**
 - 3.2.3 Computer Output Microfilm (Microfiche):** Output from a computer as microscopic images on rolls or sheet film.
 - 3.2.4 Speaker:** The sound card translates digital sounds into the electric current that is sent to the speakers for the purpose of producing output.
 - 3.2.5 Graph Plotter:** A device capable of tracing out graphs, designs and maps into paper.

UNIT - III: SOFTWARE

1. **Definition of Software:** A set of instructions, which is known as program, are combined together to perform specific task.
2. **Three Types of Software:** System Software, Application Software, General Purpose Software.
 - 2.1 **System Software:** Comprises of those programs that control and support the computer system and its data processing applications. It set of one or more programs designed to control the operation of computer system. Various types of System software are Programming Language, Operating Systems, Device Drivers, Utility Programs, and Language translators.
 - 2.1.1 **Various functions of Operating Systems:** Schedule Jobs, Manage H/W and S/W resources, Maintain system security, multiple user resource sharing, Interrupts handling, Maintain usage records.
 - 2.1.2 **Various types of Operating Systems:** MS/PC DOS, OS/2, Microsoft Windows(Windows 95, Windows 98, Windows NT, Windows 2000, Windows XP, Windows Server, Windows Vista, Windows 7.0), UNIX, Mac OS,LINUX, VMS.
 - 2.1.3 **Features of Operating Systems:** Multiprogramming, Multi-threading, Multi-tasking, Virtual Memory, Multiprocessing, Time-sharing.
 - 2.1.4 **Device Drivers:** Small files that act as an interface between hardware in a computer system and the operating system (OS).
 - 2.1.5 **Various types of Utility Programs:** Sort utilities, Spooling software, Text editor, Disk copy program, File copy program, Disk formatting program, File deletion program, File viewing program, Debugging program, and Directory program.
 - 2.1.6 **Three types of Language Translators:** Compilers, Interpreter, and Assembler.
3. **General Purpose Software/Utilities:** A framework for business, scientific and personal applications. Three types of software namely Commercial, Shareware, Open Source can be categorized as General Purpose software.
 - 3.1 **Various types of software:** Word Processor, Spread Sheet Program, DBMS, Internet Browser, E-mail.
4. **Application Software:** It employs the capability of the computer to perform task given by the user. It ranges from Payroll software, Accounting software, Inventory control, CAD, CAM, ERP etc.

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- 4.1 **ERP:** Integrates all data and process of organization into a single unified system that covers wide range of applications in the organization such as Manufacturing, Supply chain, Financials, CRM, HRM and Warehouse management.
- 4.2 **Decision Support System:** Information processing system used by accountants, managers and auditors to assist them in the decision making process.
 - 4.2.1 **Characteristics of DSS:** Supports management decision making, Solve relatively unstructured problems and provides friendly computer Interface.
 - 4.2.2 **Four Components of DSS:** The User, One or More Databases, Planning Language, The Model Base.
- 4.3 **Artificial Intelligence:** Software that tries to emulate aspects of human behavior, such as reasoning, communicating, seeing and hearing.
- 4.4 **Expert Systems:** A computerized information system that allows non-experts to make decisions comparable to those of an expert.
 - 4.4.1 **Five components of Expert Systems:** Knowledge base, Inference engine, User interfaces, Explanation facility and Knowledge acquisition facility. These are used to solve complex tasks which require experience and specialized knowledge in specific subject areas.

Question 1

(a) Describe briefly, the following terms:

- (i) Touch Screen
- (ii) Server
- (iii) Data Bus
- (iv) Dumb terminal
- (v) WORM Disk
- (vi) CMOS
- (vii) Multiprocessing
- (viii) Computer Output Microfilm
- (ix) Multiprogramming
- (x) SVGA
- (xi) Shareware
- (xii) Clock Speed

(xiii) *USB Connector*

(b) *Explain each of the following:*

(i) *Cache Memory*

(ii) *Spooling Software*

(iii) *Internet Browser*

(iv) *PROM*

(v) *Assembler*

(vi) *Flash Memory*

(vii) *Interpreter*

(viii) *Smart Card System*

(ix) *Compiler*

(x) *MMX*

(xi) *Operating System*

(xii) *BIOS*

Answer

- (a) (i) **Touch Screen:** It is used in information providing systems. It consists of a screen which is lined with light emitting devices on its vertical sides and photo-detectors are placed on the horizontal sides. When the user's finger approaches the screen, the light beam is broken and is detected by the photo detectors. It is more effect than the mouse.

Or

Touch Screen: Touch Screens are mainly used in Information – providing systems like Railway Reservation counters, stock exchanges, hotels, restaurants etc. When an invisible infrared beam 'matrix' crisscrossing the screen is pressed by finger over a function or program displayed on the screen, the infrared beam is broken at that intersection and the system is activated. The beam emanates from holes along the bottom and sides of the display unit.

- (ii) **Server:** A server is a computer system that provides services to other computing systems—called clients—over a network. Server operates continuously on a network and waits for service request from other computers on the network. It provides better access control and can reduce costs by reducing duplication of hardware/software.

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- (iii) **Data Bus:** The data bus is an electrical path that connects the CPU, memory, and the other hardware devices on the motherboard. In fact, the bus is a group of parallel wires. The number of wires in the bus affects the speed at which data can travel between hardware components.
- (iv) **Dumb Terminal:** It consists of I/O devices for data entry and obtaining result but has no processing capability. It cannot process the data at its own level, instead the data is processed by the central server. These terminals are used in central processing environment.
- (v) **WORM Disk:** It refers to Write Once, Read Many optical laser disks, or WORM disks. Once the data has been written to the medium, they only can be read, not updated or changed. When data is written to a WORM drive, physical marks are made on the media surface by a low-powered laser and since these marks are permanent, they cannot be erased. Companies generally store their proprietary information in WORM disk. These are 3½ inch diskette of 200 MB capacity onwards.
- (vi) **CMOS:** It is known as complementary metal oxide semiconductor. The PC uses the CMOS memory to store the date, time and system set up parameters, which are loaded every time the computer is started. It is powered by lithium ion battery.
- (vii) **Multiprocessing:** It refers to the use of two or more central processing units, linked together, to perform coordinated work simultaneously. The jobs can be processed more rapidly. It is also known as parallel processing.
- (viii) **Computer Output Microfilm (Microfiche):** It is an output technique that records output from a computer as microscopic images on rolls or sheet film. These are the same images, which can be printed on paper. The COM recording process reduces characters by 24, 42 or 48 times smaller than the normal size produced by the printer. The information is then recorded on sheet film called 16 mm, 35 mm microfilm or 105 mm microfiche.
- (ix) **Multiprogramming:** Multiprogramming is defined as execution of two or more programs that reside in primary storage. The CPU can execute only one instruction at a time, but can however, execute instructions from one program, then from second program then from first again, and so on. This type of processing is referred as "Concurrent Execution."
- (x) **SVGA:** SVGA or Super Video Graphics adapter is an improvement on the VGA. Two combinations of resolutions and colors provided by SVGA are:
 - 640 x 480 pixels with 256 colors.
 - 1024 x 480 pixels with 16 colors

- (xi) **Shareware:** Shareware is a software developed by individual and small companies that cannot afford to market their software world wide or by a company that wants to release a demonstration version of its commercial product.
 - (xii) **Clock Speed:** The clock speed is the speed at which the processor executes instructions. Clock speed is measured in either in megahertz (MHz)-which is a million cycles per second or in gigahertz (GHz) - which is one-billion cycles per second. Higher the clock's speed, the faster the processor, the better the system performance.
 - (xiii) **USB Connectors:** USB stands for Universal Serial Bus. USB connectors provide the user with higher data transfer speeds for different USB devices like keyboard, mouse, scanner or digital camera.
- (b) (i) **Cache Memory:** Processors incorporate a special type of internal memory (cache) to boost processing power significantly. Some of the information in the main memory is duplicated in the cache memory which is slightly slower but of much greater capacity than the processor register and faster but much smaller than main memory. It comes in three types: L₁ , L₂ and L₃ Cache.

Or

- Cache Memory:** Cache memory is a high speed memory capable of keeping up with the speed of CPU. It is similar to RAM from the access point of view and acts as a buffer between the CPU and the slower main memory.
- (ii) **Spooling Software:** The purpose of spooling software is to compensate for the speed difference between the computer and its peripheral devices such as input and output devices. It is used in large system and network computing environment.
 - (iii) **Internet Browser:** It is a application software that enables a user to display and interact with text, images and other information typically located on a web page at a website on the world wide web or local area network. Microsoft Internet Explorer is the most popular internet browser.
 - (iv) **PROM:** Programmable read only memory is a non-volatile memory which allows the user to program the chip with a PROM writer. The chip can be programmed once, there after, it cannot be altered.
 - (v) **Assembler:** It refers to a computer program that translates programs written in symbolic coding to produce machine language programs.
 - (vi) **Flash Memory:** Flash memory chips are a form of static RAM (SRAM) chips, which store data much like those used in the computer's primary storage. It is non-volatile computer storage technology through which data can be erased electrically and reprogrammed. However, the data stays recorded even when the power is turned off. Since flash memory is non-volatile, no power is needed to maintain the

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information stored in the chip. In addition, flash memory offers fast read access times and better kinetic shock resistance than hard disks

- (vii) **Interpreter:** It refers to a language translator that converts source program written in high level language to machine code. Interpreter translates programs a line at a time as it is being run. Each statement is translated into machine language just before it is executed.
- (viii) **Smart Card System:** Smart cards resemble credit cards in size and shape and contain a microprocessor chip and memory, where as some include a keypad as well. These cards are used most frequently to make electronic purchases and to electronically transfer funds between accounts. These cards could contain digitized fingerprints of the cardholder, which could be compared at a security checkpoint to fingerprints of people who are authorized to enter a secure area.
- (ix) **Compiler:** A compiler translates the entire program written in high-level languages such as COBOL, FORTRAN, and PASCAL into machine language before the program is executed. Compilers typically result in programs that can be executed much more swiftly than those handled by interpreters.
- (x) **MMX:** MMX stands for Multimedia Extensions—a set of instructions built into the CPU, specifically intended for improving the performance of multimedia or graphic applications—mainly games.
- (xi) **Operating System:** Operating System is defined as an integrated system of programs which supervises the operation of the CPU, controls the input/output functions of the computer system, translates the programming languages into the machine languages and provides various support services.
- (xii) **BIOS:** BIOS (stands for Basic Input Output System) is a small chip on the motherboard that loads the hardware settings required to load various devices like keyboards, monitors, or disk drives. It acts an interface between the operating system and the motherboard. It is a boot firmware program that controls the computer from the time we start it up until the operating system takes over. The BIOS also manages data flow between the computer's operating system and attached devices such as hard disk, video card, keyboard, mouse and printer.

Question 2

Describe the advantages and disadvantages of the computer system in brief.

Answer

Advantages of Computer Systems

- (i) **Speed:** The computer is a very high speed electronic device. The operations on the data inside the computer are performed through electronic circuits according to the given instructions. Computer can perform million of operations in one second. The computer generates signals during the process therefore the speed of computer is

usually measure in mega hertz (MHz) or gega hertz (GHz). It means million cycles units of frequency per second.

- (ii) **Accuracy:** In addition to being very fast, computer is also very accurate device. It gives accurate output result provided that the correct input data and set of instructions are given to the computer. If input data is in-correct then the resulting output will be in-correct. In computer terminology it is known as garbage-in garbage-out.
- (iii) **Reliability:** The electronic components in modern computer have very low failure rate. The modern computer can perform very complicated calculations without creating any problem and produces consistent (reliable) results. In general, computers are very reliable.
- (iv) **Storage:** A computer has internal storage (memory) as well as external or secondary storage. In secondary storage, a large amount of data and programs (set of instructions) can be stored for future use. The stored data and programs are available any time for processing.
- (v) **Automation:** A computer can automatically perform operations without interfering the user during the operations. It controls automatically different devices attached with the computer. It executes automatically the program instructions one by one.
- (vi) **Versatility:** Versatile means flexible. Modern computer can perform different kind of tasks one by one or simultaneously. It is the most important feature of computer. At one moment one can play games on computer, the next moment he/she can compose and send emails etc. In colleges and universities computers are used to deliver lectures to the students. The talent of computer is dependent on the software.
- (vii) **Communications:** Today computer is mostly used to exchange messages or data through computer networks all over the world. For example the information can be received or send through the internet with the help of computer. It is most important feature of the modern information technology.
- (viii) **Diligence:** A computer can continually work for hours without creating any error. It does not get tired while working after hours of work it performs the operations with the same accuracy as well as speed as the first one.
- (ix) **No Feelings:** Computer is an electronic machine. It has no feelings. It detects objects on the basis of instructions given to it. Based on our feelings, taste, knowledge and experience, we can make certain decisions and judgments in our daily life. On the other hand, computer can not make such judgments at its own. Their judgments are totally based on instructions given to them.
- (x) **Consistency:** People often have difficulty to repeat their instructions again and again. Computer can repeat actions consistently (again and again) without losing its concentration. A computer will carry out the activity with the same way every time.

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- (xi) **Precision:** Computers are not only fast and consistent but they also perform operations very accurately and precisely. For example, in manual calculations and rounding fractional values (The value with decimal point can change the actual result). In computer however, we can keep the accuracy and precision upto the level that we desire. The length calculations remain always accurate.

Limitations of Computer systems

- (i) **Programmed by human:** Though computer is programmed to work efficiently and accurately, but it is programmed by human beings to do so. Without a program, computer is nothing. A program is a set of instructions which perform particular task and if the instructions are not accurate, the working of computer will not be accurate.
- (ii) **No Intelligence:** Although computers are faster, more diligent, accurate and versatile than human beings, it cannot replace them. Unlike human beings, computers do not have any intelligence. Its performance is depends on instructions given to it. It cannot carry any task at its own.
- (iii) **No decision making power :**Computer cannot make any decisions nor can it render any help to solve a problem at its own like that if we plays chess with computer, the computer can take only those steps which is entered by the programmer. It cannot move at its own.
- (iv) **Emotionless :**Computers are emotionless. They do not have emotions as human beings are having. They are simply machines which work as per the instruction given to them.
- (v) **Curtail human Capabilities:** Although computers are great help to human beings. Sometimes, find it difficult to instantly speak out even those telephone numbers which they use every now and then as they have got the habit of using them by retrieving the storage. Further, excessive use of computers is causing various type of health injuries such as cervical and back pain, pain in eye, headache.

Question 3

Describe the various features of Third-Generation Languages (3GLs) and Fourth Generation Languages (4GLs).

Answer

These are the main features of the 3GLs and 4GLs:

Sl. No.	Third-Generation Languages 3 GLs	Fourth-Generation Languages 4 GLs
1.	It is intended for use by professional programmers.	It may be used by non-programming end-programmers, end users as well as a professional programmer.
2.	It requires specification of how to	It requires specification of what task to

	perform the task.	perform (system determines how to perform the task).
3.	It requires that all alternatives be specified.	It is having default alternatives built in; end user need not specify these alternatives.
4.	It requires large number of procedural instructions.	It requires far fewer instructions (less than one-tenth in most cases).
5.	The code may be difficult to read, understand and maintain.	The code is easy to understand and maintain because of English-like commands.
6.	The language developed originally for batch operation.	The language developed primarily for on-line use.
7.	It can be difficult to learn.	Many features can be learned quickly.
8.	It is difficult to debug the error.	Errors easier to locate because of short programs, more structured code, and use of defaults and English-like language.
9.	The approach is typically file-oriented.	The approach is typically data base oriented.

Question 4

Discuss in brief, various components of CPU.

Answer

CPU has at least two most important parts, the control unit and the arithmetic logic unit.

(i) The Control Unit

The control unit is one of the most important components of the CPU that implements the microprocessor instruction set. It extracts instructions from memory and decodes and executes them, and sends the necessary signals to the ALU to perform the operation needed. All the computer's resources are managed from the control unit.

The CPU's instructions for carrying out commands are built into the control unit. The instructions, or instruction set, list all the operations that the CPU can perform. Each instruction in the instruction set is expressed in microcode- a series of basic directions that tell the CPU how to execute more complex operations. Before a program can be executed, every command in it must be broken down into instructions that correspond to the ones in the CPU's instruction set. When the program is executed, the CPU carries out the instructions, in order, by converting them into microcode. Although the process is complex, the computer can accomplish it at an incredible speed, translating millions of instructions every second.

(ii) The Arithmetic Logic Unit

The actual processing of the data and instruction are performed by Arithmetic Logical Unit. The major operations performed by the ALU are addition, subtraction, multiplication, division,

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logic and comparison. Data is transferred to ALU from storage unit when required. After processing the output is returned back to storage unit for further processing or getting stored. Because computers store all the data in the form of numbers, a lot of the processing that takes place involves comparing numbers or carrying out mathematical operations.

In addition to establishing ordered sequences and changing those sequences, the computer operations can be divided into two types: arithmetic operations and logical operations. Arithmetic operations include addition, subtraction, multiplication, and division. Logical operations include comparisons, such as determining whether one number is equal to, greater than, or less than another number. Also, every logical operation has an opposite operation. For example, in addition to “equal to” there is “not equal to”.

The ALU includes a group of registers having high-speed memory locations built directly into the CPU that are used to hold the data currently being processed.

Question 5

What is CPU? Briefly describes the each features of CPU.

Answer

The heart of any computer is the central processing unit (CPU). It is this central processor that makes comparisons, performs calculations, reads, interprets and controls the execution of the instructions.

Various features of the Central Processing Unit

(i) Clock Speed: The clock speed is the speed at which the processor executes instructions. Clock speed is measured in either in megahertz (MHz)-which is a million cycles per second or in gigahertz (GHz)- which is one-billion cycles per second. Higher the clock's speed, the faster the processor, the better the system performance.

(ii) Cache: Processors incorporate their own internal cache memory. The cache acts as temporary memory and boosts processing power significantly. The cache that comes with the processor is called Level One (L1) cache. This cache runs at the processor's clock speeds, and therefore is very fast. The L1 cache is divided into 2 sections—one for data, the other for instructions. Generally, more the L1 cache, faster the processor.

PCs also include a much slower secondary, or Level Two (L2) cache. This cache resides on the motherboard and delivers slower performance when compared with the L1 cache.

The new type of cache known as L3 cache is specialized memory that works hand-in-hand with L1 and L2 cache to improve computer performance. The advantage of having on-board cache is that it's faster, more efficient and less expensive than placing separate cache on the motherboard.

(iii) Architecture: The CPU's architecture determines the manner in which it processes data. CPUs employ multi-staged pipelines for transmitting data. To ensure proper data flow through these lines, the CPU includes a kind of prediction and error correction mechanism.

(iv) **Slot:** Different processors use different sockets or slots to fit onto the motherboard. A **CPU socket** or **CPU slot** is an electrical component that attaches to a printed circuit board (PCB) and is designed to house a microprocessor. It is a special type of integrated circuit designed for very high pin counts. A CPU socket provides many functions, including providing a physical structure to support the CPU, providing support for a heat sink, facilitating replacement (as well as reducing cost) and most importantly forming an electrical interface both with the CPU and the PCB. Socket H, G32 and 34 are most popular socket used in computer system now-a-days.

(v) **Density:** A CPU is made up of millions of small transistors. A CPU performs all the calculation and manipulation operations by synchronising between the transistors. Therefore, the shorter the distance between two transistors on a CPU, the faster the performance.

(vi) **MMX:** MMX stands for Multimedia Extensions—a set of instructions built in to the CPU, specifically intended for improving the performance of multimedia or graphic applications—mainly games. However, one needs to have applications specifically designed to take advantage of MMX.

Question 6

What do you mean by a port? Describe the various types of ports.

Answer

Ports and connectors are components of the motherboard that let the user connect external devices like printers, keyboards or scanners and let them interface with the PC. The physical interfaces for the ports and connectors are located on the outside—typically at the back of the PC, but they are directly or indirectly (using a connector card) connected to the motherboard. There are various types of ports or connectors, each providing different data transfer speeds to connect various external peripherals.

- (i) **Parallel port:** A **parallel port** is a parallel communication physical interface. Parallel ports facilitate the parallel transmission of data, usually one byte (8 bits) at a time. It is also known as a **printer port** or **Centronics port**. The IEEE 1284 standard defines the bi-directional version of the port, which allows the transmission and reception of data bits at the same time. Parallel ports are used to connect external input/output devices like scanners or printers.
- (ii) **Com/Serial port:** A **serial port** is a serial communication physical interface through which information transfers in or out one bit at a time. They are used for connecting communication devices like modems or other serial devices like mice. There are two varieties of Com ports—the 9-pin ports and 25-pin ports. Serial port uses 25 pin RS-232 port.
- (iii) **IDE drive connector:** IDE devices like CD-ROM drives or hard disk drives are connected to the motherboard through the IDE connector.

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- (iv) **Floppy drive connector:** The floppy drive connectors are used for connecting the floppy drive to the motherboard, to facilitate data exchange.
- (v) **USB connector:** USB stands for Universal Serial Bus. These ports provide the user with higher data transfer speed for different USB devices like keyboards, mice, scanners or digital cameras.
- (vi) **PS/2 connector:** PS/2 stands for Personal System/2. PS/2 connectors are used to connect PS/2 based input devices like PS/2 keyboards or mice.

Question 7

Name the various characteristics of storage on which storage devices can be classified.

Answer

The division to primary, secondary, tertiary and off-line storage is based on memory hierarchy, or distance from the central processing unit. There are also other ways to characterize various types of storage.

(i) Volatility of information

- **Volatile memory** requires constant power to maintain the stored information. Volatile memory is typically used only for primary storage.
- **Non-volatile memory** will retain the stored information even if it is not constantly supplied with electric power. It is suitable for long-term storage of information, and therefore used for secondary, tertiary, and off-line storage.

(ii) Differentiation of information

- **Dynamic memory** is volatile memory which also requires that stored information is periodically refreshed, or read and written without modification.
- **Static memory** is a form of volatile memory similar to DRAM with the exception that it never needs to be refreshed as long as power is applied. (It loses its content if power is removed).

(iii) Ability to access non-contiguous information

- **Random access** means that any location in storage can be accessed at any moment in the same, usually small, amount of time. This makes random access memory well suited for primary storage.
- **Sequential access** means that the accessing a piece of information will take a varying amount of time, depending on which piece of information was accessed last. The device may need to *seek* (e.g. to position the read/write head correctly), or *cycle* (e.g. to wait for the correct location in a constantly revolving medium to appear below the read/write head) the required information at given point of time.

(iv) **Ability to change information**

- **Read/write storage**, or **mutable storage**, allows information to be overwritten at any time. A computer without some amount of read/write storage for primary storage purposes would be useless for many tasks. Modern computers typically use read/write storage, which is also used for secondary storage.
- **Read only storage** retains the information stored at the time of manufacture, and **write once storage** (WORM) allows the information to be written only once at some point after manufacturing. These are called **immutable storage**. Immutable storage is used for tertiary and off-line storage. Examples include CD-R.
- **Slow write, fast read storage** is read/write storage which allows information to be overwritten multiple times, but with the write operation being much slower than the read operation. Examples include CD-RW.

(v) **Addressability of information**

- In **location-addressable storage**, each individually accessible unit of information in storage is selected with its numerical memory address. In modern computers, location-addressable storage usually limits to primary storage, accessed internally by computer programs, since location-addressability is very efficient, but burdensome for humans.
- In **file system storage**, information is divided into *files* of variable length, and a particular file is selected with human-readable directory and file names. The underlying device is still location-addressable, but the operating system of a computer provides the file system abstraction to make the operation more understandable. In modern computers, secondary, tertiary and off-line storage use file systems.
- In **content-addressable storage**, each individually accessible unit of information is selected with a hash value, or a short identifier with no pertaining to the memory address the information is stored on. Content-addressable storage can be implemented using software (computer program) or hardware (computer device), with hardware being faster but more expensive option.

(vi) **Capacity and performance**

- **Storage capacity** is the total amount of stored information that a storage device or medium can hold. It is expressed as a quantity of bits or bytes (e.g. 10.4 megabytes)
- **Storage density** refers to the compactness of stored information. It is the storage capacity of a medium divided with a unit of length, area or volume (e.g. 1.2 megabytes per square centimeter)

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- **Latency** is the time it takes to access a particular location in storage. The latency is typically nanosecond for primary storage, millisecond for secondary storage, and second for tertiary storage. It may make sense to separate *read latency* and *write latency*, and in case of sequential access storage, *minimum*, *maximum* and *average latency*.
- **Throughput** is the rate at which information can read from or written to the storage. In computer storage, throughput is usually expressed in terms of *megabytes per second* or *MB/s*, though bit rate may also be used. As with latency, *read rate* and *write rate* may need to be differentiated.

Question 8

Explain in brief, the floppy disk as an auxiliary device.

Answer

Floppy Diskettes consisted of a circular piece of thin plastic material, approximately eight inches in diameter, which was coated with an oxide material. The circular piece of plastic, called a disk, is enclosed in a square protective jacket with a cut out so that the magnetic surface is exposed. When inserted in the appropriate hardware device, the disk is rotated inside the protective jacket, allowing keyed data or data from main computer memory to be stored on the rotating disk. Once data is stored on the disk, it can be read from the disk into main computer. This medium for input and auxiliary storage is called a floppy disk or diskette. The surfaces of diskettes are coated with millions of tiny iron particles so that the data can be stored on them. Each of these particles can act as a magnet, taking on a magnetic field when subjected to an electromagnet. The read/write heads of a diskette drive (or a hard disk/ tape drive) contain electromagnets, which generate magnetic field in the iron on the storage medium as the head passes over the diskette (or disk).

Question 9

Describe the various factors which determine the storage capacity of a magnetic disk.

Answer

Diskette Storage capacity depends upon the following factors:

- (i) **Number of sides of the diskette used:** Earlier disks and drives were designed so that data could be recorded only on one side of the diskette. Now a days disk drives are manufactured so that data can be read/written on both sides of the diskette. Such drives are called 'Double Sided Drives'. The use of double sided drives and diskette approximately doubles the number of characters that can be stored on the diskette.
- (ii) **The recording density of the bits in the track:** Recording density refers to the number of bits that can be recorded on a disk in one inch circumference of the innermost track on the diskette. This measurement is referred to as bits per inch (bpi). For the user, the diskette is identified as being either single density or double density. A single density drive can store 2768 bits per inch.

- (iii) **The number of tracks on the diskette:** Number of tracks depends upon the drive being used. Many drives record 40 tracks on the surface of the diskette. Other drives, however, can record 80 tracks on the diskette.

In case of hard disk the storage capacity depends on the number of platters that are stacked on the top of one another, the number of tracks per platter and the number of sectors per track. Hard disks generally have 6 platters, i.e. 12 faces out of which eleven faces can be used. Each side may have 200 or more tracks, each track having 54, 63 or even more sectors per track and hard disk generally store 512 bytes of data in a sector. Data on magnetic disc is stored in cylinders where the n th track of each face vertically above and below each other constitutes cylinder n .

Thus, the storage capacity of hard disk is calculated as

= No. of cylinders $\times$ No. of usable sides $\times$ No. of sectors / track $\times$ No. of bytes / sector.

Question 10

What are the advantages and disadvantages of Direct Access Storage?

Answer

The advantages of Direct access devices are:

- (i) Magnetic rigid disk is a direct access storage medium; therefore, individual records can be retrieved without searching through the entire file.
- (ii) The costs of disks are steadily declining.
- (iii) For real-time systems where direct access is required, disks are currently the only practical means of file storage. Other new types of storage, such as bubble storage, are not widely used yet.
- (iv) Records can be readily updated by writing the new information over the area where the old information was stored.
- (v) With removable disk packs, a single disk drive can store large quantities of data although all but one of the disks is offline at any given point in time. However, being offline is not a disadvantage for many applications, especially batch applications.
- (vi) Interrelated files stored on magnetic disk can allow a single transaction to be processed against all of these files simultaneously.
- (vii) Data corruption rate is much less than other storage media like floppy disk, magnetic tapes.

The disadvantages of Direct access devices are:

- (i) Security of information stored on magnetic disks which are used as shared, is major concern.

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- (ii) Regular 'head' crashes can damage the surface of the disk, leading to loss of data in that sector.
- (iii) The disk is fixed inside the computer and cannot easily be transferred to another computer.
- (iv) Updating a master file stored on disk destroys the old information. Therefore, disk does not provide an automatic audit trail. When disk is used, back-up and audit trail require that each old master file records be copied to another medium prior to update.

Question 11

What is Optical Laser Disk? How the data is stored on Optical Laser Disk?

Answer

A storage medium from which data is read and to which it is written by lasers. Optical disks can store much more data upto 6 gigabytes (6 billion bytes), than the most portable magnetic media, such as floppies.

Optical laser disk storage is capable of storing vast amount of data. With this technology, the read/write head used in magnetic storage is replaced by two lasers. One laser beam writes to the recording surface by scoring macroscopic pits in the disk, and another laser reads the data from the light sensitive recording surface. A light beam is easily deflected to the desired place on the optical disk, so a mechanical access arm is not needed.

There are four basic types of optical disks:

- (i) **CD-ROM:** It is a spinoff of audio CD technology and stands for compact-disk-read-only memory. Once inserted into the CD-ROM disk drive, the text, video images, and so on can be read into primary storage for processing or display. However, the data on the disk are fixed, they can not be altered. The capacity of a single CD-ROM is over 650 MB which is equivalent to 250,000 pages of text, or 1500 floppy disks. The tremendous storage capacity has opened the door to a variety of multimedia applications. Unlike a video tape, CD-ROM gives the presenter instant random access to any sequence of images on the disk.

There are three basic types of optical disks:

CD-ROM :It stands for compact disc read-only memory.

CD RW: It stands for compact disc rewriteable.

CD-R : It stands for compact disc, recordable.

- (ii) **WORM Disk:** It refers to Write Once, Read Many optical laser disks, or WORM disks. Once the data has been written to the medium, they only can be read, not updated or changed. When data is written to a WORM drive, physical marks are made on the media surface by a low-powered laser and since these marks are permanent, they

cannot be erased. Companies generally store their proprietary information in WORM disk. These are 3½ inch diskette of 200 MB capacity onwards.

- (iii) **Magneto-Optical Disks:** Magneto-optical disk integrates optical and magnetic disk technology to enable read-write storage. MO diskette can store many times that amount, ranging from 100 MB up to several gigabytes (GB). MO discs come in 3.5" and 5.25" cartridges. The capacities of 3.5" cartridges are 128MB, 230MB, 640MB, 1.3GB and 5.25" cartridges are 650MB, 1.3GB, 2.6GB, 5.2GB, and 9.1GB.

An MO system achieves its high data density by using a laser and a magnetic read/write head in combination. Both the laser and the magnet are used to write data onto the diskette. The laser heats up the diskette surface so it can be easily magnetized, and also to allow the region of magnetization to be precisely located and confined. A less intense laser issued to read data from the diskette. Data can be erased and/or overwritten an unlimited number of times, as with a conventional 3.5-inch diskette

- (iv) **Digital Video Disk: DVD** (also known as "Digital Versatile Disc" or "Digital Video Disc") is an optical disc storage media format that can be used for data storage, including movies with high video and sound quality. A video disk can store text, video, and audio data. Video disks can be accessed a frame at a time (to provide still information) or played like a phonograph record (to supply up to an hour of moving action). Any of the 54,000 tracks on the surface of typical video disk can be accessed in about three seconds.

DVD can store 4.7 gigabyte of data on a single-side and 17 gigabytes of data on a double-side of the disc. This compares to 650 megabytes (.65 gigabyte) of storage for a CD-ROM disk.

A digital video disk (DVD) is a 5 inch plastic disk that uses a laser to encode microscopic pits in its substrate surface. But the pits on a DVD are much smaller and are encoded much closer together than those on a CD-ROM.

DVD-5, 9, 10 and 18 are the various types of DVDs can be used for storing images, text, movies, high resolution graphics etc.

The advantages of DVDs are therefore self-evident – a huge storage capacity that enables users to archive large amounts of data on a single, lightweight, removable, reliable, easily-transportable medium. Video disks are widely used for training applications.

Question 12

Describe various types of computer terminal and their uses in brief.

Answer

A computer terminal is an electronic or electromechanical hardware device that is used for entering data into, and displaying data from, a computer or a computing system. Typically, it

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provides a text terminal interface over a serial line. A computer terminal or video display terminal (VDT), generally combines input and output functions. It consists of a QWERTY keyboard for inputting information direct to the computer, and either a printer or a TV screen for displaying information from the computer. Terminals are most commonly found in area that is remote from the main computer and they interact with the computer through communication lines or networks.

Types of terminals

- (i) **Dumb Terminal:** It is an input/output (I/O) device that provides for data entry and information exit when connected to a computer but has no additional capability.
- (ii) **Intelligent Terminal:** It has an in-built processing capability. It is also user-programmable. It contains not only a storage area but also a microprocessor. The terminal can be programmed to communicate with and instruct the user who is entering data. Intelligent terminal's is cost several times more than non-intelligent terminals.
- (iii) **Smart Terminal:** It additionally, contains a microprocessor and some internal storage. They have data editing capability and can consolidate input data before sending it to CPU. These terminals are non-programmable by users.
- (iv) **Remote Job Terminal:** Also referred to as Remote Job Entry or RJE, groups the data into blocks for transmission to a computer from a remote site. RJE terminals have the capability of receiving data back and printing the results of the application program. Such a unit is in itself a small computer, which can be used either as job entry terminal or as a stand-alone computer.
- (v) **Hard-wired Terminal:** These terminals are linked to the computer system by a direct cable. However, for remote terminals, communication to the main system can be established via telecommunication lines such as ordinary telephone lines.
- (vi) **Keyboard Printer Terminal:** The keyboard printer terminal or *teletypewriter* consists of a keyboard for sending information to the computer and a printer, for providing a copy of the input and receiving information from the computer.

Question 13

What do you mean by Direct Data Entry (DDE) system? Give a brief description of Optical Character Reader.

Answer

Direct Data Entry (DDE): Direct data entry refers to entry of data directly into the computers through machine-readable source documents. DDE does not require manual transcription of data from original paper documents. These devices can scan source documents magnetically or optically to capture data for direct entry into the computer. Magnetic Ink Character Reader and Optical Character Reader are examples of such devices.

OCR employs mechanical or electronic translation of scanned images of handwritten,

typewritten or printed text into machine-encoded text. The printing characters with standard font can be read by both human and machine readers. The machine reading is done by light scanning techniques in which each character is illuminated by a light source and the reflected image of the character is analysed in terms of the light-dark pattern produced. OCRs can read upper and lower case letters, numerals, and certain special characters from handwritten, typed and printed paper documents. The specific characters that can be read and whether the characters must be handwritten, typed or printed depend upon the type of OCR being used. OCR annihilates the time consuming step of transcription. Large volume billing applications (e.g. the bills of utility companies, credit card organizations, and magazine subscriptions etc.) increasingly are being adapted to OCR methods.

It is also widely used to convert books and documents into electronic files, to computerize a record-keeping system in an office, or to publish the text on a website. Through OCR, it is possible to edit the text, search for a word or phrase, store it more compactly, display or print a copy free of scanning artifacts, and apply techniques such as machine translation, text-to-speech and text mining to it.

Question 14

Define an Image Processing. Describe the steps involved to document imaging. Also mention any five advantages of Image Processing.

Answer

Image Processing: Image Processing captures an electronic image of data so that it can be stored and shared. Imaging systems can capture almost anything, including key stroked or handwritten documents (such as invoices or tax returns), flowcharts, drawings, and photographs.

There are five steps to document imaging:

- (i) **Data Capture:** The most common means of converting paper documents into electronic images is to scan them. By using scanner, the text and pictures can be converted into digitized electronic code.
- (ii) **Indexing:** Document images must be stored in a manner that facilitates their retrieval. Normally they are stored in an index. Great care is needed in designing the indexing scheme.
- (iii) **Storage:** As large amount of space is involved in storing, the images are usually stored on an optical disk. An appropriate size optical disk should be selected.
- (iv) **Retrieval:** Keying in any information stored in an index can retrieve documents. The index tells the system which optical disk to search and the requested information can be quickly retrieved.
- (v) **Output:** An exact replica of the original document is easily produced on the computer's

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monitor or on paper, or is transmitted electronically to another computer.

Some of the advantages of Image Processing are as follows:

- (i) **Accessibility:** Documents can be accessed and reviewed simultaneously by many people, even from remote locations.
- (ii) **Accuracy:** Accuracy is much higher because costly and error-prone manual data-entry processes are eliminated.
- (iii) **Capacity:** Vast amounts of data can be stored in very little space, which significantly reduces storage and office space.
- (iv) **Cost:** When large volumes of data are stored and processed, the cost per document is quite inexpensive. As a result, the costs to input, file, retrieve, and re-file documents are reduced significantly.
- (v) **Security:** Various levels of passwords (network, data base, files, etc.) and clearances can be assigned to restrict document access.

Question 15

Discuss the factors that determine the purchase of good quality printer.

Answer

Factors determining purchase of good quality printer

- (i) One of the main considerations when looking for good quality is the amount of usage one can anticipate with the device. An inkjet printer works very well for relatively low demands that are primarily text documents. Also, usage that may require some type of color on an occasional basis can be handled very well with an inkjet printer. However, inkjets are not designed for a large amount of production each day. Also, the cost of new ink cartridges can be prohibitive when the volume of printing is higher. Ink cartridges for inkjet types of printers simply do not last that long.
- (ii) For environments where there will be a high volume of daily usage, there is no doubt that the laser printer is the better option. The laser printer is built to hold up to repeated daily usage and large print jobs. Also, the ink cartridges that are manufactured for the laser type of printer will produce quite a few more pages than the ones created for inkjets. Color is also a factor when it comes to the laser printer. Laser printers simply produce a higher quality of color graphic or image, which make it ideal when the print job involves the printing of sales brochures or a mass mail out to customers. When deciding on whether to purchase an inkjet or a laser printer, volume usage will be a key factor.
- (iii) Another important consideration when choosing between an inkjet and a laser printer is the initial cost. Good quality inkjets can be purchased for a relatively low amount of money. If the budget is tight, going with an inkjet, at least until cash flow improves, may be a wise move. Keep in mind that while the initial purchase is low, replacing the ink

cartridges can become cost prohibitive if our average print usage continues to increase over time.

- (iv) Lastly, the type of paper that will be used is also important when deciding whether to purchase an inkjet or a laser printer. A laser printer usually can accommodate various weights of paper with little or no problem. Inkjets tend to work best with standard twenty-weight paper. If the idea is to use the printer to create sales and marketing material, small posters for trade shows, and other print jobs that require a stiffer paper product, then the laser printer is definitely the best option.

A good rule of thumb when it comes to choosing between an inkjet or a laser printer is to remember usage, paper type, and amount of color. If all three of these factors are highly important, then the laser printer is the best choice. For price, low usage, little color and use of only standard paper, then the inkjet printer will work very well.

Question 16

What is "Software"? Describe the various types of software in brief.

Answer

A set of instructions, which is known as program, are combined together to perform specific task is known as software. There are basically three types of software: Systems software, applications software and general-purpose software.

- (i) **Systems software:** System software is computer software designed to operate the computer hardware and to provide and maintain a platform for running application software. Therefore system software may be defined as a set of one or more programs designed to control the operation of computer system. It is an essential part of the computer system. It comprises of those programs that control and support the computer system and its data processing applications. It includes the following:
- Programming languages
 - Operating systems
 - Device Drivers
 - Utility programs
 - Language translators
- (ii) **Application Software:** Application software is a subclass of computer software that employs the capabilities of a computer directly to a task that the user wishes to perform. The program usually solves a particular application or problem that is unique to that organization. Examples of such programs are Payroll, General accounting, Sales statistics and Inventory control etc.

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- (iii) **General-purpose software:** This software provides the framework for a great number of business, scientific, and personal applications. Spreadsheet, Databases, Computer-Aided Design (CAD) and Word processing software etc. fall into this category. Most general-purpose software is sold as a package. The software is accompanied by user-oriented documentation such as reference manuals, keyboard templates, and so on.

Question 17

Explain the basic functions of an Operating System.

Answer

The operating system may be defined as an integrated system of programs which supervises the operation of the CPU, controls the input/output functions of the computer system, translates the programming languages into the machine languages and provides various support services.

There are six basic functions that an operating system can perform. These are:-

- (i) **Schedule Jobs:** Operating systems can determine the sequence in which jobs are executed, using priorities established by the organization.
- (ii) **Manage Hardware and Software Resources:** Operating systems cause the user's application program to be executed by loading it into primary storage and then cause the various hardware units to perform as specified by the application.
- (iii) **Maintain System Security:** They may require users to enter a password - a group of characters that identifies users as being authorized to have access to the system.
- (iv) **Enable Multiple User Resource Sharing:** They can handle the scheduling and execution of the application programs for many users at the same time, a feature called multiprogramming.
- (v) **Handle Interrupts:** An interrupt is a technique used by the operating system to temporarily suspend the processing of one program in order to allow another program to be executed. Interrupts are issued when a program requests an operation that does not require the CPU, such as input or output, or when the program exceeds some predetermined time limit.
- (vi) **Maintain Usage Records:** Operating systems can keep track of the amount of time used by each user for each system unit - the CPU, secondary storage, and input and output devices.

Question 18

What are language translators? Describe in brief each of the language translators.

Answer

A language translator or language processor is a general term used for any assembler,

compiler or other routine that accepts statements in one language and produces equivalent statements in another language. The language processor reads the source language statements one at a time and prepares a number of machine instructions to perform the operations specified or implied by each source statement. The three most widely used types of language translators are compiler, interpreter, and assembler.

- (i) **Compiler:** A system software that translates the entire program into machine language before the program is executed. The program submitted for compilation is called a *source program* (or source module). The source program then translates the program into machine language, producing an *object program* (or object module). After generating object program, it is then linked with other subprogram of object module, which is called load program for final execution of the program.
- (ii) **Interpreters:** It is a system software which translates program into machine language one line at a time as they are being run. Each statement is translated into machine language just before it is executed. Interpreter provides error message in case of any logical and syntactical error while converting source code to object code.
- (iii) **Assemblers:** It is a system software which is used to translate assembly language program to object code. A program written in assembly language consists of a series of *instructions called* mnemonics that correspond to a stream of executable instructions, when translated by an assembler, which can be loaded into memory and executed. A utility program called an *assembler* is used to translate assembly language statements into the target computer's machine code. The assembler performs a one-to-one mapping from mnemonic statements into machine instructions and data. This is in contrast with high-level languages, in which a single statement generally results in many machine instructions

Question 19

“ERP can perform certain tasks of an organization in well-structured manner.” Describe in brief.

Answer

Enterprise Resource Systems (ERPs) integrates all data and processes of an organization into a single unified system. A typical ERP system will use multiple components of computer software and hardware to achieve the integration. A key ingredient of most ERP systems is the use of a single, unified database to store data for the various system modules.

The term ERP originally implied systems designed to plan the utilization of enterprise-wide resources. ERP systems typically attempt to cover all basic functions of an organization, regardless of the organization's business or charter. Business, non-profit organizations, governments, and other large entities utilize ERP systems. Benefits of an ERP system are:

- (i) A totally integrated system

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- (ii) Ability to streamline different processes and workflows
- (iii) Ability to easily share data across various departments in an organization
- (iv) Easy access and workflow
- (v) All aspects of an organization can work in harmony instead of every single system needing to be compatible with each other. It increases productivity and efficiency at all levels of organization's activities.
- (vi) Better tracking and forecasting
- (vii) Lower costs
- (viii) Improved customer service.

Question 20

What are Decision Support Systems? Describe various characteristics of a DSS.

Answer

Decision Support System: Decision Support System (DSS) is a specific class of computerized information system that supports business and organizational decision-making activities. A properly designed DSS is an interactive software-based system intended to help decision maker to compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions. A DSS may present information graphically and may include an expert system or artificial intelligence. DSS have also achieved broad use in accounting and auditing today.

The common characteristics of Decision Support Systems are as mentioned below:

- (i) **DSS support management decision making** – These enhance decision quality. While the system might not point to a particular decision, it is the user who ultimately makes the final choice.
- (ii) **DSS solve relatively unstructured problems** – The unstructured problems with lesser well-defined questions do not have easy solution procedures and therefore need some managerial judgment. Such problems can be handled and addressed with the help of appropriate DSS.
- (iii) **DSS are friendly computer interface** – A friendly computer interface is also a characteristic of a DSS. As the managers and other decision makers using DSS are not necessarily good programmers, such systems must be easy to use. The communication between the user and the DSS is made easy through nonprocedural modeling languages.
- (iv) **DSS should be able to respond quickly to the changing needs of the decision makers** – As managers must plan for future activities, they rely heavily on assumptions. Any DSS should address the decision making for a variety of

assumptions. A key characteristic of many systems is that these allow users to ask what-if questions and examine the results of these questions.

Question 21

Explain the various components of a Decision Support System.

Answer

Components of a DSS: A decision support system has four basic components: (i) The users, (ii) Database, (iii) Planning language, and (iv) Model base.

- (i) **The users:** The user of a Decision Support System (DSS) is usually a manager with an unstructured or semi-structured problem to solve. In fact, user does not require a computer background to use a DSS for problem solving. He must have thorough understanding of the problem and the factors to be considered in finding a solution.
- (ii) **Database:** DSS includes one or more databases. These databases contain both routine and non-routine data from both internal and external sources. The data from external sources include data about economic condition, market demand for goods and services and industry competition, whereas internal data includes data from the financial and managerial accounting system, marketing, production and personnel department.
- (iii) **Planning language:** Two types of planning languages are commonly used in DSS.
 - **General Purpose:** These languages allow user to perform many routine tasks viz., retrieving various data from a database or performing statistical analysis, budgeting, forecasting and worksheet oriented problem. The languages used in most of the spread sheets are the good examples.
 - **Special purpose:** Special purpose planning languages are statistical languages viz., SAS, SPSS and Mini Tab. These languages perform statistical and mathematical operations.
- (iv) **Model Base:** The model base is the brain of the decision support system because it performs data manipulation and computations with the data provided to it by the user and database. Model base is custom developed model that does some types of mathematical functions viz., cross-tabulation, regression analysis, time series analysis, linear programming and financial computation. The analysis provided by the routines in the model base is the key to supporting the user's decision.

Question 22

Define an Expert System. Describe the components of an Expert System.

Answer

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Expert System: An expert system (ES) is a computerized information system that allows non-experts to make decisions comparable to those of an expert. Expert systems are used for complex or ill-structured tasks that require experience and specialized knowledge in narrow, specific subject areas.

Components of an Expert system are: (shown in figure below)

- (i) **Knowledge base:** This includes the data, knowledge, relationships, rules of thumb (heuristics), and decision rules used by experts to solve a particular type of problem.
- (ii) **Inference engine:** This program contains the logic and reasoning mechanisms that simulate the expert logic process and deliver advice. It uses data obtained from both the knowledge base and the user to make associations and inferences, form its conclusions, and recommend a course of action.

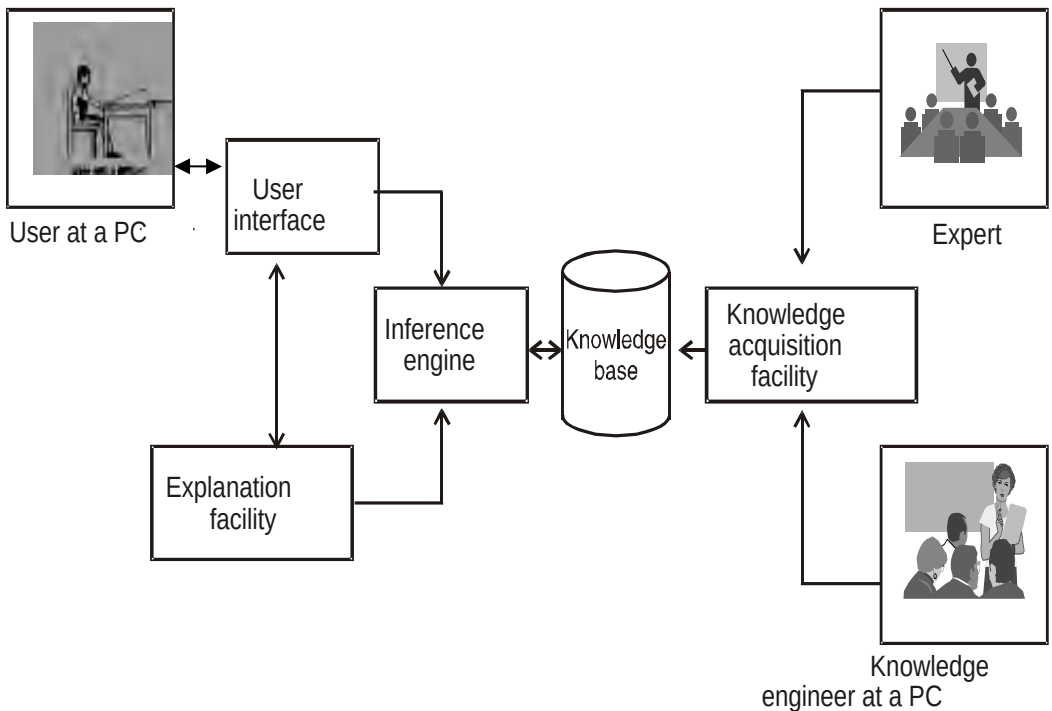


Fig.: Major components of an Expert System

- (iii) **User interface:** This program allows the user to design, create, update, use, and communicate with the expert system.
- (iv) **Explanation facility:** This facility provides the user with an explanation of the logic the ES used to arrive at its conclusion.

- (v) **Knowledge acquisition facility:** Building a knowledge base, referred to as knowledge engineering, involves both a human expert and a knowledge engineer. The knowledge engineer is responsible for extracting an individual's expertise and using the knowledge acquisition facility to enter it into the knowledge base.

Question 23

Discuss various Advantages and Disadvantages of Expert System.

Answer

Advantages offered by expert system are:

- (i) They provide a cost effective alternative to human experts.
- (ii) They can outperform a single expert because their knowledge is representative of numerous experts. They are faster and more consistent and do not get distracted, overworked or stressed out.
- (iii) They produce better quality and more consistent decisions. Expert systems assist users in identifying potential decision making problems, which increases the probability that sound decisions will be made.
- (iv) They can increase productivity.
- (v) They preserve the expertise of an expert leaving the organization.

Disadvantages offered by expert system are:

- (i) Development can be costly and time-consuming. Some large systems required upto 15 years and millions of dollars to develop.
- (ii) It can be difficult to obtain knowledge from experts who have difficulty specifying exactly how they make decisions.
- (iii) Designers have not been able to program what humans consider common sense into current systems. Consequently, rule-based systems break down when presented with situations they are not programmed to handle.
- (iv) Until recently, developers encountered skepticism from businesses due to the poor quality of the early expert systems and the high expectations of users.

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EXERCISE

Question 1

Describe the various characteristics of third and fourth generation of computer.

Answer Refer to 'Section 1.2 - Unit 1 of Chapter 1 i.e. Introduction to Computers' of Study Material.

Question 2

Discuss various types of computer system based on their working principal, size and data processing capability.

Answer Refer to 'Section 1.3 - Unit 1 of Chapter 1 i.e. Introduction to Computers' of Study Material

Question 3

Draw the schematic diagram of a computer. Briefly discuss each of the components covered in it.

Answer Refer to 'Section 1.5 - Unit 1 of Chapter 1 i.e. Introduction to Computers' of Study Material

Question 4

Discuss components of motherboard in brief.

Answer Refer to 'Section 1.6.2 - Unit 1 of Chapter 1 i.e. Introduction to Computers' of Study Material.

Question 5

What is a Magnetic Tape? Discuss different types of Magnetic Tapes.

Answer Refer to 'Section 1.8.1 - Unit 2 of Chapter 1 i.e. Input and Output Devices' of Study Material.

Question 6

What is Magnetic Disk? How the data is stored on a Magnetic Disk?

Answer Refer to 'Section 1.8.3 - Unit 1 of Chapter 1 i.e. Introduction to Computers' of Study Material.

Question 7

Describe the various input devices used to input and capture the data.

Answer Refer to 'Section 1.1 - Unit 2 of Chapter 1 i.e. Input and Output Devices' of Study Material.

Question 8

What do you understand by monitor? State the advantages and limitations of CRT, LCD and Plasma display devices.

Answer Refer to 'Section 1.3.1 - Unit 2 of Chapter 1 i.e. Input and Output Devices' of Study Material

Question 9

Describe in brief the methods of producing computer output.

Answer Refer to 'Section 1.3 - Unit 2 of Chapter 1 i.e. Input and Output Devices' of Study Material.

Question 10

Describe the various characteristics of Printers in brief.

Answer Refer to 'Section 1.3.2 - Unit 2 of Chapter 1 i.e. Input and Output Devices' of Study Material.

Question 11

Discuss the advantages and disadvantages of 1st and 2nd generation of computer languages.

Answer Refer to 'Section 1.1.1 - Unit 3 of Chapter 1 i.e. Software' of Study Material.

Question 12

Discuss in brief various flavors of Microsoft Windows Operating Systems available in the market.

Answer Refer to 'Section 1.1.2.1 - Unit 3 of Chapter 1 i.e. Software' of Study Material.

Question 13

How DSS can be helpful in taking the financial decision? Discuss in brief.

Answer Refer to "Section 1.3.2 - Unit 3 of Chapter 1 i.e. Software' of Study Material.

Question 14

Differentiate Between

- (i) *Data Bus, Address Bus and Control Bus*
- (ii) *Dynamic RAM and Static RAM*
- (iii) *RAM and ROM*
- (iv) *Semi-conductor memory and Bubble memory*
- (v) *Control unit and Arithmetic logic unit*
- (vi) *Impact Printers and Non-impact Printers.*

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- (vii) *Multithreading and Multitasking*
- (viii) *Multiprogramming and Multitasking systems*
- (ix) *Multiprogramming and Multiprocessing*

Answer Refer to 'Unit 1 of Chapter 1 i.e. Introduction to Computers', 'Unit 2 of Chapter 1 i.e. Input and Output Devices', 'Unit 3 of Chapter 1 i.e. Software' of Study Material.

Question 15

Write a short note on the following:

- (i) *Computer Output Microfilm (COM)*
- (ii) *Smart Card Systems*
- (iii) *Voice Recognition*
- (iv) *Microsoft Windows*
- (v) *Firmware*
- (vi) *Device Drivers*
- (vii) *Object Oriented Programming*
- (viii) *Spooling Software*

Answer Refer to 'Unit 1 of Chapter 1 i.e. Introduction to Computers', 'Unit 2 of Chapter 1 i.e. Input and Output Devices', 'Unit 3 of Chapter 1 i.e. Software' of Study Material.

2

DATA STORAGE, RETRIEVAL AND DATA BASE MANAGEMENT SYSTEMS

1. **Number Systems:** Represent the numbers, alphabets and the special characters which are converted into 0s and 1s, so that computer can understand to do the task.
 - 1.1 **Types and number system operation:** Decimal number system, Binary number system, Decimal-binary conversion, Binary-decimal conversion, Binary Coded Decimal code, ASCII code, EBCDIC code, Unicode.
2. **Data Types and Index Fields:** Integer Number, Single and Double precision, Logical, Character, String, Memo data, Currency Field, Date Field, Integer Field, Text Field.
3. **Data Processing:** A series of actions or operations that converts data into useful information.
 - 3.1 **Data Storage Hierarchy:** Character, Field, Record, File, Database.
4. **File Organization:** A method or technique through which users of database can organize, access, and process records and files depending upon the application.
 - 4.1. **Three commonly used file organizations:**
 - 4.1.1 **Serial:** Records are arranged one after another, in no particular order.
 - 4.1.2 **Sequential:** Records are arranged one after another in an ascending or descending order determined by the key field of the records.
 - 4.1.3 **Direct Access:** Records are stored or accessed immediately.
 - 4.1.3.1 **Direct Sequential Access:** Self direct addressing, Index sequential addressing method.
 - 4.1.3.2 **Random Access:** Address generation method, Indexed random method.
 - 4.2 **Best File Organization's factors:** File volatility, File activity, File interrogation, File size.

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5. **Database Management Systems:** A set of software programs that controls the organization, storage, management, and retrieval of data in a database.
 - 5.1 **Management Problem of File Processing:** Data duplication, Lack of data integration, Data dependence, Data Integrity and Security.
 - 5.2 **Benefits of DBMS:** Reduce data redundancy and Inconsistency, Enhance data Integrity, Provide logical and physical data independence, Provide application data independence, Reduce complexity, Provide faster data accessibility and improved data sharing, Increased productivity, Low cost of developing and maintaining system.
6. **Database Definition:** A collection of data designed to be used by different people or a collection of interrelated data stored together with controlled redundancy to serve one or more applications in an optional fashion.
 - 6.1 **3 levels of Database Architecture:** External or User view, Conceptual or Global view, Physical or Internal view.
 - 6.2 **Data Independence:** Logical and Physical Data independence.
 - 6.3 **Parts of DBMS:** Data, Hardware, Software, Users- Application Programmer, End User, Database Administrator, Database Designer.
 - 6.4 **Record Relationship:** One-to-One, One-to-Many, Many-to-One, Many-to-Many.
7. **Structure of Database:** Three Types of Database structures are:
 - 7.1 **Hierarchical Database Structure:** Records are logically organized into a hierarchy of relationships that implements one-to-one and one-to-many relationships.
 - 7.2 **Network Database Structure:** Views all records in sets and each set is composed of an owner record and one or more member records that implements one-to-one, one-to-many and many-to-many record structure.
 - 7.3 **Relational Database Structure:** A relational database allows the definition of data structures, storage and retrieval operations and integrity constraints to be organized in a table structure. A table is a collection of records and each record in a table contains the same fields. The database is structured into a series of two-dimensional tables known as relation.
 - 7.3.1 **Key:** Defines uniqueness with one or more columns whose combined values are unique among all occurrences in a given table.
 - 7.3.1.1 **Types of Key:** Candidate Key, Primary Key, Alternate Key, Secondary Key, Referential Integrity (Foreign Key).
8. **Other Database Models:** Distributed database, E-R database, Object-oriented database, Client-server database, Knowledge database.

9. **Components of Database:** Two types of Database Components are-
 - 9.1 **DDL:** Defines the conceptual schema providing a link between the logical and physical structure of database.
 - 9.2 **DML:** Enables the user and application program to be independent of the physical data structures using manipulation techniques like deletion, modification, insertion of data or records.
10. **Structure of DBMS:** DDL Compiler, Data Manager, File Manager, Disk Manager, Query Manager, Data Dictionary.
11. **Types of Databases:** Operational Database, Management Database, Information Warehouse Database, End-user Database, External Database, Text Database, Image Database
12. **Structured Query Language:** A query language is a set of commands to create, update and access data from a database allowing users to raise adhoc queries/questions interactively without the help of programmers. It is a computer programming language used to manipulate information in relational database management systems (RDBMS).
13. **Documentation and Program Library:**
 - 13.1 **Program Library Management System Software:** Functional capabilities, Integrity capabilities, Uses capabilities, Update capabilities, Reporting capabilities, Interface capabilities.
 - 13.2 **User Interface Design elements:** Source documents, Hard copy, Screen layout, Inquiry screen, Command languages, Query languages, Graphic display, Voice output, Screen layout, Icons.
14. **Backups and Recovery:** Utility program used to make a copy of the contents of database files and log files. Recovery is a sequence of tasks performed to restore a database to some point-in-time.
 - 14.1 **Types of Log:** Transaction Log and Mirror Log.
 - 14.2 **Types of Backup:** Online backup, Offline backup, Live backup, Full and Incremental backup.
15. **Data Warehouse:** Repository of an organization's electronically stored data which facilitates reporting and supporting data analysis.
 - 15.1 **Development stages of Data Warehouse:** Offline operational databases, Offline data warehouse, Real time data warehouse, Integrated data warehouse.
 - 15.2 **Component of Data Warehouse:** Data Sources, Data Transformation, Data Warehouse, Reporting, Metadata, Operations.

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16. **Data Mining:** Analysis of data and picking out relevant information from database. Also responsible for finding the patterns by identifying the underlying rules and features in the data.

16.1 Development stages of Data Mining: Selection, Preprocessing, Transformation, Data Mining, Interpretation and Evaluation.

Question 1

(a) Describe briefly, the following terms:

- (i) Data Dictionary
- (ii) Structured Query Language
- (iii) DDL
- (iv) DDL Compiler

(b) Explain each of the following:

- (i) Index Field
- (ii) Data transformation
- (iii) Transaction Log
- (iv) Data Warehouse
- (v) File Maintenance
- (vi) Incremental Backup
- (vii) Real Time Data Warehouse
- (viii) Online Backup
- (ix) Random Access

Answer

- (a) (i) **Data Dictionary:** A Data Dictionary is a set of metadata that contains definitions and representations of data elements. It maintains information pertaining to structure and usage of data and meta data.

Or

Data Dictionary: Data Dictionary maintains information pertaining to structure and usage of data and meta data. Each piece of data and various synonyms of data field are determined in consultation with database users.

- (ii) **Structured Query Language (SQL):** A query language is a set of commands to create, update and access data from a database allowing users to raise adhoc queries/questions interactively without the help of programmers. It is a

computer programming language used to manipulate information in relational database management systems (RDBMS).

- (iii) **DDL:** DDL or Data Definition Language defines the conceptual schema providing a link between the logical and physical structures of the database. Some of the DDL functions define the physical characteristics of each record, field in the record, field's data type, its length, its logical name and also specify relationships among the records, describe the schema and subschema, provide means for associating related records or fields, provide for data security measures and logical and physical data independence.
- (iv) **DDL Compiler:** DDL Compiler converts data definition statements into a set of tables. Tables contain meta-data (data about the data) concerning the database. It gives rise to a format that can be used by other components of the database.
- (b) (i) **Index field:** Index fields are used to store relevant information along with a documents. The data input to an index field is used to find those documents when needed. The program provides upto twenty five user definable index fields in an index set.
- (ii) **Data transformation:** The data transformation layer receives data from the data sources, cleans and standardizes it, and loads it into data repository.
- (iii) **Transaction Log:** A transaction log is a file that records database modifications such as insert, update, delete, commit, rollback and database schema changes. The database engine uses a transaction log to apply any changes made between the most recent checkpoint and the system failure.
- (iv) **Data Warehouse:** It is a computer database that collects, integrates and stores an organization's data with the aim of producing accurate and timely management information and supporting data analysis. The data warehouses bring in data from a range of different data sources such as mainframe computers, micro computers as well as personal computers and office automation software such as spreadsheets and integrate this information in a single place.
- (v) **File Maintenance:** File maintenance includes the updating of a file to reflect the effects of periodical changes by adding, altering data, eg. the addition of new programs to program library on magnetic disk.
- (vi) **Incremental Backup:** This uses the DBBACKUP utility to copy the transaction log file since the most recent full backup. When incremental backup is performed, the mirror log is not backed up. When the users take the backup and rename the log files, the transaction and mirror log file is renamed and new log files are created.

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- (vii) **Real time Data Warehouse:** A Real time data warehouse is updated on a transaction or event basis, every time an operational system performs a transaction such as an order or a delivery or a booking etc.
- (viii) **Online Backup:** Data base back-up can be performed while the database is being actively accessed (online). It is performed by executing the command-line or from the 'Backup Database' utility. When this process begins, the database engine externalizes all cached data pages kept in memory to the database file(s) on disk. This process is called a checkpoint. The database engine continues recording activity in the transaction log file while the database is backed up. The log file is backed up after the backup utility finishes backing up the database.
- (ix) **Random Access:** Random Access pertains to the method of file organization in a storage device in which the access time of the storage device is not significantly affected by the location of the data to be accessed. It means that any item of data which is stored online can be accessed within a relatively short time (usually in part of a second).

Question 2

What is Index-Sequential file? Describe Advantages and Disadvantages of Index-Sequential file organization in brief.

Answer

Indexed-Sequential File Organisation: The indexed sequential file organisation or indexed sequential access method (ISAM), is a hybrid between sequential and direct access file organisations. The records within the file are stored sequentially but direct access to individual records is possible through an index. It is a method of storing data for fast retrieval. In an ISAM system, data is organized into records which are composed of fixed length fields. Records are stored sequentially, originally to speed access on a tape system. A secondary set of hash tables known as *indexes* contain "pointers" into the tables, allowing individual records to be retrieved without having to search the entire data set. The key improvement in ISAM is that the indexes are small and can be searched quickly; allowing the database to then access only the records it needs. To locate a record, the cylinder index is searched to find the cylinder address, and then the track index for the cylinder is searched to locate the track address of the desired record.

Advantages of Indexed Sequential Files

- Permits the efficient and economical use of sequential processing techniques when the activity ratio is high.
- Permits direct access processing of records in a relatively efficient way when the activity ratio is low.

Disadvantages of Indexed Sequential Files

- These files must be stored on a direct-access storage device. Hence, relatively expensive hardware and software resources are required.
- Access to records may be slower than direct files.
- Less efficient in the use of storage space than some other alternatives.

Question 3

Describe various factors which must be considered in determining the best file organisation for a particular application.

Answer

Factors to be considered for best file organization are briefly discussed below:

- File Volatility:** It refers to the number of additions and deletions to the file in a given period of time. A file that constantly keeps changing is a highly volatile file. An Indexed-sequential file organization will not be suitable for such files, because additions have to be placed in the overflow area and constant reorganization of the file would have to occur. Other direct access methods would be a better choice. Even the sequential file organization could be appropriate if there are no interrogation requirements.
- File Activity:** It is the proportion of master file records that are actually used or accessed in a given processing run. At one extreme is the real-time file where each transaction is processed immediately and hence at a time, only one master record is accessed. This situation obviously requires a direct access method. At the other extreme is a file, such as a payroll master file, where almost every record is accessed when the weekly payroll is processed. In such case, a sequentially ordered file would be more efficient.
- File Interrogation:** It refers to the retrieval of information from a file. When the retrieval of individual record needs to be fast to support a real-time operation such as airline reservation, then some direct organization would be required. But if requirements of data can be delayed, then all the individual requests or information can be batched and run in a single processing run with a sequential file organization.
- File Size:** Large files that require many individual references to records with immediate response, must be organized for certain direct access method. However, with small files, it may be more efficient to search sequentially or with more efficient binary search, to find an individual record.

Question 4

What are the management problems of file processing system?

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Answer

File processing in Information systems consist of using separate computer programs that update these independent data files and use them to produce the documents and reports required by each separate user application. However, many management problems are observed with File Processing Systems that limit the efficiency and effectiveness of end user applications:

- (i) **Data Duplication:** Independent data files include a lot of duplicated data that causes problems when data is to be updated, since separate file maintenance programs have to be developed and coordinated to ensure that each file is properly updated.
- (ii) **Lack of Data Integration:** Data in independent files makes it difficult to provide end users with information for ad hoc requests that require accessing data stored in several different files. Special computer programs have to be written to retrieve data from each independent file. This is difficult, time consuming, and expensive for the organizations.
- (iii) **Data Dependence:** In file processing systems, major components of a system i.e., the organization of files, their physical locations on storage, hardware and the application software used to access those files depend on one another in significant ways. Thus, if changes are made in the format and structure of data and records in a file, changes have to be made in all the programs that use this file. This program maintenance effort is a major burden of file processing systems.
- (iv) **Data Integrity and Security:** There are certain integrity constraint defined in DBMS to protect and unauthorized access to the data in the database. For example, when inserting the data for a particular field says salary for an employee data base, it can not be null. Such type of constraint does not allow the user to leave the field blank thus providing integrity and security on the database. Whereas in file processing systems, such type of integrity constraint and security aspects are lacking. Also in file processing system, the integrity (i.e. the accuracy and completeness) of the data is suspected because there is no control over their use and maintenance by authorized end users.

Question 5

What do you understand by Database? Discuss various parts of DBMS in brief.

Answer

A data base is a computer file system that uses a particular *file organization* to facilitate *rapid updating of individual records, simultaneous updating of related records, easy access to all records, by all applications programs, and rapid access to all stored data* which must be brought together for a particular *routine report or inquiry or a special purpose report or inquiry*.

A database system has four major parts: Data, Hardware, Software and Users, which coordinate with each other to form an effective database system.

1. **Data** : It is an important component of the system. The data acts as a bridge between machine parts i.e. hardware and software and the users, who access it directly or through some application programs. The data stored in the system is partitioned onto one or more databases. A database, then, is a repository for stored data. In general, it is both integrated and shared. By integrated, it is meant that the database is a unification of several otherwise distinct data files. The individual pieces of data in the database may be shared among several different users in the sense that each of them may have access to the same piece of data. Such sharing is really a consequence of the fact that the database is integrated.

2. **Hardware**: The hardware consists of the secondary storage devices such as magnetic disks (hard disk, zip disk, floppy disks), optical disks (CD-ROM), magnetic tapes, etc. on which data is stored together with the I/O devices (mouse, keyboard, printers), processors, main memory, etc. which are used for storing and retrieving the data in a fast and efficient manner. The hardware consists of the secondary storage volumes, disks, drums, etc. on which the database resides, together with the associated devices, control units, channels, and so forth.

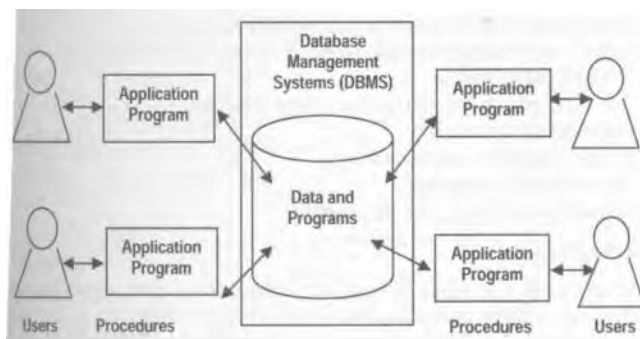


Figure shows Simplified Picture of a Database

3. **Software**: The software part of a DBMS acts as a bridge between user and the database. In other words, software interacts with users, application programs, and database and files system of a particular storage media (hard disk, magnetic tapes etc.) to insert, update, delete and retrieve data. For performing operations such as insertion, deletion and updation, query languages like SQL or application software like Visual Basic can be used.

4. **Users** : The broad classes of users are:

- **Application Programmers and System Analysts**: System analysts determine the requirements of end users; especially naive and parametric end users, and develop specifications for canned transactions that meet these requirements. Application programmers implement these specifications as programs, and then they test, debug, document, and maintain these canned transactions.
- **End Users**: These are the people who require access to the database for querying updating and generating reports. The database exists primarily for their use.

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- **Database Administrator (DBA):** DBA is responsible for authorization access to the database, for coordinating and monitoring its use, and for acquiring the needed software and hardware resources.
- **Database Designers:** These are responsible for identifying the data to be stored in the database for choosing appropriate structures to represent and store this data.

Question 6

What are the various views taken into account, while designing the architecture of a Database? Which view is user dependent and which one is user independent? Which view is storage device oriented?

Answer

The following three views are taken into account, while designing the architecture of a database.

- (i) External view (User View)
- (ii) Conceptual (Global view)
- (iii) Internal View (Physical view)

External view (User View) encircles the following:

- It is at the highest level of the database abstraction.
- It includes only those portions of database or application programs which are of concern to the users.
- It is described by means of a scheme, called the external schema.
- It is defined by the users or written by the programmers.

Conceptual (Global view) which is viewed by the Data Base Administrator, encompasses the following –

- All database entities and relationships among them are included.
- Single view represents the entire database.
- It is defined by the conceptual schema.
- It describes all records, relationships and constraints or boundaries.
- Data description to render it independent of the physical representation.

Internal View (Physical view) contains the following:

- It is at the lowest level of database abstraction.
- It is closest to the physical storage method.

- It indicates how data will be stored.
- It describes data structure.
- It describes access methods.
- It is expressed by internal schema.

External view is user-dependent as external view is also referred as User View.

Conceptual and Internal views are user-independent.

Internal view is storage device oriented.

Question 7

Discuss salient features of Hierarchical Database structure.

Answer

Salient features of Hierarchical Database:

In a hierarchical database, records are logically organized into hierarchy of relationship. It is arranged in an inverted tree pattern. The following are salient features:

- (i) Database structure is less flexible as relationships between records are relatively fixed by the structure.
- (ii) It requires that hierarchy of records must be determined and implemented before a search.
- (iii) Ad hoc queries are difficult and time consuming to accomplish.
- (iv) Frequent management queries may not be supported as effectively.
- (v) Day to day operational data can be processed rapidly.
- (vi) Any group of records with natural relation may fit nicely.
- (vii) Records are logically structured in inverted tree pattern.
- (viii) It provides the parent – child relationship amongst the nodes.
- (ix) It implements one-to-one and one-to-many relationship.

Question 8

Describe DDL and DML.

Answer

- (i) **Data Definition Language (DDL):** It defines the conceptual schema providing a link between the logical and physical structures of the database. The logical structure of a database is a schema. A subschema is the way a specific application views the data from the database.

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Following are the functions of Data Definition Language (DDL):

- They define the physical characteristics of each record, field in the record, field's type and length, field's logical name and also specify relationships among the records.
 - They describe the schema and subschema.
 - They indicate the keys of the record.
 - They provide means for associating related records or fields.
 - They provide for data security measures.
 - They provide for logical and physical data independence.
- (ii) **Data Manipulation Language (DML):** DML is a Database Language used by data base users to retrieve, insert, delete and update data in a database.

Following are the functions of Data Manipulation Language (DML):

- They provide the data manipulation techniques like deletion, modification, insertion, replacement, retrieval, sorting and display of data or records.
- They facilitate use of relationships between the records.
- They enable the user and application program to be independent of the physical data structures and database structures maintenance by allowing to process data on a logical and symbolic basis rather than on a physical location basis.
- They provide for independence of programming languages by supporting several high-level procedural languages like COBOL, PL/1 and C++.

Question 9

What are the roles and responsibilities of Database Administrator?

Answer

The database administrator is a database professional who actually creates and maintains the database, and carries out the policies developed by the data administrator. The various functions performed by DBA are:

- (i) Determines and maintains the physical structure of the database.
- (ii) Provides for updating and changing the database, including the deletion of inactive records.
- (iii) Creates and maintains edit controls over changes and additions to the database.
- (iv) DBA uses DDL to define the contents and the structure of the database so that database formats, relationships among various data elements and their usage can easily be described.

- (v) Allows only specified users to access certain paths into the database and thus prevents unauthorized access.
- (vi) Also prepares documentation which includes recording the procedures, standards, guidelines and data descriptions necessary for the efficient and continued use of the database environment.
- (vii) Ensures that operating staff performs its database processing related responsibilities which include loading the database, following maintenance and security procedures, taking backups, scheduling the database for use, etc.
- (viii) Ensures that standards for database performance are met and the accuracy, integrity and security of data is being maintained. He also sets up procedures for identifying and correcting violation of standards documents and corrects errors.
- (ix) He is responsible for incorporating any enhancement into the database environment which may include new utility programs or new system releases and changes into internal procedures for using database etc.

Question 10

What do you understand by Client-Server database and Knowledge database? Explain in brief.

Answer

A Client-server database is designed in a structure in which one system can connect to another system to perform job. The system that asks the questions and issues the instructions is called client and the system that answer the queries and responds to the instructions is called server. The client machine contains the user interface logic, business logic and the database logic and the server machine contains the database. Both are coupled with a network of high bandwidth. The computational functions are shared in such a way that the server does all such higher level functions which it alone can do leaving the client to perform low level functions. A client-server database can be classified into 2-tier, 3-tier and n-tier models. The system is scalable in as much as clients may be added or removed and the shared resources may be relocated to a larger and faster server or to multiple servers. This type of client-server database is a 2-tier model. In 3-tier and n-tier client-server database designs, there is an application server tier between the data server tier and the client tier. Client tier is responsible for data presentation, receiving user events and controlling the user interface. Application tier handles the business logic, protecting the data from direct access by the clients. Data server tier is responsible for data storage.

A **knowledge database** system provides functions to define, create, modify, delete and read data in a system. The type of data maintained in a database system historically has been declarative data describing the static aspects of the real world objects and their associations. A database system can also be used to maintain procedural data describing the dynamic aspects of the real world objects and their associations, for example, several amended

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versions of enactments in the field of labour laws to facilitate management decisions in pay negotiations. When both the declarative and procedural data are stored in a database it constitutes a knowledge database with more powerful data maintenance.

Question 11

Discuss the features of Program Library Management System Software.

Answer

Features of Program Library Management System Software

- (i) It provides several functional capabilities to effectively and efficiently manage data center software inventory which includes – Application Program Code, System Software Code and Job Control Statements.
- (ii) It possesses integrity capabilities such that –
 - Each source program is assigned,
 - A modification number is assigned,
 - A version number is assigned,
 - It is associated with a creation date.
- (iii) It uses Password, Encryption, Data Compression and Automatic backup.
- (iv) It possesses update capabilities with the facilities of Addition, Modification, Deletion and Re-sequencing library numbers.
- (v) It possesses reporting capabilities for being reviewed by the management and the end users by preparing lists of Additions, Deletions, Modifications, Library catalogue, Library members attributes.
- (vi) It possesses interface capabilities with the Operating System, Job scheduling system, Access control system, Online program management.
- (vii) Controls movement of program from test to production status and
- (viii) At last, changes controls to application programs.

Question 12

Why documentation is required? List any 4 types of documentations required to be prepared prior to delivery of customized software to a customer.

Answer

The documentation is an important aspect of Software Development Life Cycle which provides a method to understand the various issues related with software development and provide a method to access details related to system study, system development, system testing,

system operational details, details related to preventive maintenance and details associated with further modification aspects of the software.

Four important documentations required to be prepared prior to delivery of customized software to customer are as follows:

- (i) Strategic and Application Plans.
- (ii) Application Systems and Program Documentation.
- (iii) System Software and Utility Program Documentation.
- (iv) Database Documentation, Operation Manuals, User Manuals, Testing Manual, Standard Manual, Preventive Maintenance Manual, and Backup Manual are other important documentations.

Question 13

What are the different issues related with the backup and recovery of the databases?

Answer

'Backup' is a utility program used to make a copy of the contents of database files and log files. The database files consist of a database root file, log file, mirror log file, and other database files called dbspaces.

'Recovery' is a sequence of tasks performed to restore a database to some point-in-time. Recovery is performed when either a hardware or media failure occurs. Hardware failure is a physical component failure in the machine, such as, a disk drive, controller card, or power supply. Media failure is the result of unexpected database error when processing data.

Certain issues related with Database Backup and Recovery

A **Transaction Log** is a file that records database modifications. Database modification consists of inserts, updates, deletes, commits, rollbacks, and database schema changes.

A **Mirror Log** is an optional file and has a file extension of **.mlg**. It is a copy of a transaction log and provides additional protection against the loss of data in the event the transaction log becomes unusable.

An **Online Backup** is performed by executing the command-line or from the 'Backup Database' utility. When an online backup process begins the database engine externalizes all cached data pages kept in memory to the database file(s) on disk. This process is called a checkpoint. The database engine records the activity in the transaction log file while the database is being backed up. The log file is backed up after the backup utility finishes backing up the database. The log file contains all of the transactions recorded since the last database backup. For this reason the log file from an online full backup must be 'applied' to the database during recovery.

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An **Offline Backup** does not have to participate in recovery but it may be used in recovery if a prior database backup is used.

A **Live Backup** is carried out by using the BACKUP utility with the command-line option. A live backup provides a redundant copy of the transaction log for restart of your system on a secondary machine in the event the primary database server machine becomes unusable.

A **Full Backup** is the database backup utility copies the database and log.

An **Incremental Backup** uses the DBBACKUP utility to copy the transaction log file since the most recent full backup.

Question 14

Write short notes on Data warehouse.

Answer

(i) **Data warehouse:** It is a computer database that collects, integrates and stores an organization's data with the aim of producing accurate and timely management information and supporting data analysis. It was developed to meet a growing demand for management information and analysis that could not be met by operational systems. Operational systems were unable to meet this need for a range of reasons:

- ◆ The processing load of reporting reduced the response time of the operational systems.
- ◆ The database designs of operational systems were not optimised for information analysis and reporting.
- ◆ Most organizations had more than one operational system, so company-wide reporting could not be supported from a single system.
- ◆ Development of reports in operational systems often requires writing specific computer programs, which is slow and expensive.

As a result, separate computer databases began to be built that were specifically designed to support management information and analysis purposes. These data warehouses were able to bring in data from a range of different data sources.

The advantages of using a data warehouse are:

- ◆ Enhanced end-user access to a wide variety of data.
- ◆ Increased data consistency.
- ◆ Increased productivity and decreases computing costs.
- ◆ It is able to combine data from different sources, in one place.
- ◆ It provides an infrastructure that could support changes to data and replication of the changed data back into the operational systems.

Question 15

Differentiate Data mining and Data warehousing? Describe the component used in Data warehousing in brief.

Answer

A Data Warehouse is a computer database that collects, integrates and stores an organization's data with the aim of producing accurate and timely management information and supporting data analysis. These data warehouses were able to bring in data from a range of different data sources, such as mainframe computers, minicomputers, as well as personal computers and office automation software such as spreadsheets and integrate this information in a single place. This capability, coupled with user-friendly reporting tools, and freedom from operational impacts has led to a growth of this type of computer system.

A Data Mining is concerned with the analysis of data and the use of software techniques for finding patterns and regularities in sets of data. It is the computer, which is responsible for finding the patterns by identifying the underlying rules and features in the data. The idea is that it is possible to strike gold in unexpected places as the data mining software extracts patterns not previously discernable or so obvious that no-one has noticed them before.

Data Mining analysis tends to work from the data up and the best techniques are those developed with an orientation towards large volumes of data, making use of as much of the collected data as possible to arrive at reliable conclusions and decisions. The analysis process starts with a set of data, uses a methodology to develop an optimal representation of the structure of the data during which time knowledge is acquired. Once knowledge has been acquired this can be extended to larger sets of data working on the assumption that the larger data set has a structure similar to the sample data.

Components of a Data Warehouse

The primary components of the majority of data warehouses are discussed below:

- (i) **Data Source Layer:** Data sources refer to any electronic repository of information that contains data of interest for management use or analytics. This definition covers mainframe databases, client-server databases, PC databases, spreadsheets and any other electronic store of data. Data needs to be passed from these systems to the data warehouse either on a transaction-by-transaction basis for real-time data warehouses or on a regular cycle for offline data warehouses.
- (ii) **Data Transformation Layer:** The Data Transformation layer receives data from the data sources, cleans and standardizes it, and loads it into the data repository, also called staging data. Some of the activities that occur during data transformation are - Comparing data from different systems to improve data quality, Standardizing data and codes, Integrating data from different systems and Performing other system housekeeping functions.

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- (iii) **Data Warehouse Layer:** The Data Warehouse is a relational database organized to hold information in a structure that best supports reporting and analysis.
- (iv) **Reporting Layer:** The data in the data warehouse must be available to the organization's staff if the data warehouse is to be made useful. There are a very large number of software applications that perform this function, or reporting can be custom-developed. Examples of types of reporting tools include: Business Intelligence tools, Executive Information Systems, Online Analytical Processing (OLAP) Tools and Data Mining.
- (v) **Metadata Layer:** Metadata, or "data about data", is used to inform operators and users of the data warehouse about its status and the information held within the data warehouse. Examples of data warehouse metadata include the most recent data load date, the business meaning of a data item and the number of users that are logged in currently.
- (vi) **Operations Layer:** Data warehouse operations comprises of the processes of loading, manipulating and extracting data from the data warehouse. Operations also cover user management, security, capacity management and related functions.

The following components also exist in some data warehouses:

- Dependent Data Marts
- Logical Data Marts
- Operational Data Stores.

EXERCISE

Question 1

- (i) $(675)_{10} = ()_2$
- (ii) $(1000111)_2 = ()_{10}$
- (iii) $(350.25)_{10} = ()_2$
- (iv) $(101110.001)_2 = ()_{10}$

Answer Refer to 'Section 2.1 of Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.

Question 2

Discuss the Advantages and Disadvantages of Sequential File Organization.

Answer Refer to 'Section 2.6.2.2 of Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.

Question 3

What is Data Base Management System? Discuss the benefits of using DBMS.

Answer Refer to 'Section 2.7.4 of Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.

Question 4

What is database structure? Explain relational database structure.

Answer Refer to 'Section 2.8.3 of Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.

Question 5

Discuss various types of database Key in brief.

Answer Refer to 'Section 2.8.3.1 of Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.

Question 6

Describe in brief the different types of database used to store the data.

Answer Refer to 'Section 2.13 of Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.

Question 7

Describe briefly how an SQL statement works? What are the elements that are used to form a SQL statement?

Answer Refer to 'Section 2.14 of Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.

Question 8

Discuss difficulties in management of system document.

Answer Refer to 'Section 2.15 of Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.

Question 9

What are the elements that are required to be considered in designing of user interface? How the interface design is developed.

Answer Refer to 'Section 2.15.2 of Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.

Question 10

Discuss various steps in development of a backup and recovery strategy.

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Answer Refer to 'Section 2.16.3 of Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.

Question 11

What do you understand by the term “Data Mining”? Discuss different stages involved in the process of Data Mining.

Answer Refer to 'Section 2.18 of Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.

Question 12

Distinguish between the following:

- (i) *Master File and Transaction File*
- (ii) *Sequential File Organization and Random File Organization*

Answer Refer to 'Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.

Question 13

Write Short notes on

- (i) *Distributed Database*
- (ii) *Object Oriented Database*
- (iii) *E-R Model*
- (iv) *Computer Data Code*
- (v) *Data Dictionary*
- (vi) *Data Independence*

Answer Refer to 'Chapter 2 i.e. Data Storage, Retrieval and Data Base Management Systems' of Study Material.