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A+ Core Hardware Exam

Basic System Components

Processor: Manages the processing and logical operations of a computer system. The two main components of a processor are the *Arithmetic Logic Unit* (ALU) and the *Control Unit* (CU). The ALU handles arithmetic and logical operations. The CU decodes and executes the memory instructions. Processor is also commonly known as microprocessor or Central Processing Unit (CPU).

Motherboard: The biggest and most important circuit board of a computer system. The components on a motherboard are *CPU*, *Binary Input Output System* (BIOS), memory, mass storage interfaces, parallel and serial ports, controllers and expansion slots. It handles all memory, system resources and the processor.

Memory: Storage space in the computer where digital data is stored. The main physical memory is called *Random Access Memory* (RAM) which allows data to read and written into it. The different types of memories are - *Random Access Memory* (RAM) and *Read-Only Memory* (ROM).
Some commonly used storage devices are floppy disk, hard disk, compact disk, digital videodisk and tape drive.

Input Device: Any device, which allows a user to enter the desired data into the computer system. Some commonly used input devices are mouse, keyboard, scanner, joystick and touch screen.

Display Unit: Machine, which displays the data and information being entered, retrieved and the results of the processed data from the system. Some commonly used display devices are monitor, *Liquid Crystal Display* (LCD) panel and touch screen.

Adapter: Circuit in a computer system, which supports a particular device. Video adapters are used to support graphics monitor. Network adapters allow a computer to communicate with another computer. Also called expansion board, add-ons, add-ins or cards.

Power supply: Provided through a *Power Supply Unit* (PSU) to the computer. Continuous power input is required for the proper functioning of the system, which can be provided through a direct power supply. *Surge suppressors*, power conditioners and *Uninterruptible Power Supply* (UPS) are commonly used for regulating the power input to the computer.

Cooling system: Used to drain out the extra heat from the CPU. Equipment like fans, liquid coolants and *heat sinks* are used to drain the heat out which is very important for the proper functioning of the computer. A cooling fan should maintain the temperature up to 90-110 degrees Fahrenheit. Combination of a *heat sink* and cooling fan called cooler is also used.

Other Components:

Floppy Drive Controllers: Circuitry that is responsible for managing transmission of data from the computer to the floppy drive and vice-versa.

Hard Drive Controllers: Circuitry that is responsible for the managing transmission of data from the hard drive to the computer and vice-versa.

Internal Modem: Transforms data from analog signals to digital and vice versa to facilitate data transfer over cable and telephone lines. Internal modem is integrated on the expansion board The main features of a modem are: <u>Speed</u>: Measured in *Bits Per Second* (bps); <u>Auto Answer feature</u>: Modem answers the call automatically in the user's absence; <u>Data compression</u>.

Multimedia Devices: Facilitates the data communication between a computer and a user. The data can contain text, video, audio, graphics, gaming and virtual reality.

Network Card: Expansion card that enables one computer to connect and communicate with one or more than one computer(s).

Specialized Cards: Used by specific utilities. Some commonly used specialized cards are *Sound Card* that enhances the audio capabilities of a system by allowing it to manipulate record and output sound. *Video Card* that enhances the displaying properties of text and graphics.

Basic Tips on Preventive Maintenance:
- Check all wires for wear and tear
- Clean the peripherals regularly
- Vacuum clean your computer case regularly
- Check the voltage
- Do not smoke near your computer

Tools used for maintenance:
- Liquid cleaning compounds
- Vacuum cleaner
- UPS
- Power suppressors

Software utilities:
- Disk defragmenter
- Scandisk

Maintenance for Basic System Components:
- *System unit*: Should be vacuum cleaned on yearly basis.
- *Monitor*: Screen should be cleaned with a soft cloth on monthly basis.
- *Keyboard*: Vacuum clean on monthly basis.
- *Mouse*: Clean the ball and rollers on monthly basis.
- *Floppy drive*: Clean monthly using the floppy drive cleaning kit.

Installation Of Peripheral Devices:
A peripheral device is not a fundamental part of the computer. It may be an external device also. Tips for installation of peripheral devices:
- Check if the device is compatible with the configuration of the motherboard of the system.
- Create a copy of the data stored on the system for backup.
-. Follow the device's instruction manual for the right installation procedure.
- For installation of an external device, simply connect and attach the device to an external port present on the PC.
- For installing an internal device you have to wear an antistatic wristband as a protection against high voltage.
- Internal devices are installed in the CPU, by attaching them to the right ports and connectors.

Tips For Maximizing PC Performance:
- Using the right cooling technique for the CPU to avoid overheating.
- *Disk partitioning*-creating subdivisions of a single hard drive for better memory management.
- Using additional cards for increasing the specific equipment's performance.
- Using recent antivirus software to prevent the system and data from getting corrupted.

Ports, Cables And Connectors

Port: Interface present on the computer, which is used to attach any peripheral device to the computer. Types of ports:
- *Serial*: Used for connecting a modem and a mouse to the computer. It is a 9-pin or 25-pin male connector.
- *Parallel*: Used for connecting printer and scanner

It is present on the back of the PC and it uses a 25 pin female connector.
- *Universal Serial Bus* (USB) Port: Used for supporting data transfer from USB devices. Mice, modems and keyboards (with USB interface) can be attached through this port.
- *Infrared* port: Used for wireless connectivity between a device and the computer. There is no physical contact between the two communicating machines.
- *Registered Jack* (RJ) connector: Used to connect telephone lines (RJ-11) and 10baseT or Ethernet (RJ-45) cables.

Cable: Wire or bundle of wires, which act as a transmission medium. A cable is insulated and has a connector at both the ends, mainly used for computer networking. Types of cables:
- *Serial Null Modem cable*: Allows some signals to pass through but other signals are routed to different destinations.
- *Straight through cable*: Allows all the signals to pass through it straight without any interference with the flow.
- *Parallel*: Used by parallel ports, where data and signal transmission takes place simultaneously.
- *USB*: Connects two USB ports and allows information to be transferred between them.

Connector: Component of a cable that is inserted into the port to attach a device to the computer. It is classified as male and female connector. A Male connector has one or more exposed pins and a Female connector has holes.
Types of connectors:
- *Serial*: Used with serial cables. DB-9, DB-25, RJ-11 and RJ-45 are examples of a serial connector.
DB connectors: Specifies the physical configuration of the connector not the use of lines. Available as 9, 15, 25,37and 50 pins type.
DIN connectors: Round multipin electrical connector. Available as 4, 5 and 8 pin sizes. Used for keyboards and MIDI.
- *Parallel*: Used with parallel cables. DB-25 and centronics for printers are examples of parallel connectors.
Centronics: It has 8 data lines and other lines for control and status information. It is found at the back of printer and has 36 pins and for scanners and SCSI devices has 50 pins.
- *USB*: Used for the USB port connectivity with the computer.
- *Institute of Electrical and Electronics Engineers (IEEE)*: Standard serial connector RS-232C.
- *Audio connectors*: Specially designed for audio frequencies. Available as digital and analog.
- *BNC connectors*: Used for 10base2 coaxial cable and wireless system antenna. It is a male type and has a rotating ring that locks it with a female connector.

Cases

Form Factors: Define the size, shape, and configuration of a hardware part. Form factors for case and power supply depend on the motherboards form factor.
Types of form factors:
- *AT*: Full AT measures 12" x 13.8 " Full AT case cannot be used with any other motherboard case.
- *Baby AT*: measures 13" x 8.7" and provides more flexibility. Power supply for this form factor allows air to be blown out of the case.
- *ATX*: Measures 12" x 9.6" and components of the motherboard are better positioned. A single power connector P1, for the motherboard and the power supply is present.

-*LPX*: Has a riser card. It is difficult to upgrade and is not compatible with fast processors.
-*NLX*: Motherboard has only one expansion slot and it is used with low profile cases. It provides flexibility and space efficiency.

Types Of Cases:
-Desktop: Acts as a monitor stand and has 4 drive bays and six expansion slots. Occupies space so not commonly used now. Low Profile or Slim line case is another type.
-Tower: Two feet high and can accommodate many drives. Mini tower, mid size tower and full size tower are the variations of this case.
-Notebook cases: Smallest cases are called sub notebook cases. Design allows for portability, space efficiency, less heating and less power consumption.

Microprocessors
Comparison chart for processors based on some common properties:

Micropro cessors	CPU SPEED	L2 CACHE	FRONT SIDE BUS SPEED	TRAN SISTORS
CELERON	1.06 GHz - 2 GHz	256 KB at full speed	133 MHz and 400 MHz	7,500,000
PENTIUM III XEON	500 MHz - 1 GHz	256 KB - 2 MB at full speed	100 MHz	28,100,000
PENTIUM IV	1.4 - 3.4 GHz	256 KB at full speed	800 MHz	55,000,000
ATHLON XP	1.67 GHz	384 KB at full speed	266 MHz	37,500,000
DURON	700 - 800 MHz	64 KB at full speed	200 MHz	N/A
POWERP C G4	400 - 800 MHz	1 MB at half speed	100 MHz	10,500,000

CPU Packages:
-*Pin Grid Array (PGA)*: Pins are present at the bottom and can be inserted in the socket in one way. Also available as plastic PGA, flip chip PGA, flip chip PGA2.
-*Single Edge Contact Cartridge (SECC)*: Processor is covered in black housing to which a heat sink and fan is attached. Also available as SECC2.
- *Pin Array Cartridge (PAC)* and *Single Edge Processor (SEP)* are other types of CPU packages.
- Intel has introduced MMX for 3D games. AMD has introduced 3DNOW for the same purpose.

Power Supplies
Measuring The Voltage:
- Using a *Multimeter*: Measures voltage and current both. Current and voltage should be measured when the current is on. *Multimeter* is a small, portable, battery powered unit and can be either digital or analog. Instructions have to be given to the *multimeter* about what you want to measure, is it the current AC or DC and what is the minimum and maximum level of readings it has to allow.
- For measuring the voltage of the power supply every circuit, which is supported by it, has to be checked.
Power Management Techniques:
-*Advanced Power Management (APA)*
-*AT attachment*: for IDE drives
-*Display Power Management Signaling (DPMS)*
-*Advanced Configuration and Power Interface (ACPI)*
Power management can be implemented by using the

following features available in the CMOS and OS.
-Green timer: Allows setting number of minutes of idle time of the CPU after which it should go into sleep mode.
- Doze time: Time limit after which the system reduces its power consumption by 80%.
-Standby time: Time limit after which the system reduces its power consumption by 92%.
-Suspend time: Time limit after which the system reduces its power consumption by 99%.
- Hard drive standby time: Time limit after which the hard drive shuts down.

Integrated Drive Electronics Devices (IDE)
A standard interface, which is used to connect the hard disk or other massive storage tools, to the computer. In an IDE Device the controller is incorporated in the drive internally. IDE is a very easy to use but a very restrictive interface. It is incorporated within the motherboard and permits only four internal devices to be connected through it.
Types Of Interfaces:
- *Enhanced integrated Drive Electronics (EIDE)*: The recent version of the IDE. It is faster and is capable of handling high capacity data storage devices.
- *Advanced Technology Attachment (ATA)*: IDE which supports one or two hard drives. It allows cd-rom and tape drive support.
- *Programmed Input Output (PIO)* - Technique used for transfer of data between two devices by using the processor as a medium.
Redundant Array Of Independent Disks (RAID)
Type of disk drive arrangement that allows more than two drives to be grouped for efficiency and fault tolerance. A RAID can have different types of levels. Level 0 has data striping but does not provide fault tolerance. Level 1 has mirroring and duplexing features and it uses 2 hard disks only. Level 2 has error correction coding. Level 3 has bit interleaved parity. Level 4 has dedicated parity drive. Level 5 has block interleaved distributed parity and it requires a minimum of 3 hard disks. Level 6 has independent data disks with double parity. Level 0+1 has mirror of stripes. Level 10 has a stripe of mirrors. Level 7 adds caching to level 3 and 4.
How Hard Drives Work : (IDE)
- Partitions: Dividing the storage space into independent separate segments. Each segment behaves like a separate disk. It allows installing two separate operating systems in two separate spaces on the same hard disk and hence increases efficiency as well as fault tolerance.
- File System Types:
→*File Allocation Table (FAT)*: Used in DOS and Windows, is a 16 bit file system. The maximum size of a file is 2 GB, allows for only 512 directories in the root directory and supports the 8.3 file naming system.
→ *Virtual file allocation table (VFAT)*: Can use virtual memory and virtual device drivers. The maximum size of a file is 4 GB, allows for only 512 directories in the root directory but in the non-root directory number of files is unlimited. Supports 8.3 and long file naming system
→ *File Allocation Table 32 (FAT32)*: Supports file size of 4TB and there is no limitation to the number of files in the root and non root directory.

Small Computer Systems Interface Devices-(SCSI)
SCSI is a standard for attaching peripheral devices to computer through a parallel interface. It is fast, but complicated and permits both internal, external devices and many more devices to be connected through it to the computer. A SCSI chain requires only one *Interrupt Request (IRQ)* Line for the whole chain.
Types Of Interfaces:
Narrow: The SCSI bus in this type of SCSI is 8 bits in width.
Wide: The SCSI bus in this type of SCSI is 16 bits in width.
Low Differential Voltage (LVD): Low voltage differential interface, which is present in the ultra2 and ultra3 SCSI. It is a common name for Ultra2 wide SCSI.
High Voltage Differential (HVD): Refers to the high voltage differential type of SCSI bus. The effect of noise interference in HVD is highly reduced.
Internal Vs External devices: An adapter card called the *Host Adapter* is used to support both internal and external devices by the SCSI bus. The *Host Adapter* and all the devices form a daisy chain.
Identification:
IDs are assigned to devices on the SCSI channel so that there is no conflict about accessing the devices. The ID has to be unique for each device. For *narrow SCSI* the IDs are from 0-7 and for *wide SCSI* the IDs are from 0-15. The *Host Adapter* generally has an ID 7 or 15.
Cabling:
For the standard SCSI device the cable length should be 6 meters and it should have 50 pins. For the *fast SCSI device* the length of the cable should be 3 meters and it should have 50 pins. For the *fast wide SCSI device* the length of the cable should be 3 meters and it should have 68 pins. For *ultra SCSI* device the length of the cable should be 1.5 meters and it should have 50 pins.
Terminators: Termination is used to stop the noise from spreading at the end of the SCSI daisy chain and corrupting the data transmission.

Upgrading Components
An upgrade refers to the implementation of the current edition of any hardware.
Upgrading Tips:
-Check if the hardware you are upgrading to is the latest model or not.
-Check whether the memory capacity will be sufficient for the new upgrade.
-Check the compatibility of the new hardware device with all other components of the system.
-Check if the motherboard design allows for the new hardware to be integrated on it.
-Check if the processor supports the new hardware version.
-Check for device drivers for the new hardware.
-Check for future feasibility of the upgrade.
-Check the power input and output consumption limit.
Components Involved:
-Motherboards
-Memory
-Hard drives
-CPU
-BIOS

Troubleshooting Of System Components

Analyzing The Problem:
- Ascertain whether it is a software or a hardware problem.
- Collect information about the environment in which the user uses the system.
- Understand the scenario in which the problem had first appeared.
- Draw together as much information as possible from the user.
- Combine the various symptoms indicated by the user logically.
- After establishing the problem, specific troubleshooting steps can be followed to rectify the faults in the hardware.

Checklist for Replacing Parts:
- Wear an antistatic wrist strap.
- Turn off the system power.
- Unplug all cables from electronic circuits
- Remove system cover when the power is off.
- Do not remove parts from their antistatic covers before you are ready to replace them.
- Hold parts by their edges and metal brackets.
- Avoid rubbing parts with one another.
- Do not apply pressure to any component.
- Do not solder or heat any component.
- Do not disassemble any component or circuit.
- Avoid static causing surfaces.

Networking

A network is a collection of computers linked to one another allowing information and resources to be shared between them.

Setting Up A Network:
A network is setup by connecting the various computers through the cables, connectors and connectivity devices such as *hubs* or *switches* along with which necessary protocols for enabling communication between them are implemented. Any computer can access a network directly by using a network adapter expansion card also known as *Network Interface Card (NIC)* and a network cable.

Required Parameters:
Cabling: Types Of Cables are:
- *Coaxial* cable: Contains a central wire which is insulated and on top of which there is a grounded layer of braided wire. Coaxial cables can carry more data and are less prone to interference.
- *Plunem* cable: Has an outer shield made of Teflon, which is a fire repellant, and which does not produce poisonous fumes when burnt.
- *Unshielded Twisted Pair (UTP)* cable: Two coupled and twisted wires so that the noise of the two separate wires that are covered in a shield of foil, so that data transmission is safer.
- *Fiber Optic* cable: Made of plastic, glass or hybrid fiber, which transmits data in the form of light signals. It is expensive but has high speed and ensures security in data transmissions.
Connectors: Some commonly used connectors in a network are BNC, RJ-45, AUI, ST\SC, and IDC\UDC.
Network Cards: Transmit and receive information in the parallel mode to and from the system bus and in serial mode to and from the network. It handles the conversion of information to a compatible format as per the network.
Bandwidth: Quantity of information that can be transferred in a specific time unit. The unit for bandwidth is *Bits per Second (bps)*. Higher the bandwidth, faster is the data transfer.
Addressing: Every computer on the network is also

called a node and each node has a specific address, so that, data can be routed correctly to the respective node. Four main types of addressing techniques are :
- *Media Access Control (MAC) addressing*: Used for addressing the internal devices of a network not the devices outside the Local Area Network (LAN).
- *Internet Protocol addressing (IP address)*: Identifies the long distance addresses of devices on a transmission control protocol\ internet protocol (TCP\IP) network. It is a 32 bit address.
- Character based names: Non –numeric character addresses like host names and domain names.
- Port addressing: recognizes program running on a computer. It is a number between 0 and 65,535 and also called I\O address.

Protocols:
Set of rules and regulations that define the method of communication between two or more computers in a network. Types of protocols are:
- *Transmission Control Protocol \ Internet Protocol (TCP\IP)*: Establishes connection between two computer systems that are used by the user from a different location and transfer of information packets. IP deals only with packets. It defines their format and the addressing method. TCP and IP are coupled together to setup a virtual network between a source and a destination system.
- *Internetwork Packet Exchange/Sequenced Packet Exchange (IPX\SPX)*: Deals with information and data packets called datagram in a connectionless network environment. SPX is a higher level protocol, which is used for rectification and recovery from errors.
- *AppleTalk*: Communication protocol that has seven layers and deals with the range of apple Macintosh products.
- *NetBIOS Enhanced User Interface (NETBEUI)*: Superior version of the NetBIOS protocol meant for network operating systems.

Network Models:
- *Peer-to-Peer (P2P)*: Network in which each system shares the same level of performance competence and responsibility. This type of network is simple but under heavy workload it does no have a consistent performance. In this type of network, there are no dedicated servers. Every system acts as client as well as server.
- *Client/Server*: Every computer will either be a client or a server. A client is the system which the user uses to access the resources on the main server system. The server is a powerful system which controls all the resources and the processes. The server caters to all the needs of a client.
- Wireless network: Does not use any wires or cables for networking .It uses high frequency radio signals for interaction between the systems. An example of the wireless technology is infrared network.

Networking Technologies:
- *Local Area Network (LAN)*: A computer network that spans a relatively small area. The important types of models for a LAN are the Ethernet, wireless LAN and token ring.
- *Digital Subscriber Line (DSL)*: Allows the transmission of information through simple copper telephone lines.
- *Integrated Services Digital Network (ISDN)*: Worldwide established standard for transmitting voice, video and information through digital and normal phone lines.
Other commonly used technologies include Dial –Up, cable, Satellite, and wireless.
Domain Name System (DNS): It maps the domain names into corresponding IP addresses.
Dynamic Host Configuration Protocol (DHCP): Protocol used for allocating dynamic IP addresses to devices like printers and client computers connected to a network.

This address may be different in every new connection and it can also change while the device is connected to the network.

Memory

Random Access Memory (RAM) is a volatile form of memory storage because once the system is turned off; the data stored on the RAM is lost.

Types Of RAM:
- *Static RAM*: Cache memory, which helps in decreasing the access time to the main memory. It does not require constant refreshing and it is fast but costly. No memory addresses are assigned in this memory.
- *Dynamic RAM*: Memory that needs to be refreshed constantly. The data is rewritten to the chip after every millisecond. It is slower than static RAM. Memory addresses are assigned in this memory.
- *Extended Data Output RAM – (EDO RAM)*: Is a better version of First Page Memory (FPM). It has a faster access time but is still implemented on older motherboards.
- *Synchronous DRAM (SDRAM)*: Works in synchronization with the system clock and its performance is evaluated based on the clock speed.
- *Double Data Rate RAM (DDR RAM)*: Type of SDRAM which is better and faster than the SDRAM.
- *RAMBUS DRAM*: Type of dynamic RAM that uses a system bus which has very high speed.
- *Video RAM*: RAM which deal only with the display of the bitmap graphics .It is present on the video or graphics card. It can be read and manipulated at the same time and it is faster than the ordinary RAM.
- *Read Only Memory (ROM)*: Allows only data to be read from it does not allow writing data into it. It stores the instructions for system start up. ROM is a non-volatile memory.

Types of ROM:
- *Programmable Read Only Memory (PROM)*: Used to store a set of instructions but it cannot be reused to store anything else. PROM is a non-volatile memory.
- *Erasable Programmable Read Only Memory (EPROM)*: type of erasable PROM.
- *Electrically Erasable PROM (EEPROM)*: type of PROM that is electrically erasable. Also known as *Flash ROM*.

Form Factors:
- *SINGLE IN LINE MEMORY MODULE (SIMM)*: Uses FPM methodology and it has two versions. In one the edge connector has 30 pins and the other one has 70 pins. Another SIMM technology uses the EDO methodology and it has 72 pins.
- *DUAL IN LINE MEMORY MODULE (DIMM)*: Has versions which have used EDO and SDRAM methodology. It has 168 or 184 pins.
- *RAMBUS IN LINE MEMORY MODULE (RIMM)*: It is also called *RDRAM*. It uses a 16 or 32 bit data path.
SO DIMM: small outline DIMM: It is used in laptop systems.

Operational Characteristics:
PARITY: It is used in the error checking procedure. It is a procedure for testing the validity of the data bits, which are transmitted and also those, which are stored in the RAM.
It has two basic methods –the even parity and the odd parity. For even parity the total number of 1s has to be even and for odd parity the total number of 1s has to be odd.
Error Correction Code (ECC): It is a technique used in current memory types .It can detect as well as correct the parity error. Memory modules have ECC and if they do not have then they are called non ECC modules.

Motherboards

Types Of Motherboards:
AT: It is the oldest available motherboard, which is still used in some systems. The power connections available in this motherboard are for 5 and 12 volt lines. It uses P8 and P9 power connections.
ATX: Developed for Pentium systems by Intel. Has a better motherboard layout and features for power management as compared to the AT layout. It uses a P1 connector and supports 5, 12 and 3.3 volts lines.

Components Of A Motherboard:
The main components of a motherboard are the CU and its chipset, the system clock, the ROM BIOS, the RAM, the system bus with expansion slots, jumpers and DIP, power supply connections and communication ports like the serial, parallel, USB and infrared ports.

Types Of Slots And Sockets:
-Slot 1: Used by Pentium II and III CPUs. It has 242 pins in 2 rows.
-Slot 2: Used by Pentium II and III Xeon range of CPUs. It has 330 pins in 2 rows.
-Slot A: Used by AMD Athlon CPUs. It has 242 pins in 2 rows.
-Socket A: Used by AMD Athlon and Duron CPUs. It has 462 pins.
-Socket 7: Used by Pentium MMX, Fast Classic Pentium, AMD K5 and Cyrix M CPUs. It has 321 pins.
-Socket 8: Used by Pentium Pro CPUs. It has 387 pins.
-Socket 423: Used by Pentium 4 CPUs. It has 423 pins.
-Socket 478: Used by Pentium 4 CPUs. It has 478 pins.

Types Of Bus Architecture:
-*Industry Standard Architecture (ISA)* Bus: This Architecture was originally used in the IBM PC/XT and PC/AT. It is a very old technology used for connecting peripheral devices.
-*Peripheral Component Interconnect (PCI)*: Developed by Intel Corporation. It is a standard for local bus. It has a throughput rate of 133 MBps.
-*Accelerated Graphics Port (AGP)*: A standard for interfaces developed by Intel. It caters to the needs of the throughput for 3-D graphics and has a bandwidth of 266 MBps.
-*Universal Serial Bus (USB)*: An external bus, which can support peripheral devices up to 127. It is a very good replacement for serial and parallel ports.

Installing a Motherboard:
1. Setting the jumpers and DIP switches based on the hardware you are installing.
2. A Universal Retention Mechanism (URM) is preinstalled in the motherboard in which the processor fits. Prepare the arms of the URM.
3. Insert the braces on the fan into the holes within the CPU package. Push the clamp to secure the fan.
4. Connect the fan power cord to the motherboard.
5. Install the mother board in the case by performing the steps:
- Install the face plate by inserting it in the hole at the back of the case.
- Install the stand offs.
- Place the motherboard inside the case and attach it with screws to the case.
- Connect the power cord from the power supply to the power connection on the motherboard.
- Connect the wire leads from the front panel of the case to the motherboard.
- To check which wire connects with which pin consult the motherboard documentation.

Other Features:
-*Audio Modem Riser (AMR)* slots -A standard developed by Intel which specifies a new design for the motherboards. The analog input output functions are placed on a separate card which is fitted at a right angle with the mother board and not directly integrated on the motherboard. This improves the overall audio quality and performance.
-*Communication Network Riser (CNR)* slots: A card developed by Intel for ATX motherboards. It specifies a new motherboard riser card and interface, which can tolerate heavy and increased workload.
-*Chipsets*: A group of integrated circuits. A chipset can perform a specific function. It signifies the core operations of a motherboard.

Complementary Metal Oxide Semiconductor (CMOS) Memory Features: is also known as the real
–time clock/non-volatile ram chip.
-It does not loose the data stored on it even when the system is switched off.
- CMOS uses very less amount of power and does not generate a high amount of heat also, as it uses both the negative and positive polarity. This feature makes it usable in computer systems.
-A battery powered CMOS memory is used in the computers to store date, time and system setup information.
-CMOS also contains the systems BIOS setting information.
-Facilitates the real time clock for the system.
-The data stored in the CMOS can be changed through the setup program in the ROM BIOS. CMOS setup also has a power menu, which allows you to change the power saving settings for the system.
-In the CMOS setup the power menu allows you to change the power saving settings for the system.
-CMOS setup has a boot menu also to handle the BOOTING of the system.
- Controls the usage and access to the system by setting up a password in the CMOS.
-A battery powers the CMOS chip. If this battery power is lost or interrupted the system setup data stored on the CMOS is lost.
- The coin cell type battery is the commonly used battery for CMOS.

Basic Input Output System (BIOS): Pre-integrated software, which determines the actions of a computer which it, can perform without accessing the disk. Present in the ROM chip and contains code for various functions and devices

Printers

Types Of Printers:
-*Laser printers*: Uses laser beam to print on the electrical charge on the drum .The drum is then rolled through the ink toner, which sticks to the charged parts. The toner is transferred to the paper through heat and pressure.
Six main steps of laser printing are:
1. Cleaning Drum: To remove any traces of toner and charge.
2. Conditioning Drum: So that it can hold a high electrical charge.
3. Writing: Low charge is emitted by laser beam on the sections where toner will get applied.
4. Developing: As charge gets lessened on the drum toner is placed on it.
5. Transferring: Is performed outside the cartridge. Applying the toner to the paper is done by pulling it off the drum using a strong electrical charge.
6. Fusing: To bond the toner strongly to the paper heat and pressure is applied.
-*Ink-jet printers*: A printing head moves on the paper and one line is printed each time the head passes on the paper. A matrix of small dots is used to print on the paper. It uses around 480021200 dots per inch. It generally includes separate black and color ink cartridges.
-*Dot Matrix printers*: Print multicopy documents. It has a print head, which prints along the width of the paper by using pins to form a matrix of dots. A cloth ribbon contains the ink and the lubricant for the pins, which hit against it for printing. Printer head should be kept as cool as possible for efficiency.
-*Thermal printers*: Are non-impact printers. It uses wax-ink which is hit by hot pin heads and melted ink gets imprinted on the paper. The head, which contains the pins, is as broad as the paper. Most useful for printing bar codes and price tags.
-*Solid Ink printers*: Ink is stored in solid blocks called ColourStixs which are used as required. Through the breadth of the paper the solid ink is melted in the print head. The head takes around 15 minutes to heat up before printing starts.
- *Dye Sublimation Printers:* Are a type of thermal printers. They are used for printing access cards and identification cards.

Interfaces: For sharing a printer, every computer on the network should have a printer driver installed on it.
- *Parallel*: use an IEEE 1284 compliant printer cable.36 pin male /female connector.
-*Serial*: Not very commonly used for printers now.
-*USB*: Minimum transfer rate of 12 Mbps.
-*SCSI*: Faster than parallel interface transfers data at the rate of 8 bps and more.
-*Infrared*: Place printer in the straight line view of the infrared port on the PC.

Steps To Troubleshoot Basic Printer Problems
1. Check if you can print from an application or not. If you cannot then try to print out a test page.
2. If you can print the test page then try to troubleshoot the application.
3. Check if you can print using the controls of the printer and if no then try to check the cables and the connectivity of the printer.
4. Check the power to the printer.
5. Troubleshoot operating system and printer drivers.
6. Try to troubleshoot according to the error messages displayed for the printing process.

Sound

Musical Instrument Digital Interface (MIDI):
Music industry has established MIDI standard for managing the musical devices. Based on MIDI the components of sound include volume, pitch, length, time delay and attack of the musical note. It has a data transfer rate of 31,250 bits per second. It is a serial and asynchronous interface through which various musical instruments of different brands communicate. Sound data from musical instruments is stored as digital information. MIDI has 3 main types of files:
-0 MIDI: all information is stored on one track.
-1 MIDI: more than one simultaneous track of data.
-2 MIDI: More than one independent sequential single-track format.
The most important feature of the MIDI level 1 sound set is its defined list of sounds called patches. It does not define how the sound is generated it only names the sound.
MIDI Utilities:
- MIDI file assembler \ disassembler
- MIDI patch lister
- MIDI file converter
- MIDI device info tool