Computer hardware refers to the **physical components** of a computer that you can see and touch. These components work together to process input and deliver output based on user instructions. In this article, we'll explore the different types of computer hardware, their functions, and how they interact to make your computer work.

The computer has mainly has two major components:

1. **Hardware**
2. **Software**

In this article, we only discuss computer hardware.

What is a Computer Hardware

Computer hardware is a physical device of computers that we can see and touch. E.g. Monitor, Central Processing Unit, Mouse, Joystick, etc. Using these devices, we can control computer operations like input and output.

Also read, Peripheral Device.

Computer Hardware Parts

These hardware components are further divided into the following categories, which are:

- **Input Devices**
- **Output Devices**
- **Storage Devices**
- **Hardware Components**

Input Devices

Input devices allow users to interact with a computer by entering data or commands. These devices convert the input into a format that the computer can process.

Now we discuss some input devices:

- **Keyboard:** The most widely used input device, featuring 104 keys, including alphabetic, numeric, and function keys. Modern keyboards connect via Bluetooth, replacing traditional wired connections.
- **Mouse:** A pointing device that controls the cursor on the screen. It features left, right, and middle buttons for selection and interaction. The sensor inside the mouse detects its movement speed, adjusting the cursor accordingly.
- **Scanner:** Scans documents, images, and other media, converting them into digital formats for editing or processing, similar to a Xerox machine.
- **Trackball:** A stationary pointing device with a ball that the user rotates to control the cursor, requiring less space than a traditional mouse.
- **Light Pen:** A light-sensitive pen used to draw or select objects on a CRT screen by detecting raster patterns, offering a direct interaction with the display.
- **Microphone:** Converts sound into electrical signals. It captures voice input for speech recognition and voice commands on the computer.
- **Optical Character Reader (OCR):** Scans printed or handwritten text, converting it into digital data by detecting reflected light from the characters, similar to a scanner.
- **Bar Code Reader:** Reads bar codes and converts them into digital data for processing. The bar code consists of light and dark lines that encode information.

Output Devices

Output devices display the results of tasks given to the computer in a human-readable form. Let’s discuss some common output devices:

- **Monitor:** The main output device. It is also called VDU(visual display unit) and it looks like a TV screen. The Monitor displays the information from the computer. It is used to display text, video, images, etc.
- **Printer:** A printer is an output device that transfers data from the computer in a printed format by using text or images on paper. There are both coloured and black & white printers. Further, there are also different types of printers, like Laser Printer, Dot-matrix printers, and Inkjet printers.

- **Plotter:** It is similar to a printer but potters are large. A plotter is used to generate large drawings, architectural blueprints, etc. on paper and these are high-quality images and drawings and large.
- **Speakers:** It is a very common output device and it gives sound as an output. The speaker is generally used to play music or anything having sound.

Storage Devices

Some devices are used for storage purposes and are known as secondary storage devices. Some of them are discussed below:

1. CD (Compact disc): A CD is circular and made up of thin platted glass and plastic polycarbonate material. It has a storage capacity of 600 MB to 700 MB of data. It has a standard size of 12 cm with a hole in the centre of about 1.5 cm and 1.2 mm in thickness. There are 3 types of CDs, which are:

- **CD-ROM (CD - Read Only Memory):** Contents of this type of CD cannot be erased by the user. Only the publisher is allowed to access the data imprinted on this CD. CD-ROM is used for commercial purposes like for a music album or any application package by a software company.
- **CD-R (CD-Recordable):** In this, content or data can be stored once. After that, they can be read many times but the data or content cannot be rewritten or erased. (Kind of one-time use)
- **CD-RW(CD-Rewritable):** As the name suggests, this type of CD is used to rewrite the content or erase previous content and again write new content many times.

2. DVD (Digital Video/Versatile Disc): A DVD is the same as a CD but with some more features. A DVD comes in single and dual-layer formats. It has much greater storage capacity in comparison to CD. The storage capacity of a DVD with a one-sided single layer is - 4.7 GB, one-sided double layer - 8.5 GB, double-sided single layer - 9.4 GB, and double-sided double layer - 17 GB. There are also some types of DVDs, which are :

- **DVD-ROM:** In this type, the contents of the DVD cannot be written on or erased by the user. DVD ROM is used for applications and databases for distributing them in large amounts.
- **DVD-R / DVD+R:** DVD-R (DVD minus R) and DVD+R (DVD plus R) are two different kinds of discs and they are once recordable format. Also, they have no difference virtually.
- **DVD-RW / DVD+RW:** This is a kind of rewritable disc and it allows up to 1,000 rewrites.
- **DVD-RAM:** DVD RAM is accessed like a hard disk. It provides high data security and storage capacity. This is a kind of rewritable disc and it allows up to 1,00,000 rewrites.

3. Hard Disk AtheAn hard disk is a non-volatile storage device that uses its read/write heads to store digital data on the magnetic surface of a rigid plate. It is generally 3.5 inches in size for desktops and 2.5 inches in size for laptops. A hard disk can be classified further into 3 types, which are:

- **Internal Hard Disk:** It has a common storage capacity stated as GB or TB. A system case or cabinet is the place where it is located. It can perform faster operations and its storage is fixed. It is mainly used to store large data files and programs.
- **Internal Cartridges:** The Internal hard disk can't be removed from the system cabinet easily. To resolve this problem Internal Cartridges are introduced. So, Internal cartridges make it easy to remove CDs. It has a storage capacity of 2 GB to 160 GB. It is used as an alternative to an internal hard disk.
- **Hard Disk Packs** are used by organizations such as banks and government sector organizations to store large amounts of data. They have a storage capacity of PB (peta bytes).

Hardware Components

Some important hardware devices known as the internal components are discussed below:

1. CPU (Central Processing Unit)

The CPU is also known as the heart of the computer. It consists of three units, generally known as the control unit, the Arithmetic Logical Unit (ALU), and the memory unit.

The input goes to memory and the control unit gets instructions from memory. The control unit now decides what to do with the input or instructions and transfers it to ALU. Now, ALU performs various operations like addition, subtraction, multiplication, division, logical operations, etc. After that, the final result gets stored in memory and finally passed to output devices to give the output. So, this is how the CPU works.

2. Motherboard

It is the main circuit board inside a computer and it contains most of the electronic components together. All the components of the computer are directly or indirectly connected to the motherboard. It includes RAM slots, controllers, system chipsets, etc.

3. RAM (Random Access Memory)

It is also known as temporary or volatile memory. It holds the program and data, which are currently in process or processing. All the data is erased as soon as the computer is turned off or in case of a power failure. Data stored in this memory can be changed. There are two types of RAM:-

1. **SRAM (Static RAM):** SRAM consists of a flip-flop using a transistor or Mosfet (MOS). It is fast and has less access time. In this refreshing circuits are not required. But it is costly and requires more space. E.g. cache memory.
2. **DRAM (Dynamic RAM):** DRAM consists of capacitors and the data is stored in the form of capacitors. Capacitors charge when data is 1 and don't charge if data is 0. It requires refreshing circuits, as leakage of current in the capacitor can occur, so they need to be refreshed to the data. It is slower and has a higher access time. It is cheaper in comparison with SRAM. E.g. Main memory.

4. Video Graphics Array Port

A video input commonly used on computer monitors is called a video graphics array (VGA) port. Verifying that there isn't a loose connection, a damaged cable, or a broken

display is one step in troubleshooting a VGA port. Compressed air can also be sprayed inside the VGA port by a computer expert to make sure it's dust-free.

5. Power Supply

All of a computer system's parts are powered by a power source. Typically, a power cord is used to connect a computer tower to an electrical outlet. By turning off the computer, unplugging and separating the power supply cord, or trying a different cord or socket, a technician can diagnose the power supply.

6. Cooling Fan

A computer's system to prevent overheating uses cooling fans. To aid customers who use their computers intensively, such as when streaming video or playing games, many computers contain more than one cooling fan. If a user detects their computer overheating, a computer expert might need to repair the cooling fan. The blades may be examined for any damage and cleared of any foreign objects. A technician's standard method of troubleshooting may involve replacing computer fans.

7. Hard Drive

On a computer system, files, programs, and other types of information are stored on hard drives, which are data storage devices. They utilise hard drives, which are magnetically coated discs used to store digital versions of information. A computer technician can suspect a corrupt hard disk when a hard drive dies.

Relationship Between Computer Hardware and Software

Category	Hardware	Software
Definition	Physical devices that perform tasks	Programs or applications that run on hardware
Examples	CPU, RAM, Hard Drive, Monitor, Keyboard	Operating Systems, Applications, Utilities
Purpose	Executes and stores data physically	Processes data and provides user interface

Category	Hardware	Software
Dependence	Independent of software, but relies on it to function	Requires hardware to operate
Interaction	Direct interaction with the user or system	Indirect interaction, using hardware as a platform
Examples of Interaction	Input/Output devices like keyboard, mouse	Word processors, video editors, web browsers
Upgradability	Can be upgraded by adding/removing components	Can be updated via patches or newer versions
Cost	Generally higher initial cost	Often lower initial cost
Installation	Requires physical setup or installation	Installed via software package or online

Computer assembly and system installation

Assembling a computer and installing the operating system involves several steps to ensure the hardware components work together seamlessly. Here's a general guide on how to assemble a computer and install an operating system:

1. Gather Components: Collect all the necessary components for your computer, including the CPU, motherboard, RAM, storage devices (e.g., SSD or HDD), power supply unit (PSU), graphics card (if applicable), cooling solutions, case, keyboard, mouse, monitor, and any additional peripherals.

2. Preparing the Workspace: Find a clean and well-lit workspace with enough room to work comfortably. Use an anti-static wrist strap to ground yourself and prevent static electricity from damaging sensitive components.

3. Assembling the Computer:

1. **Install CPU and RAM:** a. Open the CPU socket on the motherboard. b. Carefully place the CPU in the socket, aligning the notches. c. Close the socket lever to secure the CPU. d. Insert RAM modules into the appropriate slots, ensuring they click into place.
2. **Mount the Motherboard:** a. Place the motherboard into the computer case, aligning the mounting holes. b. Use standoffs to elevate the motherboard and prevent it from touching the case, which could cause short circuits.
3. **Connect Power Supply:** a. Connect the main 24-pin power connector from the PSU to the motherboard. b. Connect the CPU power connector (usually 4 or 8 pins) to the motherboard.
4. **Install Storage and Graphics Card (if applicable):** a. Mount SSDs/HDDs in the appropriate drive bays. b. Insert the graphics card into the appropriate PCIe slot.
5. **Connect Cables:** a. Connect SATA cables from the motherboard to storage devices. b. Connect the graphics card power cables if required. c. Connect front-panel headers (power, reset, USB, audio) to the motherboard.
6. **Install Cooling Solutions:** a. Attach the CPU cooler according to the manufacturer's instructions. b. Connect the fan's power cable to the CPU fan header on the motherboard.
7. **Close the Case:** Securely close the computer case, ensuring all cables are neatly routed and not obstructing airflow.

4. System Installation:

1. **Insert Operating System Media:** Insert a bootable USB flash drive or DVD containing the operating system installation files.
2. **Boot from Installation Media:** Restart the computer and enter the BIOS/UEFI settings by pressing the appropriate key (usually Delete, F2, or F12) during startup. Set the boot priority to the installation media.
3. **Install Operating System:** Follow the on-screen instructions to install the operating system (e.g., Windows, Linux, macOS). Choose the installation location (e.g., SSD/HDD) and create partitions if needed.
4. **Follow Setup Prompts:** Set your preferred language, time zone, and user account information. Create or log in with your Microsoft, Apple, or Linux account.

5. **Install Drivers and Updates:** After the OS is installed, install necessary drivers for your hardware components (graphics card, motherboard, etc.). Download and install updates to ensure system stability and security.
6. **Install Applications:** Install essential software such as web browsers, productivity tools, and any additional applications you need.

5. Final Testing:

1. **Check Hardware Functionality:** Test each hardware component to ensure they are functioning correctly. Check display, audio, network connectivity, and any other peripherals.
2. **Benchmark and Stress Test (Optional):** Run benchmarking and stress testing software to assess the system's performance and stability under heavy load.
3. **Backup System:** Create a backup of your operating system and important data to prevent data loss in case of any future issues.

By following these steps, you can assemble a computer and install an operating system effectively. Keep in mind that specific steps and details may vary based on the components you're using and the operating system you're installing. Always refer to the user manuals and guides provided by the manufacturers for accurate instructions.

What is required Computer assembly and system installation

To assemble a computer and install an operating system, you'll need a variety of components and tools. Here's a list of the essential items required for computer assembly and system installation:

Computer Assembly:

1. **Computer Components:**

- CPU (Central Processing Unit)
- Motherboard
- RAM (Random Access Memory)
- Storage devices (SSD, HDD, or both)
- Graphics card (if not integrated)
- Power supply unit (PSU)
- Computer case
- Cooling solution (CPU cooler, case fans)

- Peripherals (keyboard, mouse, monitor, etc.)

2. **Tools:**

- Screwdriver (usually Phillips-head)
- Anti-static wrist strap
- Cable ties or Velcro straps for cable management

System Installation:

1. **Operating System Installation Media:**

- Bootable USB flash drive or DVD containing the operating system installation files (Windows, Linux, macOS, etc.)

2. **Tools:**

- Computer with assembled components
- Monitor, keyboard, and mouse
- Internet connection (for downloading drivers and updates)
- BIOS/UEFI access key (for accessing BIOS/UEFI settings)
- Drivers for hardware components (graphics card, motherboard, etc.)

Additional Considerations:

1. **User Manuals and Documentation:**

- User manuals provided by component manufacturers for guidance during installation.

2. **Driver and Software Downloads:**

- Access to the internet to download the latest drivers and software for your components.

3. **Operating System License:**

- A valid license key for the operating system you're installing (if applicable).

4. **Backup:**

- If you're installing an operating system on a system with existing data, make sure you have a backup of important files to prevent data loss.

Who is required Computer assembly and system installation

The process of computer assembly and system installation involves a combination of individuals with different roles and expertise. Depending on the complexity of the task and the context, various people might be involved. Here are some of the individuals who might be required for computer assembly and system installation:

1. **End User or Consumer:** The individual who ultimately intends to use the assembled computer. They might choose the components, oversee the process, and interact with the system once it's up and running.
2. **IT Professionals or Technicians:** IT professionals or technicians are experienced in computer hardware, software, and troubleshooting. They might assist in building and configuring the system, ensuring compatibility, and troubleshooting any issues that arise during or after installation.
3. **Computer Enthusiasts or Hobbyists:** These are individuals who have a passion for building and customizing computers. They might undertake computer assembly and system installation as a hobby or as a service to help others set up their systems.
4. **System Integrators:** System integrators are professionals or companies that specialize in assembling and configuring computer systems for specific purposes or industries. They might work with businesses, organizations, or individuals who need tailor-made systems for specific tasks.
5. **Technical Support Staff:** For larger organizations, technical support staff might be involved in the setup and installation process. They ensure that the computer systems are properly configured and ready for use, often in a corporate or institutional setting.
6. **Manufacturers' Support Teams:** Manufacturers of components (CPU, motherboard, graphics card, etc.) often provide customer support and documentation for assembling and installing their products. Consumers can reach out to these support teams for guidance and troubleshooting.
7. **Operating System Distributors:** Distributors of operating systems (Microsoft, Linux distributions, etc.) provide installation guides and support for setting up their software on newly assembled systems.
8. **Online Communities and Forums:** Many online communities and forums are dedicated to computer building and troubleshooting. People can seek advice, share experiences, and ask questions when assembling and installing their systems.
9. **Retail Store Personnel:** If purchasing components from a physical retail store, the store's personnel might provide advice and guidance on selecting components and may even offer assembly services for a fee.

When is required Computer assembly and system installation

Computer assembly and system installation are required in various situations, typically when you need to set up a new computer system or upgrade an existing one. Here are some common scenarios when computer assembly and system installation are necessary:

1. **Building a New Computer:** When you decide to create a new computer from scratch, whether for personal use, gaming, professional work, or other purposes, you'll need to assemble the hardware components and install an operating system.
2. **Upgrading Hardware:** If you want to upgrade specific hardware components in an existing computer, such as adding more RAM, replacing the graphics card, upgrading the storage, or even changing the CPU, you'll need to perform assembly and installation tasks.
3. **Customizing a System:** When you need a computer tailored to your specific requirements, assembling components allows you to choose the best-performing parts for your needs. This might be important for creative professionals, gamers, researchers, and more.
4. **Repairing or Troubleshooting:** If your computer is experiencing hardware issues, you might need to disassemble and reassemble parts to diagnose and repair the problem. This could involve checking connections, replacing faulty components, or troubleshooting issues.
5. **Setting Up Business Systems:** Businesses often require custom-built systems for their specific needs. This could involve assembling computers for office work, servers for data management, or workstations for specialized tasks like graphic design or engineering.
6. **Server Deployment:** When setting up a server for web hosting, data storage, or other purposes, assembling and installing the hardware is a critical step in ensuring reliable performance and uptime.
7. **Educational Purposes:** Learning about computer hardware and how systems are put together is a common reason for performing computer assembly and installation. Educational institutions often teach students these skills as part of computer science or IT courses.

8. **Home Labs and Testing:** Computer enthusiasts and IT professionals might assemble and install systems in their home labs for testing purposes. This allows them to experiment with different configurations, software setups, and technologies.
9. **Data Recovery or Transfer:** When transferring data from one system to another, or recovering data from a faulty system, you might need to assemble and install components to access and transfer the data.
10. **Specialized Projects:** Certain projects or research might require custom-built systems with specific hardware configurations. Researchers, developers, and scientists might assemble systems for tasks like machine learning, simulations, and scientific computing.

It's important to note that while some individuals prefer to assemble and install systems themselves, others might choose to purchase pre-built systems or seek professional assistance, especially if they lack experience or time. The need for computer assembly and system installation arises whenever you require a functional and optimized computer setup tailored to your specific needs.

Where is required Computer assembly and system installation

Computer assembly and system installation are typically required in various settings where individuals or organizations need to set up or upgrade computer systems. Here are some common places where computer assembly and system installation might be necessary:

1. **Homes:** Many individuals assemble and install computers at home for personal use, entertainment, gaming, or work. Building a computer from scratch or upgrading existing systems can be a DIY project for tech-savvy individuals.
2. **Businesses and Offices:** Offices and businesses often require computers and workstations for employees. IT teams or professionals may handle the assembly and installation of these systems to ensure consistent performance and compatibility with business software.
3. **Educational Institutions:** Schools, colleges, and universities may have computer labs with custom-built systems for students to use. IT departments or instructors might handle the assembly and maintenance of these systems.

4. **Data Centers:** Data centers host servers and other networking equipment. Professionals in data centers assemble and install servers, storage arrays, and networking hardware to create a robust computing infrastructure.
5. **Research Facilities:** Research institutions might require specialized computer systems for scientific simulations, data analysis, and other research purposes. Experts in the field may assemble and install these systems.
6. **Gaming Cafes and Esport s Centers:** Gaming cafes and esport s centers often have high-performance gaming PCs. Staff or enthusiasts might handle the assembly and installation of these systems to ensure optimal gaming experiences.
7. **Small Businesses:** Small businesses might need customized systems for specific tasks. Computer assembly and installation could be done by business owners themselves, IT consultants, or external vendors.
8. **Technology Workshops and Classes:** Institutions offering technology workshops, classes, or training programs may teach participants how to assemble and install computers as part of their curriculum.
9. **IT Service Providers:** Professional IT service providers or technicians offer computer assembly and installation services to individuals and businesses as part of their offerings.
10. **Remote Locations:** In remote or off-grid locations, individuals might need to assemble and install computer systems for various purposes such as research, monitoring, or communication.

How is required Computer assembly and system installation

Performing computer assembly and system installation requires a methodical approach to ensure that all components are properly connected, configured, and functional. Here's a step-by-step guide on how to perform computer assembly and system installation:

1. Prepare Your Workspace:

- Choose a clean, well-lit, and static-free workspace.
- Wear an anti-static wrist strap to prevent static electricity damage to components.

2. Gather Tools and Components:

- Ensure you have all the necessary components and tools, including a screwdriver (usually Phillips-head), thermal paste (if needed), cables, and user manuals.

3. Computer Assembly:

A. Mount CPU and RAM:

- Open the CPU socket on the motherboard.
- Carefully insert the CPU, ensuring correct orientation.
- Secure the CPU with the socket lever.
- Insert RAM modules into the appropriate slots until they click into place.

B. Install Cooling Solution:

- Attach the CPU cooler according to the manufacturer's instructions.
- Apply a small amount of thermal paste to the CPU (if not pre-applied).

C. Mount Motherboard:

- Place the motherboard in the case, aligning it with the I/O shield.
- Secure the motherboard using standoffs and screws.

D. Install PSU:

- Install the power supply unit in the designated PSU compartment.
- Connect the main 24-pin and CPU power connectors to the motherboard.

E. Install Storage and Graphics Card:

- Mount storage drives (SSD, HDD) in appropriate drive bays.
- Insert the graphics card into the PCI e slot and secure it with screws.

F. Connect Cables:

- Connect SATA cables from storage drives to the motherboard.
- Connect power cables to storage drives and graphics card.
- Connect front-panel connectors (power, reset, USB, audio) to the motherboard.

G. Organize Cables:

- Route cables neatly and use cable ties or Velcro straps for cable management.
- Ensure cables do not obstruct airflow or components.

H. Close the Case:

- Close the computer case and secure it with screws.

4. System Installation:

A. Prepare Installation Media:

- Create a bootable USB flash drive or insert a bootable installation DVD with the operating system.

B. Boot from Installation Media:

- Restart the computer and access BIOS/UEFI settings by pressing the designated key (e.g., Delete, F2, F12).
- Set the boot priority to the installation media.

C. Install Operating System:

- Follow on-screen instructions to install the operating system.
- Choose the installation location and partition settings.

D. Install Drivers and Updates:

- After OS installation, install necessary drivers for hardware components.
- Download and install system updates for stability and security.

E. Install Applications:

- Install software and applications as needed.

5. Final Testing:

A. Hardware Functionality:

- Boot the system and check if all hardware components are functioning properly (display, audio, network).

B. Performance Testing:

- Run benchmarking or stress testing software to ensure stability and performance.

C. Data Backup:

- If migrating from an old system, back up and transfer important data.

Following these steps ensures a systematic and organized approach to computer assembly and system installation. Always refer to the user manuals and guidelines provided by component manufacturers for accurate instructions.

Case study on Computer assembly and system installation

Certainly, let's delve into a case study that illustrates the process of computer assembly and system installation:

Case Study: Setting Up a Home Media Center

Background: Sarah is a tech-savvy individual who loves entertainment and wants to create a home media center. She plans to build a custom computer system that can

handle streaming, gaming, and media playback. She has experience with computer assembly and system installation but wants to ensure a smooth setup.

Requirements:

1. Smooth media playback for movies and TV shows.
2. Capable of streaming high-quality content.
3. Gaming capability for casual gaming.
4. Compatibility with her home theater system.
5. Neat cable management for an organized setup.

Process:

1. Planning and Component Selection:

- Sarah researches components that fit her requirements, including a high-performance CPU, sufficient RAM, a capable graphics card, an SSD for fast storage, and a compatible motherboard.

2. Component Assembly:

- She sets up her workspace with an anti-static mat and gathers her tools.
- She mounts the CPU, applies thermal paste, and installs the CPU cooler.
- Sarah inserts RAM modules and secures them in place.
- She places the motherboard in the case and secures it with standoffs and screws.
- Sarah connects the PSU, ensuring all power connectors are properly attached.
- She installs an SSD and secures it in a drive bay.
- Sarah mounts her graphics card and connects its power cables.
- She carefully routes and manages cables, using cable ties for neat organization.
- Sarah closes the case and secures it with screws.

3. System Installation:

- She prepares a bootable USB drive with the operating system installation files.
- Sarah boots from the USB drive and follows on-screen instructions to install the OS.
- She selects the SSD as the installation location and sets up the necessary partitions.

4. Driver and Software Installation:

- After OS installation, Sarah installs drivers for the graphics card, motherboard, and other components.
- She downloads updates to ensure system stability and security.

- Sarah installs media playback software, a gaming platform, and streaming apps.

5. Testing and Optimization:

- She tests media playback, streaming, and gaming performance to ensure smooth operation.
- Sarah adjusts graphics settings to optimize performance and quality.
- She tests compatibility with her home theater system, connecting to her TV and audio system.

6. Cable Management and Aesthetics:

- Sarah double-checks cable connections and ensures all components are securely in place.
- She takes time to organize and route cables, keeping the setup clean and tidy.

Outcome: Sarah successfully assembles and installs her custom-built home media center. The system performs seamlessly for media playback, streaming, and casual gaming. With neatly managed cables and optimized settings, her setup blends well with her home theater system. Sarah can now enjoy a personalized entertainment experience at home.

Lessons Learned: Through this case study, Sarah gained a deeper understanding of computer assembly and system installation. She realized the importance of careful planning, proper cable management, and thorough testing to ensure the system meets her requirements and functions flawlessly within her desired environment.

Types of computer hardware systems

The personal computer is one of the most common types of computer due to its versatility and relatively low price.

- **Desktop** personal computers have a monitor, a keyboard, a mouse, and a computer case. The computer case holds the motherboard, fixed or removable disk drives for data storage, the power supply, and may contain other peripheral devices such as modems or network interfaces. Some models of desktop computers integrated the monitor and keyboard into the same case as the processor and power supply. Separating the elements allows the user to arrange the components in a pleasing, comfortable array, at the cost of managing power and data cables between them.

- **Laptops** are designed for portability but operate similarly to desktop PCs. They may use lower-power or reduced size components, with lower performance than a similarly priced desktop computer. Laptops contain the keyboard, display, and processor in one case. The monitor in the folding upper cover of the case can be closed for transportation, to protect the screen and keyboard. Instead of a mouse, laptops may have a touchpad or pointing stick.
- **Tablets** are portable computers that use a touch screen as the primary input device. Tablets generally weigh less and are smaller than laptops. Some tablets include fold-out keyboards or offer connections to separate external keyboards. Some models of laptop computers have a detachable keyboard, which allows the system to be configured as a touch-screen tablet. They are sometimes called 2-in-1 detachable laptops or tablet-laptop hybrids.
- **Mobile phones** are designed to have an extended battery life and light weight, while having less functionality than larger computers. They have diverse hardware architecture, often including antennas, microphones, cameras, GPS devices, and speakers. Power and data connections vary between phones.

  System Software and Application Software

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In the era of Digitalization and Modernization, Software is the very crucial support that allows hardware to perform various useful tasks. There are two categories of software; System Software and Application Software, these types perform different work which is why it is crucial to understand the difference.

Application software is created to help users to perform specific tasks directly and System software acts as a mediator between hardware and user applications. Computer Software is a sort of program that allows clients to work on different assignments or use them to work on their System. It tells the working and responsibilities of the System.

Basically, Software is a set of instructions or commands that tells a user how to do and what to do. In this article, we will look into these topics in detail along with their differences.

Types of Software

- System Software
- Application Software

What is System Software?

System Software is the type of software that is the interface between application software and the system. Low-level languages are used to write the system software. System Software maintains the system resources and gives the path for application software to run. An important thing is that without system software, the system cannot run. It is general-purpose software.

Functions of System Software

- Memory Management
- Processor Management
- File Management
- Security
- Error-detecting Aids
- Scheduling

Features of System Software

- System software is written in a low-level language.
- The size of the system Software is smaller.
- System software is complex to understand.
- System software is present near hardware components.

Types of System Software

1. Operating System: Operating System is the main part of the Computer System. It has the responsibility of managing all the resources such as CPU, Printer, Hard Disk, etc. It also provides services to many other Computers Softwares. Examples of Operating Systems are Linux, Apple, macOS, Microsoft Windows, etc.

2. Language Processor: System Software converts Human-Readable Language into a Machine Language and it is done by Language Processor. It converts programs into instructions that are easily readable by Machines.

3. Device Driver: A Device Driver is a program or software that helps to perform its functions by controlling the device. You first have to install a driver for running the program.

What is Application Software?

Application Software is the type of software that runs as per user request. It runs on the platform which is provided by system software. High-level languages are used to write the application software. It's a specific purpose software. The main difference between System Software and Application Software is that without system software, the system can not run on the other hand without application software, the Low-level maintenance system always runs.

Functions of Application Software

- Information and data management
- Management of documents (document exchange systems)
- Development of visuals and video
- Emails, text messaging, audio, and video conferencing, and cooperation are all options.
- Management of accounting, finance, and payroll
- Management of resources (ERP and CRM systems)

Features of Application Software

- Application software is written in a high-level language.
- Application software requires more storage space than system software.
- Only a single task is performed by each application software.
- Application Software is easy to build in comparison to system software.

Types of Application Software

1. General Purpose Software: This Application Software is used to perform tasks that are used for a variety of tasks, just not limited to a specific task only. For Example, MS Word, MS Excel, etc.

2. Customized Software: It is used to perform tasks that are designed for specific organizations. For Example, Railway Reservation System, Airline Reservation System, etc.

3. Utility Software: It is used to support the architecture of the Computer. It is designed for optimizing and maintaining the system and also taking care of its requirements.

Difference Between System Software and Application Software

System Software	Application Software
System Software maintains the system resources and gives the path for application software to run.	Application software is built for specific tasks.
Low-level languages are used to write the system software.	While high-level languages are used to write the application software.
It is general-purpose software.	While it's a specific purpose software.
Without system software, the system stops and can't run.	While Without application software system always runs.

System Software	Application Software
System software runs when the system is turned on and stops when the system is turned off.	While application software runs as per the user's request.
Example: System software is an operating system, etc.	Example: Application software is Photoshop, VLC player, etc.
System Software programming is more complex than application software.	Application software programming is simpler in comparison to system software.
The Software that is designed to control, integrate and manage the individual hardware components and application software is known as system software.	A set of computer programs installed in the user's system and designed to perform a specific task is known as application software.
A system software operates the system in the background until the shutdown of the computer.	Application software runs in the front end according to the user's request.
The system software has no interaction with users. It serves as an interface between hardware and the end user.	Application software connects an intermediary between the user and the computer.
System software runs independently.	Application software is dependent on system software because they need a set platform for its functioning.

Online UPS and Offline UPS

A UPS (Uninterruptible Power Supply) is a crucial component of any power backup system. It ensures that critical equipment and systems remain operational in the event of a power outage or other power-related issues. Two main types of UPS systems are available in the market – On-Line UPS and Off-Line UPS. Understanding the difference between these two types of UPS systems is essential for choosing the right one for your needs.

When it comes to Uninterruptible Power Supply (UPS), there are two main types: Online UPS and Offline UPS. Although both types supply power to devices during power outages, they have distinct differences. The primary difference between Online UPS and Offline UPS is the way they provide power. Online UPS utilizes a rectifier and inverter combination to simultaneously power the load and charge the battery, ensuring that the battery is ready to supply power when needed. On the other hand, Offline UPS supplies AC power directly to the load by switching ON the transfer switch, and only uses the battery backup in the event of a power failure. Another crucial difference is that Online UPS requires a large heat sink.

The rectifier in the Online UPS supplies power directly to the inverter as well as the battery. As a result, heat dissipation will be significant. As a result, an Online UPS requires a larger heat sink than an Offline UPS.

Online UPS

The Online UPS, consisting of a rectifier, battery, and inverter, is directly connected to both the AC mains and the load. The rectifier circuit converts the AC power into DC power, which is used to charge the battery and supply the inverter circuit that powers the load. The transfer switch is always in the ON position, allowing power to be continuously delivered to the load from the rectifier and inverter circuits, without any interruptions in case of a power outage.

Benefits of Online UPS

- One of the significant advantages of using Online UPS is that there is no need to switch between the two power paths during a power outage, thus ensuring that power is continuously delivered to the load.

- Another benefit is that Online UPS provides proper isolation between the load and input circuits, resulting in distortion-less signals.
- Since the inverter is always in the ON position, power is continuously available to the load, resulting in zero transfer time.

Drawbacks of Online UPS

- Designing an Online UPS is complex, as it requires a large heat sink.
- The instantaneous supply of power to the battery backup and inverter circuit in Online UPS leads to increased power dissipation.
- The cost of designing Online UPS is higher than that of Offline UPS.

Offline UPS

The Offline UPS functions by directly providing the AC power to the device connected to the load. During normal operation, the AC power is supplied directly to the load, while the battery is charged with the help of the rectifier circuit.

However, in the event of a power outage, the Offline UPS switches the position of the transfer switch to connect the load to the battery backup path. The charged battery then supplies DC power to the inverter, which converts it into AC and supplies it to the load terminal.

Benefits of Offline UPS

- One significant advantage of the Offline UPS is its low design cost in comparison to the Online UPS.
- The internal control of the Offline UPS is simple, as there are only two paths, which work at different times according to the position of the transfer switch.
- The efficiency of the Offline UPS is high because the battery backup and inverter are not always ON, as they are in the case of the Online UPS.

Drawbacks of Offline UPS

- The electric signal obtained from the Offline UPS has poor quality because the inverter is not always ON.

- In case of power outage, the transfer time is approximately 5ms, during which there will be no output power. There will be a slight disruption in the output power due to transfer time.
- Since the Offline UPS directly supplies AC power when it is available, any spikes or surges present in the input voltage will also be transmitted to the output circuit.

Comparison of On-Line and Off-Line UPS

1. Performance Comparison

- Efficiency: On-Line UPS is generally more efficient than Off-Line UPS due to the continuous regulation of the power supply.

Power protection: On-Line UPS provides a higher level of power protection than Off-Line UPS, making it suitable for critical equipment.

- Voltage regulation: On-Line UPS can regulate the output voltage, ensuring that the connected equipment receives stable power, while Off-Line UPS cannot regulate voltage.

- Switching time: On-Line UPS has a seamless transition between power sources, while Off-Line UPS has a delay in switching to battery power.

2. Cost Comparison

- Initial cost: On-Line UPS is generally more expensive than Off-Line UPS due to the higher level of power protection provided.

- Operating cost: On-Line UPS consumes more energy than Off-Line UPS, resulting in higher operating costs.

3. Application Comparison

- Suitable applications for On-Line UPS: On-Line UPS is suitable for critical equipment such as servers, medical equipment, and industrial machinery.

- Suitable applications for Off-Line UPS: Off-Line UPS is suitable for basic power backup needs such as desktop computers and small appliances.

Key Difference Between Online UPS and Offline UPS

The main differences between Online UPS and Offline UPS are in their operation. Online UPS supplies AC power through a rectifier and inverter circuit even when AC mains power is available, whereas Offline UPS directly supplies AC mains power to the load circuit when the power supply is available. Transfer time is a crucial factor that distinguishes the two types of UPS. Online UPS has zero transfer time as there is no switching between the inverter and mains supply path, while Offline UPS has a transfer time of approximately 5ms.

Another significant difference is that the inverter in Online UPS is always ON, while the inverter in Offline UPS is only active during power outages. Online UPS is generally more expensive than Offline UPS. However, the efficiency of Offline UPS is generally higher compared to Online UPS because the inverter and rectifier circuit are not constantly active in Offline UPS.

SMPS

An SMPS, or Switched Mode Power Supply, is an efficient power converter that uses a switching regulator to regulate voltage and current by rapidly switching power semiconductors on and off, enabling high efficiency, compact size, and lighter weight compared to linear power supplies. SMPS connectors, such as the 24-pin ATX connector for the motherboard, 4-pin Molex connector, and SATA

connectors, physically link the SMPS to the components it powers, providing specific voltages and currents for different devices like hard drives and optical drives.

Introduction to SMPS (Switched Mode Power Supply)

- **Purpose:**
  SMPS converts electrical power from a source to a load by changing its voltage and current characteristics, providing a well-regulated and stable output voltage despite input variations.
- **High Efficiency:**
  By switching transistors on and off at high frequencies (e.g., 50 Hz to 1 MHz) and using components like inductors, capacitors, and transformers, SMPS minimizes energy waste and heat dissipation, achieving much higher efficiencies than linear power supplies.
- **Pulse Width Modulation (PWM):**
  Efficiency and regulation are further enhanced by controlling the on-to-off time of the switching transistor using PWM, which varies the duty cycle.
- **Advantages:**
  Key benefits include high efficiency, compact and lightweight design, and the ability to operate over a wide range of input voltages.
- **Applications:**
  SMPS are widely used in computers, telecommunications equipment, industrial machinery, and consumer electronics.
  Study of SMPS Connectors
- **Function:**
  SMPS connectors are crucial for delivering the necessary voltages and currents from the power supply unit to various computer components.

- **Types:**
- **20/24-pin ATX Connector:** The main power connector for the motherboard.
- **4-pin P4 Connector:** Provides additional power to the CPU.
- **Molex 4-pin Connector:** Primarily used for older hard disk drives and optical drives.
- **SATA Connectors:** Used to connect SATA hard drives and optical drives.
- **6-pin Connector:** A connector for supplying power to graphics cards.
- **4-pin BERG Connector:** Used for floppy drives.

Color Coding:

Connectors often use color-coded wires to indicate different voltage levels, such as yellow for +12V and red for +5V in Molex connectors, with black wires serving as ground connections.

PRINTERS

PrintersareOutputdevicesusedtopreparepermanentOutputdevicesonpaper.Printers canbe divided into two main categories : Impact Printers : In this hammers or pins strike against a ribbon and paper to print the text. This mechanism is known as electro-mechanical mechanism.

There are two types of printers.

Impact printers

An impact printer makes contact with the paper. It usually forms the print image by pressing an inked ribbon against the paper using a hammer or pins. Following are some examples of impact printers.

Dot-Matrix Printers

The dot-matrix printer uses print heads containing from 9 to 24 pins. These pins produce patterns of dots on the paper to form the individual characters. The 24 pin dot-matrix printer producesmore dots that a 9 pin dot-matrix printer, which results in much better quality and clearer characters. The general rule is: the more pins, the clearer the letters on the paper. The pins strike

theribbonindividuallyastheprintmechanismmovesacrosstheentireprintlineinbothdirections, i-e, from left to right, then right to left, and so on. The user can produce a color output with a dot- matrix printer (the user will change the black ribbon with a ribbon that has color stripes). Dot- matrix printers are inexpensive and typically print at speeds of 100-600 characters per second.

Daisy-wheel printers

In order to get the quality of type found on type writers, a daisy-wheel impact printer can be used. It is called daisy-wheel printer because the print mechanism looks like a daisy; at the end of each “Petal” is a fully formed character which produces solid-line print. A hammer strikes a “petal” containing a character against the ribbon, and the character prints on the paper. Its speed is slow typically 25-55 characters per second.

Line printers

In business where enormous amount of material are printed, the character-at-a-time printers are too slow; therefore, these users need line-at-a-time printers. Line printers, or line-at-a-time printers, use special mechanism that can print a whole line at once; they can typically print the range of 1,200 to 6,000 lines per minute. Drum, chain, and band printers are line-at-a-time printers.

Drum printer

A drum printer consists of a solid, cylindrical drum that has raised characters in bands on its surface. The number of print positions across the drum equals the number available on the page. This number typically ranges from 80-132 print positions. The drum rotates at a rapid speed. For each possible print position there is a print hammer located behind the paper. These hammers strike the paper, along the ink ribbon, against the proper character on the drum as it passes. One revolution of the drum is required to print each line. This means that all characters on the line are not printed at exactly the same time, but the time required to print

the entire line is fast enough to call them line printers. Typical speeds of drum printers are in the range of 300 to 2000 lines per minute.

Chain printers

A chain printer uses a chain of print characters wrapped around two pulleys. Like the drum printer, there is one hammer for each print position. Circuitry inside the printer detects when the correct character appears at the desired print location on the page. The hammer then strikes the page, pressing the paper against a ribbon and the character located at the desired print position. An impression of the character is left on the page. The chain keeps rotating until all the required print positions on the line have filled. Then the page moves up to print the next line. Speeds of chain printers range from 400 to 2500 characters per minute.

Band printers

A band printer operates similar to chain printer except it uses a band instead of a chain and has fewer hammers. Band printer has a steel band divided into five sections of 48 characters each. The hammers on a band printer are mounted on a cartridge that moves across the paper to the appropriate positions. Characters are rotated into place and struck by the hammers. Font styles can easily be changed by replacing a band or chain.

Non-impact printers

Non-impact printers do not use a striking device to produce characters on the paper; and because these printers do not hammer against the paper they are much quieter. Following are some non- impacted printers.

INK-JET PRINTERS

Ink-jet printers work in the same fashion as dot-matrix printers in the form images or characters with little dots. However, the dots are formed by tiny droplets of ink. Ink-jet printers form characters on paper by spraying ink from tiny nozzles through an electrical field that arranges the charged ink particles into characters at the rate of approximately 250 characters per second. The ink is absorbed into the paper

and dries instantly. Various colors of ink can also be used.

One or more nozzles in the print head emit a steady stream of ink drops. Droplets of ink are electrically charged after leaving the nozzle. The droplets are then guided to the paper by electrically charged deflecting plates [one plate has positive charge (upper plate) and the other has negative charge (lover plate)]. A nozzle for black ink may be all that's needed to print text, but full-color printing is also possible with the addition of needed to print text, but full-colorprintingis also possible with the addition three extra nozzles for the cyan, magenta, and yellow primary colors. If a droplet isn't needed for the character or image being formed, it is recycled back to its input nozzle.

Several manufacturers produce color ink-jet printer. Some of these printers come with all their color inks in a cartridge; if you want to replace on color, you must replace all the colors. Other color ink-jet printers allow you to replace ink individually. These printers are a better choice if user uses one color more than other colors. These printers produce less noise and print in better quality with greater speed.

Laser Printer

A laser printer works like a photocopy machine. Laser printers produce images on paper by directing a laser beam at a mirror which bounces the beam onto a drum. The drum has a special coating on it to which toner (an ink powder) sticks. Using patterns of small dots, a laser beam conveys information from the computer to a positively charged drum to become neutralized. From all those areas of drum which become neutralized, the toner detaches. As the paper rolls by the drum, the toner is transferred to the paper printing the letters or other graphics on the paper. A hot roller bonds the toner to the paper.

Laser printers use buffers that store an entire page at a time. When a whole page is loaded, it will be printed. The speed of laser printers is high and they print quietly without producing much noise. Many home-use laser printers can print eight pages per minute, but faster and print approximately 21,000 lines per minute, or 437 pages per minute if each page contains 48 lines. When high speed laser printers

were introduced they were expensive. Developments in the last few years have provided relatively low-cost laser printers for use in small businesses.

Advantages of Laser Printer

- ThemainadvantageofLaserprinterisitsspeed&efficiencyatwhichitprintshigh- quality quality graphics & text.
- Laserprintersproduce high-quality outputascomparedtootherprinters.
- Laserprintersarequiteand doesnotproducedisturbing sounds.
- Theyarealsocapabletoproducecolorprints.

DisadvantagesofLaserPrinter

- ThemaindisadvantageofLaserprinterisitscost, theyarerelativelycostlyascomparedto other printers.
- Themaintenance,repair& servicing chargesarealso highofthesepprinters.
- Laserprintersemitsmall amountofozoneandarehazardoustohealthandthe atmosphere.

PRINTER CONTROLLER

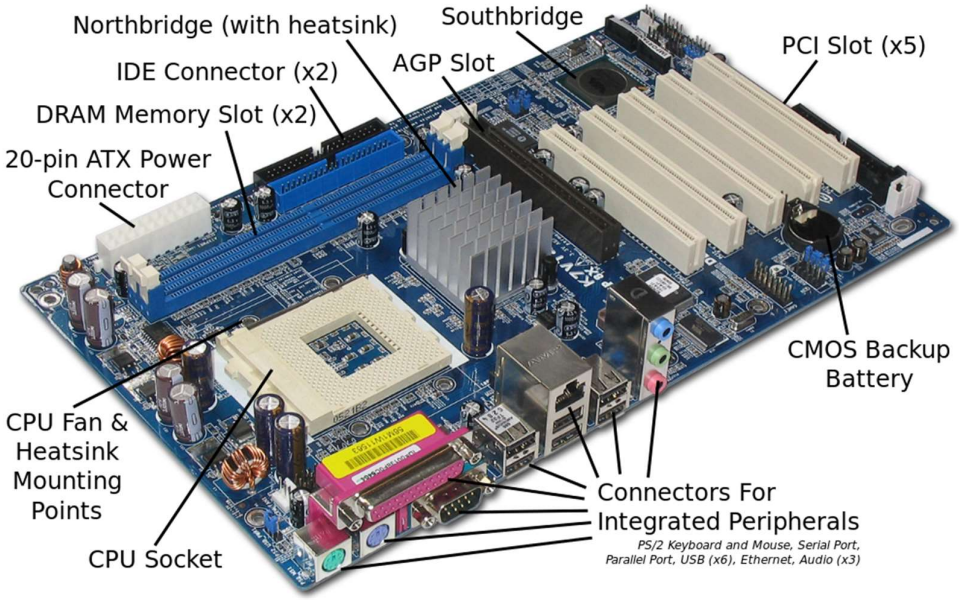
In a world where our devices are becoming more mobile and less dependent on a direct connection to a PC, why should you disc printer be any different. Previously, every printer that can print on optical discs, required a direct connection to a computer to transfer the image file of the artwork. This was typically done through a USB capable and limited ones effort to allow their dupe and print operation to be more mobile. Vinpowerhasseveredthoserestrictionswithitsnewmobilestandaloneprintercontroller VPD-PRT. The new VPD-PRT can work with up to two printers allowing the artwork and operation functions to be controlled through a compact lightweight device which is extremely portable and easy to use.

Even if you're not looking to use your printer outside of your business or home, why tie up your computer or need to purchase multiple computers just to operate your disc printer, when you can save money and time using Vin power'sVPD-PRT.Sowhenyou're ready to cut the ties from your printer and save money at the same time, the VPD-PRT is your best solution.

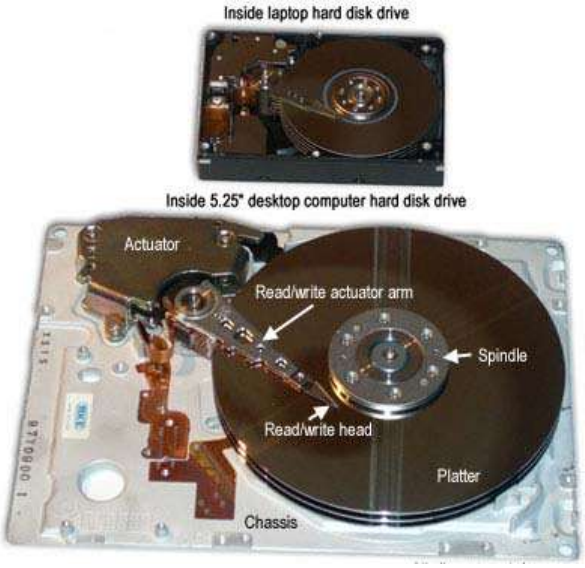
Ex.No 1:Study of peripherals of a computer and its functions.

Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor

AIM: To identify the peripherals of a computer.



Hard drive



Alternatively referred to as a **hard disk drive** and abbreviated as **HD** or **HDD**, the **hard drive** is the computer's main storage media device that permanently stores all data on the computer. The hard drive consists of one or more hard drive platters inside of an air sealed casing. Most computer hard drives are in an internal drive bay at the front of the computer and connect to the motherboard using either an ATA, SCSI, or SATA cable and power cable. Below is a picture of what the inside of a hard drive looks like for a desktop and laptop hard drive.

As can be seen in the picture, the desktop hard drive consists of the following components:

- the head actuator,

- read/write actuator arm,
- disk read/write head,
- spindle,
- platter.

On the back of a hard drive is a circuit board called the controller.

How is data read and stored on a hard drive?

Data sent to and from the hard drive is interpreted by the disk controller, which tells the hard drive what to do and how to move the components within the drive. When the operating system needs to read or write information, it examines the hard drive's File Allocation Table (FAT) to determine file location and available areas. Once this has been determined, the disk controller instructs the actuator to move the read/write arm and align the read/write head. Because files are often scattered throughout the platter, the head needs to move to different locations to access all information.

All information stored on a traditional hard drive, like the above example, is done magnetically. After completing the above steps, if the computer needs to read information from the hard drive, it would read the magnetic polarities on the platter. One side of the magnetic polarity is 0 and the other is 1. Reading this as binary data, the computer can understand what the data is on the platter. For the computer to write information to the platter, the read/write head aligns the magnetic polarities, writing 0's and 1's that can be read later.

External and Internal hard drives

Although most hard drives are internal hard drives, many users also use external hard drives to backup data on their computer and expand the total amount of space available to them. External drives are often stored in an enclosure that helps protect the drive and allow it to interface with the computer, usually over USB or eSATA.

ROM

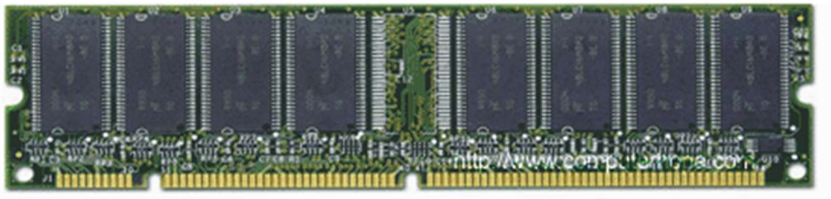
Computer BIOS

Short for **Read-Only Memory**, **ROM** is a storage medium that is used with computers and other electronic devices. As the name indicates, data stored in ROM may only be read. It is either modified with extreme difficulty or not at all. ROM is mostly used for firmware updates. A simple example of ROM is the cartridge used with video game consoles, which allows one system to run multiple games. Another

example of ROM is EEPROM, which is a programmable ROM used for the computer BIOS, as shown in the picture below. Unlike Random Access Memory (RAM), ROM is non-volatile, which means it keeps its contents regardless of whether or not it has power.

RAM

Alternatively referred to as main memory, primary memory, or system memory, Random Access Memory (RAM) is a computer storage location that allows information to be stored and accessed quickly from random locations within DRAM on a memory module. Because information is accessed randomly instead of sequentially like a CD or hard drive the computer can access the data much faster than it would if it was only reading the hard drive. However, unlike ROM and the hard drive RAM is a volatile memory and requires power in order to keep the data accessible, if power is lost all data contained in memory lost.



As the computer loads parts of the operating system and drivers are loaded into memory, which allows the CPU to process the instructions much faster and your computer to load faster. After the operating system has loaded, each program you open such as the browser you're using to view this page is loaded into memory while it is running. If too many programs are open the computer will swap the data in the memory between the RAM and the hard disk drive.

Flash memory

Alternatively referred to as flash storage, flash memory is a non-volatile computer memory. This type of memory is an integrated circuit that does not need continuous power to retain the data, but is a bit more expensive than magnetic storage. Today, flash memory is becoming more popular, and solid-state drives are a practical replacement for large hard drives if you have the extra money.

Flash memory is widely used with car radios, cell phones, digital cameras, PDAs, solid-state drives, and printers. The picture is an example of a MicroSD flash memory card.

Memory slot

A **memory slot**, **memory socket**, or **RAM slot** is what allows computer memory (RAM) to be inserted into the computer. Depending on the motherboard, there may be 2 to 4 **memory slots** (sometimes more on high-end motherboards) and are what determine the type of RAM used with the computer. The most common types of RAM are SDRAM and DDR for desktop computers and SODIMM for laptop computers, each having various types and speeds. In the picture below, is an example of what memory slots may look like inside a desktop computer. In this picture, there are three open available slots for three memory sticks.

CPU

Alternatively referred to as the **brain of the computer**, **processor**, **central processor**, or **microprocessor**, the **CPU** (pronounced as C-P-U) is short for **Central Processing Unit**. The computer CPU is responsible for handling all instructions it receives from hardware and software running on the computer. In the picture below, is an example of what the top and bottom of an Intel Pentium processor looks like. The processor is placed and secured into a compatible CPU socket found on the motherboard, and because of the heat it produces it is covered with a heat sink to help keep it cool and running smoothly.

As can be seen by the picture, the CPU chip is usually in the shape of a square or rectangle and has one notched corner to help place the chip into the computer properly. On the bottom of the chip are hundreds of connector pins that plug into each of the corresponding holes on the socket. Today, most CPU's resemble the picture shown above; however, **Intel** and **AMD** have also experimented with slot processors that were much larger and slid into a slot on the motherboard. Also, over the years there have been dozens of different types of sockets on motherboards, each socket only supports so many different processors, and each has its own pin layout.

In the CPU, the primary components are the ALU (Arithmetic Logic Unit) that performs mathematical, logical, and decision operations and the CU (Control Unit) that directs all of the processors operations. Over the history of computer processors, the speed (clock speed) and capabilities of the processor have dramatically improved.

Heat sink

A **heat sink** is an electronic device that incorporates either a fan or a peltier device to keep a hot component such as a processor cool. There are two heat sink types: **active** and **passive**.

Passive heat sinks are 100% reliable, as they have no mechanical components. Passive heat sinks are made of an aluminum-finned radiator that dissipates heat through convection. For Passive heat sinks to work to their full capacity, it is recommended that there is a steady air flow moving across the fins.

PowerSupply

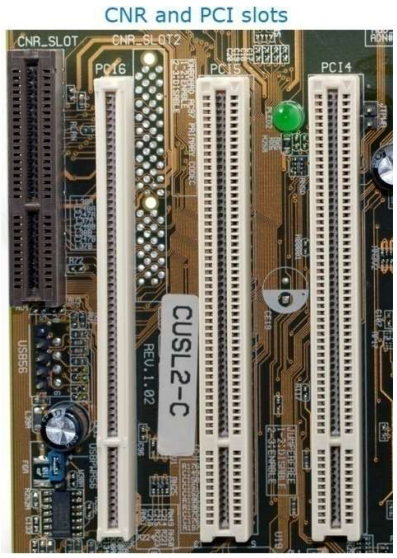
Short for **Power Supply** and sometimes abbreviated as **PSU**, which is short for **Power Supply Unit**. The **PS** is an internal hardware component used to supply the components in a computer with power by converting potentially lethal 110-115 or 220-230 volt alternating current (AC) into a steady low-voltage direct current (DC) usable by the computer.

Caution: Do not open the power supply, it contains capacitors that are capable of holding hold electricity even if the computer is off and unplugged for a week, if not longer.

On the back end of the power supply as shown in the above picture is where you connect the power cord to the computer. In addition to the power cord connection the back also has a fan opening to draw air out of the power supply, a small red switch to change the power supply voltage, and the rocker switch to turn the power supply on and off.

On the front-end, which is not visible unless the computer is opened is several dozen other cables that connect the power supply to each of the devices and the computer motherboard.

PCI



Short for **Peripheral Component Interconnect, PCI** is an expansion to the ISA bus. The PCI bus is a 32-bit (133MBps) computer bus that is also available as a 64-bit bus and was the most commonly found and used computer bus in computers. In the picture, there are three PCI slots, PCI4, PCI5, and PCI6.

Today's computers and motherboards have replaced PCI with PCI Express (PCIe) slots.

Examples of PCI devices

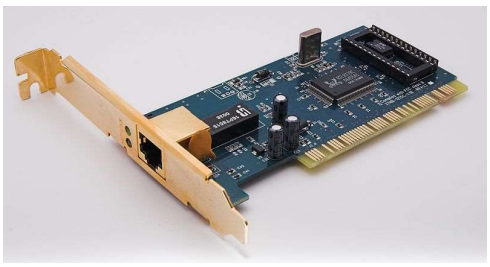
- Modem
- Network card
- Sound card
- Video card

AGP

Short for Accelerated Graphics Port, AGP is an advanced port designed for Video cards and 3D accelerators. Designed by Intel and introduced in August of 1997, AGP introduces a dedicated point-to-point channel that allows the graphics controller direct access the system memory. Below is an illustration of what the AGP slot may look like on your motherboard.

Each computer with AGP support will either have one AGP slot or on-board AGP video. If you needed more than one video card in the computer, you can have one AGP video card and one PCI video card or use a motherboard that supports SLI.

NOTE: Not all operating systems support AGP because of limited or no driver support. For example, Windows 95 did not incorporate AGP support. Today, AGP is being replaced by PCI Express.



NIC

Short for Network Interface Card, the NIC is also referred to as an Ethernet card and network adapter. It is an expansion card that enables

a computer to connect to a network; such as a home network, or the Internet using an Ethernet cable with an RJ-45 connector.

Due to the popularity and low cost of the Ethernet standard, most new computers have a network interface build directly into the motherboard. The top image shows 10/100 PCI network card, one of the more common examples.

The bottom picture shows a PC Card, more specifically the SMC EZ Card 10/100 wireless network card; found in laptop computers that do not have onboard wireless capabilities.

Wireless PCMCIA Network Card

A network card can communicate with each other over the same network using a network switch or if only two computers a direct connection. If computers on your network need to connect to a different network (e.g. the Internet) they must be eventually connected to a router that allows networks to communicate with each other.

SATA

Short for SerialATA, SATA 1.0 was first released in August 2001 and is a replacement for the Parallel ATA interface used in IBM compatible computers. SerialATA is capable of delivering 1.5Gbps (150MBps) of performance to each drive within a disk array, offers backwards compatibility for existing ATA and ATAPI devices, and offers a thin, small cable solution This cable helps make a much easier cable routing and offers better airflow in the computer when compared to the earlier ribbon cables used with ATA drives.

SATA Power Cable

SATA Data Cable

SATA MB Connection

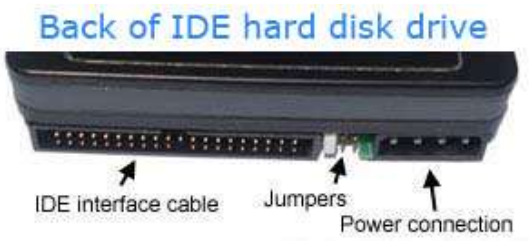
In addition to being an internal solution, SATA also supports external drives through **External SATA** more commonly known as**eSATA**. eSATA offers many more advantages when compared to other solutions. For example, it is hot-swappable, supports faster transfer speeds and no bottleneck issues when compared with other popular external solutions such as USB and Firewire, and supports disk drive technologies such as S.M.A.R.T..
Unfortunately, however, eSATA does have some disadvantages such as not distributing power
through the cable like USB, which means drives will require an external power source and it only supports a maximum cable lengths of up to 2m.

CMOS

CMOS Battery

Alternatively referred to as a Real-Time Clock (RTC), Non-Volatile RAM (NVRAM) or CMOS RAM, CMOS is short for Complementary Metal-Oxide Semiconductor. CMOS is an on-board semiconductor chip powered by a CMOS battery inside computers that stores information such as the system time and date and the system hardware settings for your computer. The picture shows an example of the most common CMOS coin cell battery used in a computer to power the CMOS memory.

IDE



Short for **Integrated Drive Electronics** or **IBM Disc Electronics**, **IDE** is more commonly known as **ATA** or **Parallel ATA** (**PATA**) and is a standard interface for IBM compatible hard drives. IDE is different from the Small Computer Systems Interface (SCSI) and Enhanced Small Device Interface (ESDI) because its controllers are on each drive, meaning the drive can connect directly to the motherboard or controller. IDE and its updated successor, Enhanced IDE (EIDE), are the most common drive interfaces found in IBM compatible computers today. Above, is a picture of the IDE connector on the back of a hard drive, a picture of what an IDE cable looks like, and the IDE channels it connects to on the motherboard.

Back of Sound Card

Sound card

Alternatively referred to as an audio output device, sound board, or audio card. A sound card is an expansion card or IC for producing sound on a computer that can be heard through speakers or headphones. Although the computer does not need a sound device to function, they are included on every machine in one form or another, either in an expansion slot or built into the motherboard (onboard).

Sound card connections

The picture is an example of a sound card audio ports or audio jacks on the back of your computer, associated colors, and the connector symbols.

- Digital Out (White or Yellow; words: "Digital" or "Digital Out") - Used with surround sound or loudspeakers.
- Sound in or line in (Blue; Arrow pointing into waves) - Connection for external audio sources, e.g. tape recorder, record player, or CD player.
- Microphone or Mic (Pink; Microphone) - The connection for a microphone or headphones.
- Sound out or line out (Green; Arrow pointing out of waves) - The primary sound connection for your speakers or headphones. This sound card also has a second (black) and third (orange) sound out connector.
- Firewire (Not pictured) - Used with some high-quality sound cards for digital video cameras and other devices.
- MIDI or joystick (15 pin yellow connector) - Used with earlier sound cards to connect MIDI keyboard or joystick.

Uses of a computer sound card

- Games
- Audio CDs and listening to music
- Watch movies
- Audio conferencing
- Creating and playing Midi
- Educational software
- Business presentations
- Record dictations
- Voice recognition

Parallel port

Parallel Port (DB25)

Less commonly referred to as the **Centronics interface** or **Centronics connector**after the company that originally designed it, the port was later developed by Epson. The **parallel port** is found on the back of IBM compatible computers and is a 25-pin (type **DB-25)** computer interface commonly used to connect printers to the computer. Below is an example of the DB25 interface found on the back of the computer.

Serial port

An Asynchronous port on the computer used to connect a serial device to the computer and capable of transmitting one bit at a time. Serial ports are typically identified on IBM compatible computers as COM (communications) ports. For example, a mouse might be connected to COM1 and a modem to COM2. With the introduction of USB, FireWire, and other faster solutions serial ports are rarely used when compared to how often they've been used in the past. The picture shows the DB9 serial port on the back of a computer.

USB

Short for Universal Serial Bus, USB (pronounced yoo-es-bee) is a plug-and-play interface that allows a computer to communicate with peripheral and other devices. USB-connected devices cover a broad range; anything from keyboards and mice, to music players and flash drives. For more information on these devices, see our USB devices section.

USB may also be used to send power to certain devices, such as smartphones and tablets, as well as charge their batteries.

USB transfer speeds

USB 1.x is an external bus standard that supports data transfer rates of 12 Mbps and is capable of supporting up to 127 peripheral devices. The picture shows an example of a USB cable being connected into the USB port.

USB 2.0, also known as hi-speed USB, was developed by Compaq, Hewlett Packard, Intel, Lucent, Microsoft, NEC and Phillips and was introduced in 2001. Hi-speed USB is capable of supporting a transfer rate of up to 480 megabits per second (Mbps), or 60 megabytes per second (MBps). Hi-speed USB is backward compatible, meaning it is capable of supporting USB 1.0 and 1.1 devices and cables.

USB 3.0, also known as SuperSpeed USB, was first made available in November 2009by Buffalo Technology, but the first certified devices weren't available until January 2010. USB

3.0 improved upon the USB 2.0 technology with speed and performance increases, improved power management and increased bandwidth capability. It provides two unidirectional data paths for receiving and sending data at the same time. USB 3.0 supports transfer rates up to 5.0 gigabits per second (Gbps), or 640 megabytes per second (MBps). Following the release of USB 3.1, it has been officially renamed to "USB 3.1 Gen1" for marketing purposes. The first certified devices included motherboards from ASUS and Gigabyte Technology. Dell began including USB 3.0 ports in their Inspiron and Dell XPS series of computers in April 2011.

USB 3.1, also known as SuperSpeed+, was made available as of July 31, 2013 and is the latest version of the USB protocol. USB 3.1 is capable of transfer rates of up to 10 Gbps, putting it in line with the first generation of Apple's Thunderbolt channel. Today, many devices use the USB 3.0 and 3.1 revisions for improved performance and speed.

USB Type-C was developed around the same time as USB 3.1 and is a reversible-plug, 24-pin, double-sided connector for use with USB devices.

Viva Questions:

1) Differentiate the following: Dual Core, Core 2Duo, i3, i5, i7
2) Differentiate between DDR2, DDR3, DDR4
3) What is meant by Firmwire?
4) What is meant by hot swappable
5) Compare HDD vs SDD.
6) Compare FAT, FAT32 with NTFS.
7) Write the memory storage specification from smallest unit
8) Write down any 15 Keyboard Shortcut keys with description.

Answers:

Criteria (20)	Developing (1-7mark)	Achieving (8-14marks)	Excelling (15-20 marks)	Score
Understanding Application Terminology	limited understanding of appropriate terminology and identify functions and interaction of the components	uses appropriate terminology and identify functions and interaction of the components	consistently uses appropriate terminology and identify functions and interaction of the components	
Knowledge/ Understanding Internal components	limited ability to identify and describe the function of internal components	usually identifies and describes the function of internal components	consistently identifies and describes the function of internal components	
Understanding External components	limited ability to identify and describe the function and interactions of external components	usually identifies and describes the function and interactions of external components	consistently identifies and describes the function and interactions of external components	
Understanding Peripherals	limited ability to identify and describe the function and interaction of some of peripheral components	usually identifies and describes the function and interactions of peripheral components	consistently identifies and describes the function and interactions of some peripheral components	
Timeliness	Finished 21-30 mins. or further after the declared time.	Finished 1-10 mins. after the declared time.	Finished before the declared time.	
			Total	

EX. NO 2: ASSEMBLING AND DISASSEMBLING OF PC

Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

AIM: To assemble and disassemble the system

Why should one learn about hardware?

1. Troubleshoot you and save time.
2. Knowing about system internals and components.
3. Very easy installation for modern hardware.
4. Install extra memory.
5. Removing components.

Safety Precautions:

1. Beware of electrostatic discharge (ESO)
2. Build computer on a hard surface, away from concepts.
3. Wear shoes and the short sleeved cotton wear.
4. Use Phillips, head screw driver.
5. Keep the components away from moisture.
6. Avoid using pressure while installing.

Steps for Assembling

1. Setting the cabinet ready.
2. Preparing to fit the components.
3. Fitting the mother board.
4. Fitting the RAM, processor and cooler.
5. Installing PCI cards.
6. Fitting the hard disk and floppy drive.
7. Installing the CD ROM drives.
8. Connecting the ribbon cables.
9. Powering the drives and mother board.
10. Connecting the cables for the case front panel.
11. Final check.

Getting the Cabinet ready:

1. Check how to open the cabinet and determine where to fix the components.
2. Determine if the case has the appropriate risers installed.

Preparing to fit the Components:

1. Network adapter drive.

2. Cables.
3. Hard disk.
4. CD-ROM Drive.
5. RAM
6. CPU
7. Heat sink / cooler / fan.
8. Mother board.

Fitting the Mother board.

1. Line up the patch on the motherboard (ps/l, USB, etc) with the appropriate holes in the block panel I/O shield of the case.
2. Check the points where you and to install
3. Install them and make the mother board sit on them and fix screws if required.

Mother board parts:

1. ACR slot.
2. PCI Slot.
3. AGP Slot.
4. ATX Connectors.
5. CPU Fan.
6. Chipset North Bridge.
7. CPU socket.
8. System memory.
9. Chipset south bridge.
10. Panel connector.
11. Power supply.
12. IDE connectors.

ATX Connectors:

1. PS, Mouse.
2. Key board.
3. USB.
4. Parallel (Prints)
5. Serial COM1.
6. Serial COM 2.
7. Joystick.
8. Sound.

Fitting the processor:

1. Raise the small lever at the side of the socket.
2. Notice that there is a pin missing at one corner, determine the direction to fit in the processor.
3. You should not force the CPU. When inserting it. All pins should slide smoothly into the socket.
4. Lock the lever back down.
5. Install the heat sink over it (Different type for each processor). Heat sink / CPU fan.

Fitting the RAM:

1. The RAM must be suitable for motherboard.
2. There are currently 3 types of RAM available.
    a) SD RAM.
    b) DDR SD RAM.
    c) RD RAM.
3. The mother board's chipset determines which type of RAM may be used.

Installing the PCI Cards:

1. Most of the cards are inbuilt these days.
2. NIL, Sound Cards etc. are fitted into PCI slots.

Fitting the hard disk and Floppy disk:

1. Place the floppy and hard disks in their slots.
2. Leave some space above HDD to prevent heat building.
3. Check the jumper configuration.
4. Fix the screws.

Installing the CD-ROM Drives:

1. CD-ROM drive is similar to installing a hard disk.
2. 1ST check that the jumper configuration is correct.
3. Fix the screw.

Connecting the Cables:-

1. Attach the long end of the cable to the IDEU connector on the motherboard first.
2. The red stripe on the IDE cable should be facing the CD Power.

Powering the driver and motherboard:

Connecting the cables for the case front pane

1. SD, SPK or SPEAK: The loud speakers o/p. it has 4 pins.
2. RS, RE, RS or RESET: Connect the two pin Reset cable here.
3. PWR, PW, PWSW, PS or power SW: Power switch, the pc's on (switch, the plug is two pin).
4. PWLED, PWRLED or Power LED: The light emitting diode on the front panel

of the case illuminates when the computer is switched on. It's a 2-pin cable.

5. HD, HDD, and LED: These two pins connect to the cable for the hard disk activity LED.

Final Check:-

1. Mother board jumper configurations are the settings for the processor operator.
2. Drive jumper settings, master/ slave correct?
3. Are the processor, RAM modules and plug in cards finally seated in there sockets?
4. Did you plug all the cables in? Do they all fit really?
5. Have you frightened all the screws in plug- in cards or fitted the clips?
6. Are the drive secure?
7. Have u connected the power cables to all driver?

Powering up for the first time:

1. Ensure that no wires are touching the CPU heat sink fan.
2. Plug your monitor, mouse and keyboard.
3. Plug in power card and switch the power supply.
4. If everything is connected as it should be
    - All system, fans should start spinning.
    - U should hear a single beep and after about 5-10 sec.
    - Amber light on monitor should go green.
    - You will see computer start to boot with a memory check.
    - Now check front LED'S to see if u plugged them in correctly.
    - Check all other buttons.
    - Power afford change any wrong settings.

Viva Questions:

1) Define assembling of a system?
2) Explain the steps involved in the installation of the mother board>
3) What is the use of pin 1 indicated on the processor?
4) What is the use of locking level at the processor slot?
5) Define a port?

Answers:

RUBRICS FOR ASSEMBLING AND DISASSEMBLING OF PC

Criteria (20)	Developing (1-7 mark)	Achieving (8-14 marks)	Excelling (15-20 marks)	Score
Remove PC components Remove all components from the PC.	Student did not remove any components successfully from their PC.	Student removed most components successfully from their PC.	Student removed all components successfully from their PC.	
Identify Components Identify all Components From Disassembled PC.	Student correctly identified less than 7 components from disassembled PC.	Student correctly identified between 7 - 15 components from disassembled PC.	Student correctly identified all components from disassembled PC.	
Assembly of PC Correctly install all components into PC.	Student correctly assembled most components into PC.	Student correctly assembled most components into PC.	Student correctly assembled all components into PC.	
Application Safety	limited safety procedures followed when working with electrical current	usually follows recognized safety procedures when working with electrical current	consistently follows safety procedures	
Working with others	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team player.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	
			Total	

EX. NO 3: Installation of Operating Systems – Windows

Every student should individually install MS windows OS on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

INSTALLATION OF WINDOWS OS:

AIM: To install Windows 7 Operating System

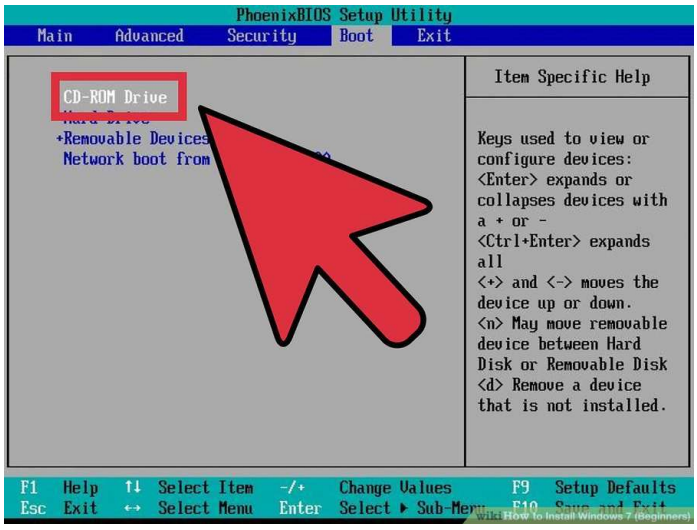
BASIC FILE SYSTEMS:

- FAT: File Allocation Table.
- NTFS: New Technology File System. Format and create using NTFS partition

BASIC STEPS IN INSTALLATION:-

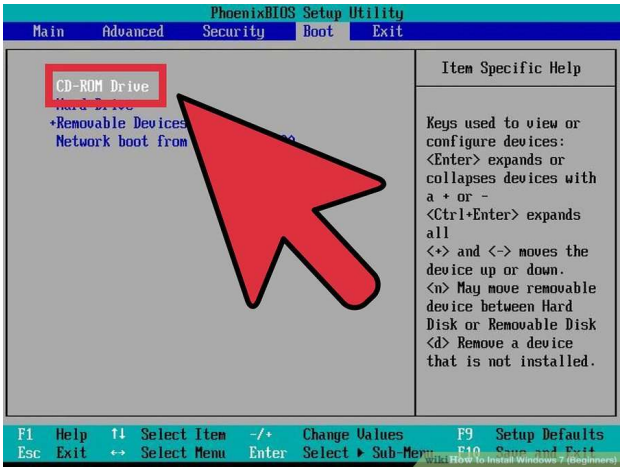
A clean install is intended for users who want to freshly install Windows on their computer (by deleting all of the data on the hard disk and then installing Windows) or computers that do not have an operating system yet.

1. **Enter your computer's BIOS.** Turn off the computer that you want to install Windows on then turn it back on. When the BIOS screen appears or you are prompted to do so, press Del, Esc, F2, F10, or F9 (depending on your computer's motherboard) to enter the system BIOS. The key to enter the BIOS is usually shown on the screen.



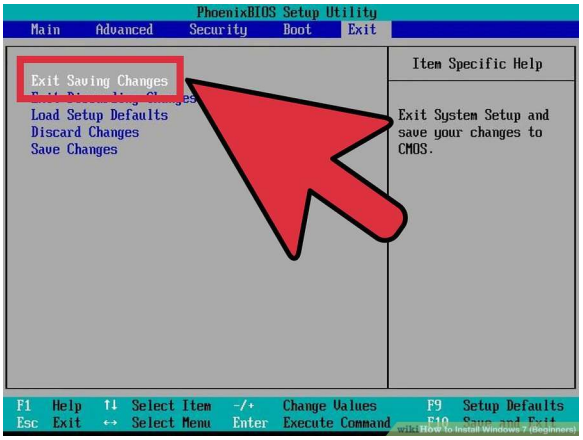
2. **Find your BIOS's boot options menu.** The boot options menu of your BIOS may vary in location or name from the illustration, but you may eventually find it if you search around.

   If you can't find the boot options menu, search the name of your BIOS (most likely located in the BIOS menu) online for help.

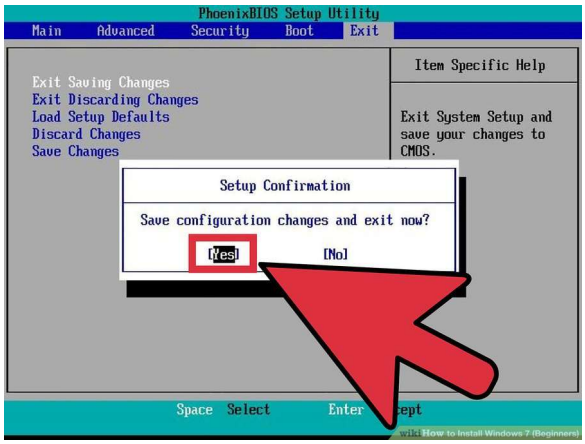


3 Select the CD-ROM drive as the first boot device of your computer.

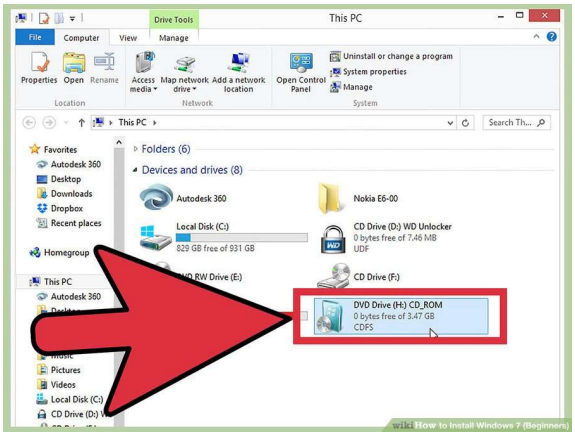
Although this method may vary among computers, the boot options menu is typically a menu of movable device names where you should set your CD-ROM drive as the first boot device. It can also be a list of devices that you can set the order of their boot on. Consult a manual or the internet for help if you're stuck.



4 Save the changes of the settings. Press the button indicated on the screen or select the save option from the BIOS menu to save your configuration.



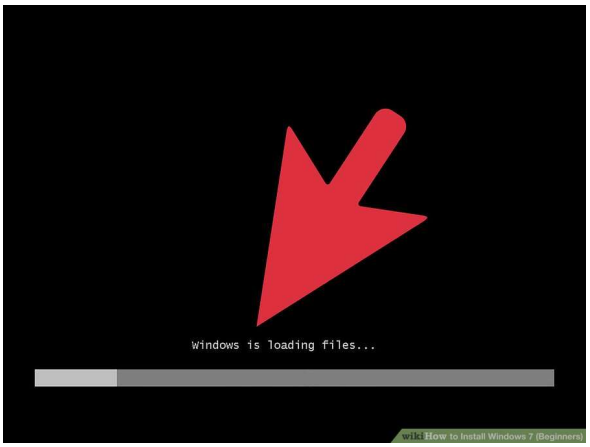
5. Shut off your computer. Either turn off the computer by choosing the shut-down option in your current operating system, or hold the power button until the computer powers off.



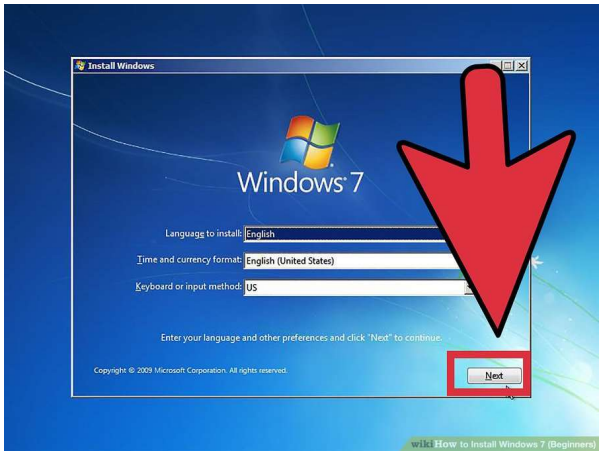
6. Power on the PC and the insert the Windows 7 disc into your CD/DVD drive.

7. Start your computer from the disc. After you have placed the disc into the disc drive, start your computer. When the computer starts, press a key if you are asked if you would like to boot from the disc by pressing any key. After you choose to start from the disc, Windows Setup will begin loading.

- If you are not asked to boot from the disc, you may have done something wrong. Retry the previous steps to solve the problem.

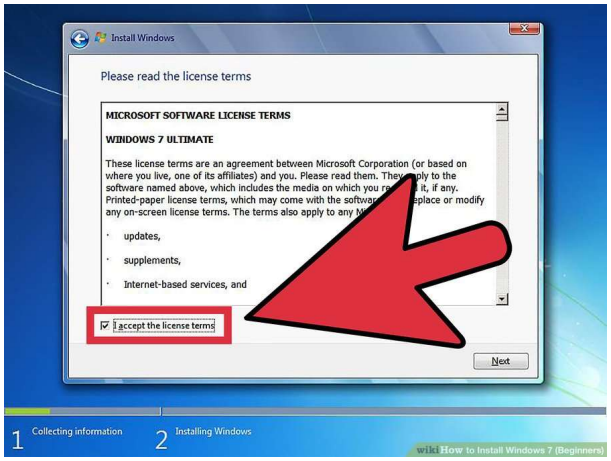


8. Choose your Windows Setup options. Once Windows Setup loads, you'll be presented with a window. Select your preferred language, keyboard type, and time/currency format, then click *Next*.

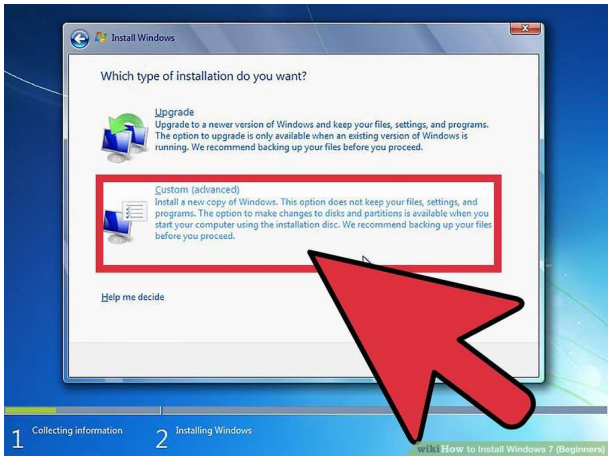


9. Click the ***Install*** *Now* button.

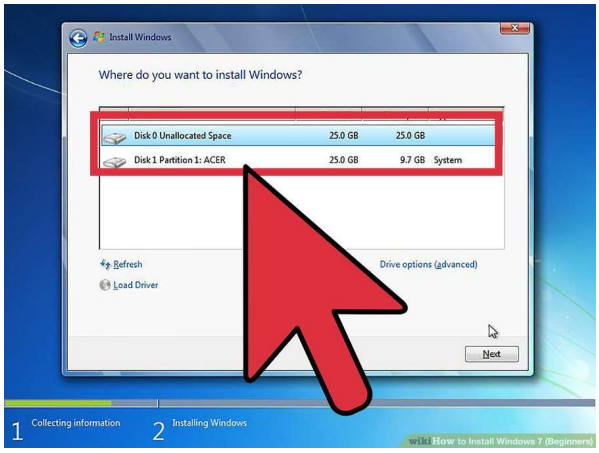
10. Accept the License Terms. Read over the Microsoft Software License Terms, check *I accept the license terms*, and click *Next*.



11. Select the ***Custom*** **installation.**

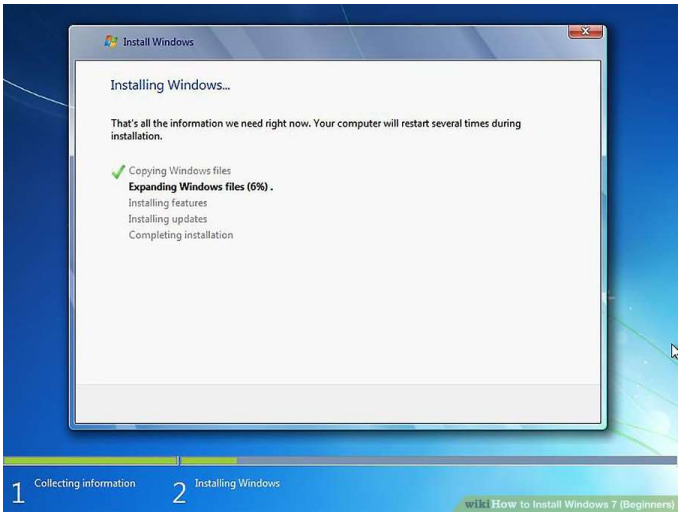


12. Decide on which hard drive and partition you want to install Windows on. A hard drive is a physical part of your computer that stores data, and partitions "divide" hard drives into separate parts.



- If the hard drive has data on it, delete the data off of it, or **format** it.
- Select the hard drive from the list of hard drives.
- Click *Drive options (advanced).*
- Click *Format* from Drive options.
- If your computer doesn't have any partitions yet, create one to install Windows on it.
- Select the hard drive from the list of hard drives.
- Click *Drive options (advanced).*
- Select *New* from Drive options.
- Select the size, and click *OK*.

13. **Install Windows on your preferred hard drive and partition.** Once you've decided on where to install Windows, select it and click *Next*. Windows will begin installing.



Viva Questions:

1) NTFS stands for ?
2) What is the use of product key in the installation process of a software?
3) Installing - What does "upgrade" mean?
4) Write the procedures to create bootable disc?
5) Describe different kinds of Microsoft Operating systems?
6) What are the pre-arrangements for installing the windows OS?
7) What is virtual memo

Rubrics for Windows OS Installation:

Criteria (20)	Developing (1-7 mark)	Achieving (8-14 marks)	Excelling (15-20 marks)	Score
Install Operating System Correctly install appropriate Operating System on the PC.	Student was unable to successfully install the appropriate OS	Student was unable to successfully install the appropriate OS on the PC without close guidance and assistance	Student was unable to successfully install the appropriate OS on the PC without close guidance and assistance	
Install all device drivers Correctly identify and install all necessary device drivers	Identify and install the drivers on the PC. Student was unable to successfully locate	Identify and install the drivers on the PC; without close guidance and assistance Student was able to successfully locate	identify and install the drivers on the PC with very little supervision and guidance	
Install Windows Updates Perform all Windows Updates.	Student was unable to install Windows updates.	Student was able to perform partial updates for Windows.	Student was able to successfully update Windows with all available updates.	
Install 3rd party software Download and install the following: 1. Adobe Acrobat 2. Adobe Flash 3. Java, Browser 4. Free Antivirus	Student was unable to download and install any of the required software.	Student was able to install 3 4 of the six required applications.	Student was able to install all of the required applications.	
Timeliness	Finished installing operating system 21 mins. or further after the given time.	Finished installing operating system 11-20 mins. after the given time.	Finished installing operating system before the given time limit.	
			Total	

Ex. No 4:Installation of Operating Systems –LINUX

Every student should install Linux on the computer .This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructor should verify the installation and follow it up with a viva.

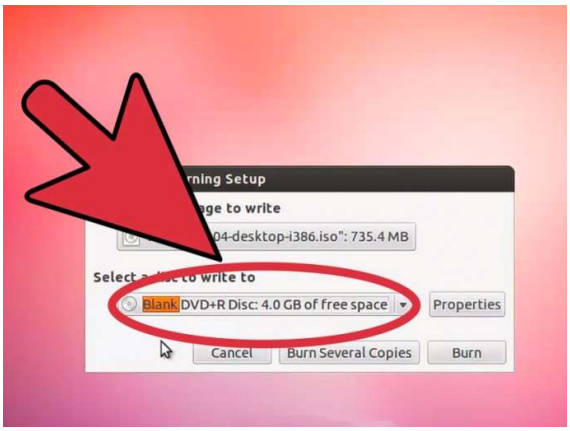
AIM: To install Linux operating system(Ubuntu 12.04 LT)

PROCEDURE:

Ubuntu is one of the most popular and easy-to-use versions of Linux available, and you can download and install it absolutely free. All you need is a CD burner and an internet connection, and you can have Ubuntu up and running in just a few minutes.

1. **Download the Ubuntu image.** Ubuntu is available for free from the Ubuntu website. It is downloaded in ISO format, which needs to be burned to a CD or DVD before you can use it. Most newer computers (built after 2011) will use the 64-bit version, while older computers will need the 32-bit version.

2. **Burn the image to a disc.** There are a variety of free image burning programs available, and Windows 7, 8 and Mac OS X all have image burning capabilities built-in.

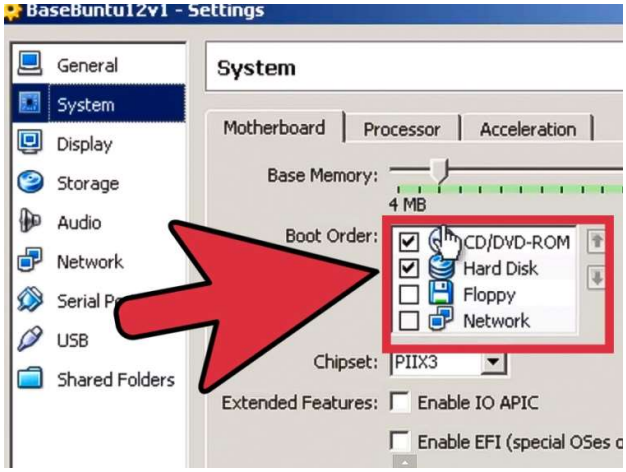


- In Windows 7 and 8, navigate to the downloaded ISO file and double-click on it. Insert a blank disc into your burner, and follow the on-screen instructions to burn the disc

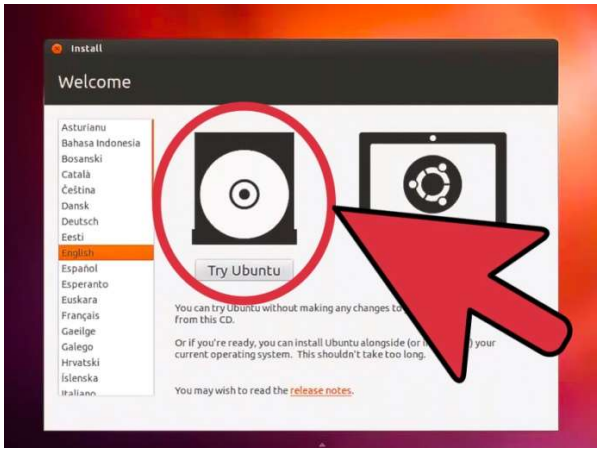
- In Mac OS X, open the Disk Utility. This is located in the Utilities folder, in your Applications folder. Insert your blank disc into your disc drive. Drag and drop the ISO file into the left frame of Disk Utility. Select the ISO file in the frame and click Burn.

3. **Set your computer to boot from the CD/DVD drive.** In order to install Ubuntu, you will need to set your computer to boot from discs. This is because the installation has to occur before your existing operating system is loaded from the hard disk.

- When you reboot your computer, press the BIOS setup key to enter your BIOS menu. In the Boot section, select your CD/DVD drive as the primary boot device. Once you have it set, save and exit the BIOS. Your computer will reset again.
- In Windows 8, hold the Shift key while clicking Restart in the Power menu. This will reboot the computer into the Advanced Startup Options. From here, you can choose to boot from a CD or DVD.

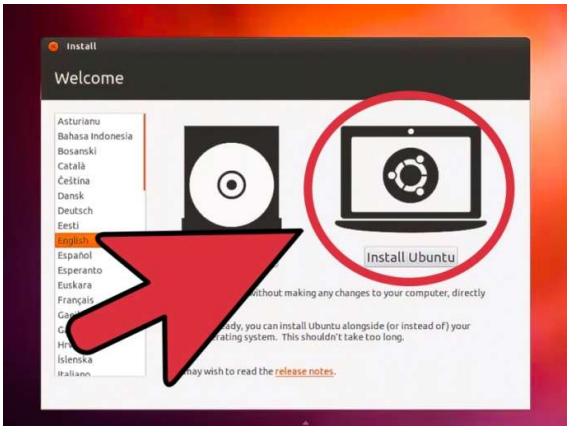


4. **Try Ubuntu before you install.** If you'd like to take Ubuntu for a test drive before you commit to installing it, you can run Ubuntu directly from the installation CD without making any changes to your computer. Click the "Try Ubuntu" button to test it out.

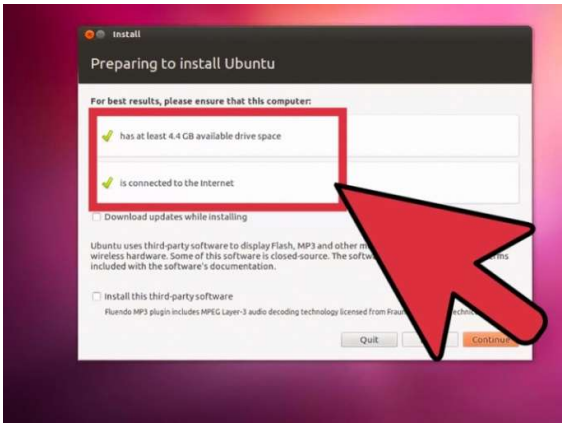


5. **Start the installation process.** Click the Install Ubuntu button to begin the installation. If you are trying out Ubuntu before installing, you can start the installation by opening the Install file on the test desktop.

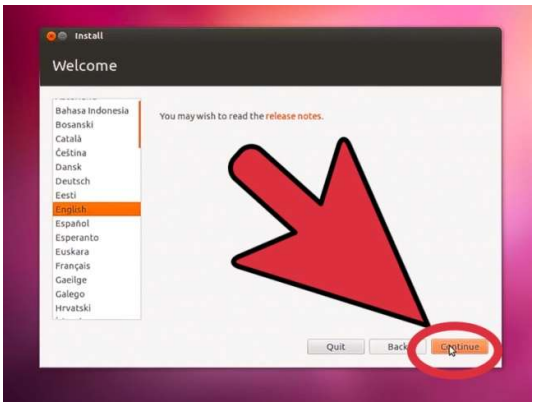
- You will need around 5 GB of free space on your computer to install Ubuntu.
- Installation works best if you are connected to the internet. The easiest way to do this is to plug an Ethernet cable directly into your computer from the router.
- You can also connect to a wireless network if Ubuntu recognizes your wireless adapter.



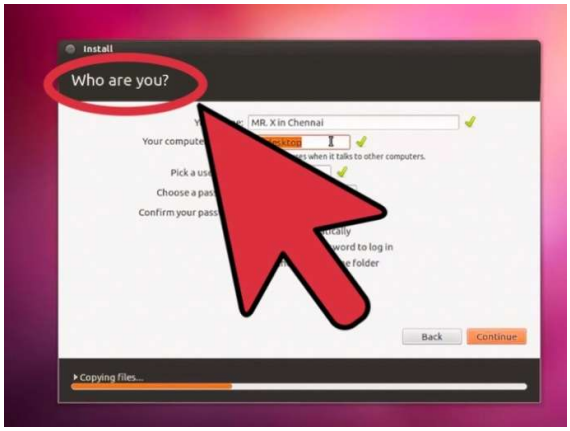
6. **Check the boxes in the "Preparing to install Ubuntu" window.** Ubuntu can automatically download updates during the installation, and can install software that will allow you to play MP3 files and Flash video (YouTube). Installing these updates and software during installation will save you a significant amount of time and headaches when the operating system is installed.



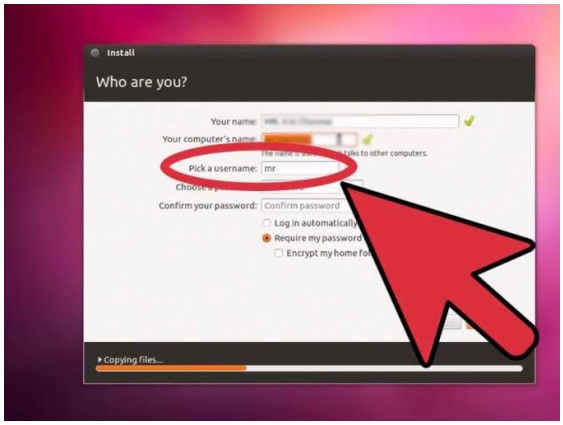
7. **Choose your installation type.** You can choose to install Ubuntu alongside your existing operating system, you can replace your existing operating system, or you can create new partitions yourself. If you choose to install alongside your existing operating system, you will be given the option to set how much space is allocated for each operating system.
    - If your computer doesn't have an operating system installed yet, you will need to select "Something else" and create a partition to install Ubuntu on. Make sure that the partition is formatted as Ext4.
    - If you install Ubuntu alongside your existing operating system, you will be given the option to choose your operating system every time your computer is rebooted.
    - If you replace your existing operating system with Ubuntu, you will lose all of your files and programs. Make sure that you have everything backed up that you want to save.



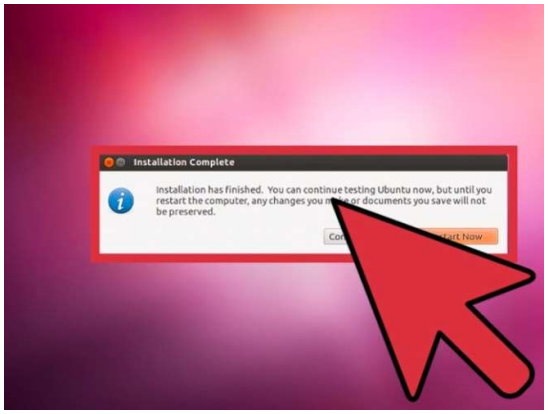
8. **Select your user options.** Ubuntu will ask for your location in order to set the correct timezone. If you are connected to the internet, this should happen automatically. You will also need to select your keyboard layout, which is typically automatically picked for you.



9. **Select a username and password.** In the "Who are you?" window, you will need to enter your name, your computer's name, and a username and password that you will use to log in. You will need the password when making administrative changes to the computer as well.



10. **Wait for the installation to complete.** Once you have set your options, Ubuntu will begin to install. This can take 30 minutes or more depending on your computer's speed. Tips for using Ubuntu will be displayed above the progress bar. Once the installation is complete, you will be prompted to reboot your computer. Ubuntu is ready to use.



- If you have multiple operating systems installed, you will be given the option to choose the one you want to load when your computer starts.

- If you don't have any other operating systems installed, Ubuntu will begin automatically.

Viva Questions:

1) Give the advantages of Linux over other OS?
2) What do you mean by open source OS?
3) What do you mean by dual boot systems?
4) Where the all directories are stored in Linux
5) Which command is used to make directory
6) Which command is used to change directory
7) Which command is used to copy from one file to another file?
8) Which command is used to move data from one file to another file?

Rubrics for Linux OS Installation:

Criteria (20)	Developing (1-7 mark)	Achieving (8-14 marks)	Excelling (15-20 marks)	Score
Install Operating System Correctly install appropriate Operating System on the PC.	Student was unable to successfully install the appropriate Operating System	Student was unable to successfully install the appropriate Operating System on the PC without close guidance and assistance	Student was unable to successfully install the appropriate Operating System on the PC without close guidance and assistance	
Install all device drivers Correctly identify and install all necessary device drivers	Identify and install the drivers on the PC. Fair Student was unable to successfully locate	Identify and install the drivers on the PC; Without close guidance and assistance. Student was able to successfully locate	Identify and install the drivers on the PC with very little supervision and guidance	
Install Windows Updates Perform all Windows Updates.	Student was unable to install Windows updates.	Student was able to perform partial updates for Windows.	Student was able to successfully update Windows with all available updates.	
Install 3rd party software	Student was unable to download and install any of the required software.	Student was able to install 3 4 of the six required applications.	Student was able to install all of the required applications.	
Timeliness	Finished installing operating system 21 mins. or further after the given time.	Finished installing operating system 11-20 mins. after the given time.	Finished installing operating system before the given time limit.	
			Total	

Ex. No 5:Hardware Troubleshooting

It is a process of sorting out the problems.

The set of steps we follow during trouble shooting are:

a) Identify the problem.

b) Identify the set of solutions.

c) Analyze any one solution which is less costly and more efficient.

d) Apply the solution.

e) Test the output.

Trouble shooting is generally of 2 types:

1) Hardware troubleshooting:deals with the process of eliminating bugs related to PC components.
2) Software trouble shooting:refers to removal of problems rising due to system software or application software.

HARDWARE TROUBLESHOOTING:

The list of techniques under this are:

- Hard disk troubleshooting
- Monitor troubleshooting
- Modem troubleshooting
- Keyboard troubleshooting.

a) HARD DISK TROUBLESHOOTING

It contains platters, head arms, classes and headaqualators. Most of the HDDS are connected by either the ATA(i.e.; another name for IDE) or we use SCSI(small computer system interphase) cables.

The difference between SCSI and IDE is

- Using IDE we can connect almost two hard disks
- Using SCSI we can connect 7to 15 hard disks
- Maintenance of SCSI is very difficult when compared to IDE
- The cost of SCSI is more compared to IDE.

Problems related to Hard disk

- ✓ If the HDD is not detected inside the configurations
- ✓ If the system files on the hard disk drive are missing or if they because corrupt.
- ✓ The computer does not boot up when turned on.

Solutions related to hard disk

- ✓ Check whether HDD is physically available or NOT.
- ✓ Check if the bias is connected to the hard disk and if it is detected.
- ✓ On the existing hard disk make sure that you scan the disk very well using the current version of antivirus
- ✓ Make sure that you setting up a disk or charge of its partitions.

b) MONITOR TROUBLESHOOTING:

Which is physically connected to video cards like TV monitor also contains CRT (cathode ray tube).CRT contains 3guns, red, green and blue. These guns stream electrons from left to right.

Set of troubleshooting etc:

PROBLEM: If the picture is not visible

SOLUTION: Check the signal cable is into the power socket or not.

Set of troubleshooting steps are: Check if the signal cable is connected to graphic admor.

Check brightness of the screen.

PROBLEM: If the screen is too bright or dark.

SOLUTION: Check the brightness value. Check if the specified voltage is applied or not. Check if the frequency is horizontal as well as vertical.

PROBLEM: If the screen is blurred

SOLUTION: More all the objects that emit magnetic field away. Check whether the specified is applied or not.Check if the signal timing of system is with in the specification.

MONITOR ICONS:

- ✓ Power
- ✓ Brightness
- ✓ Contrast
- ✓ Horizontal size
- ✓ Vertical size
- ✓ Full screen
- ✓ Degauss(de magnetizers the crt)
- ✓ Comer(user can more the picture)
- ✓ Monitor status
- ✓ Language

c) MODEM TROUBLESHOOTING:

We can call a modem as translator, demodulator, which describes a method by which digital data is converted to analog while receiving the data by the computer it is converted to digital from analog.

There are 2 types of modem which are available they are RJ11 and RJ45.RJ11 consists of 6 pins and RJ45 of 8 pins.

Steps of troubleshooting for modem are:

- ✓ Check the telephone cable connections 10 feet or less than contain a RJ11 cable connection.
- ✓ Check to ensure that you are plugged to the correct modem jack i.e; RJ45 will not fit in RJ11 but RJ11 will fit into RJ45.
- ✓ Check for the error message i.e wrong user name and password the contact your ISP (Internet service provider)for the correct account settings.
- ✓ Reduce your port speed in your modem settings.
- ✓ Check the initialization settings
- ✓ Use hyper terminal on another tool to test the modem.

d) KEYBOARD TROUBLESHOOTING:

- ✓ If the keyboard is not working then check if the keyboard cable is inserted properly in the connector on the motherboard.
- ✓ Swap a non-functional keyboard with a functioning one.

Check if the cable is twisted or damaged.

Other Hardware Issues:

1. Disk Boot Failure
2. S.M.A.R.T Command Failed
3. Automatic Restart of your Computer
4. Fix MBR issues
5. Hide computer Hard disk Drive
6. How to Change Computer Hard Disk Drive Letters
7. Protect your PC from Over heating
8. Use Flash Memory (USB Memory) as Virtual RAM
9. Problems in booting computer in safe mode
10. Connect two Systems using USB cable
11. Bios Backdoor Passwords for Laptops
12. Reset Bios Passwords

Viva Questions:

1) Define trouble shooting?
2) Mention a few problems associated with Modem.
3) What is the function of a modem?
4) What are the different key board problems?
5) Give the preventive measures for better computer utilization?

A Generic Rubric in Troubleshooting Computer-Related Devices

Criteria (20)	Developing (1-7 mark)	Achieving (8-14 marks)	Excelling (15-20 marks)	Score
Safeness	Not utilized the safety handling of tools or equipment thrice or more during laboratory.	Not utilized the safety handling of tools or equipment once during laboratory.	Utilized the safety handling of all tools and equipment during laboratory	
Familiarity	No part of the device is recognized at all.	Some parts of the device are not recognized correctly	Recognized all the parts of the device correctly.	
Preparation	Not well prepared. Had most tools, but borrowed some items. No clear plan of attack.	Prepared for event. Had to borrow one item. Seemed to be guessing at troubleshooting steps.	Thoroughly prepared for event. Had all necessary tools and equipment. Showed clear plan for troubleshooting and moved through work efficiently. Kept work area neat and tidy.	
Diagnosis/ Resolution	Had to ask for help, but with minor guidance, resolved issue.	Problem identified and resolved, but took many failed attempts.	Problem quickly identified and resolved.	
Timeliness	Finished 21-30 mins. or further after the declared time.	Finished 1-10 mins. after the declared time.	Finished before the declared time.	
			Total	

Ex. No 6: Software Troubleshooting

Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up by the viva.

AIM: Software troubleshooting

PROCEDURE:

✓ **Error messages encountered during boot before Windows loads**

Ensure that your computer BIOS settings are correctly configured to the hardware that is installed in your computer

1. **Issues and questions related to the Windows taskbar.**
2. **Information about the Taskbar.**

✓ **Verify Auto hide is not activated by following the below steps**

1. Press CTRL + ESC or your Windows key to make Start menu appear
2. Click Settings and choose Taskbar & Start menu
3. Verify that Auto Hide is not checked

✓ **If Auto Hide is not enabled move the task bar up by following the below steps**

Press CTRL + ESC or your Windows key to make Start menu appear
Try to notice where the Start menu appeared; generally, it should be the bottom left corner.
Press ESC. You should now notice a small gray line at the location of where the start was.

✓ **Issues and questions related to Rundll**

Rundll and rundll32 enable users to run a DLL file as an application.

Below are some examples of how the rundll.exe rundll32.exe files can be used in Microsoft Windows to perform numerous windows commands from the command prompt. Because of the different versions of rundll and rundll32, not all of the below options will work. If rundll or rundll32

encounter an error, it is possible that the command will fail without any error messages.

✓ **Shutdown, restart, logoff, and/or poweroff the computer**

Users can shutdown Windows through the command line using rundll32 and the shell32.dll file.

✓ **Additional information and help with the boot.ini:**

The "boot.ini" is a Microsoft initialization. This file is always located on the root directory of the primary hard disk drive. In other words, it is located at "C:\" directory or the "C Drive". This file is used by Microsoft Windows as a method of displaying a menu of operating systems currently n the computer and allowing the user to easily select which operating system to load. In addition, this file is also used to point to the locations of each of the operating systems.

Basic example of the boot.ini file:

```
[boot loader]
timeout=5
default=multi(0)disk(0)rdisk(1)partition(1)\WINDOWS
[operating systems]
multi(0)disk(0)rdisk(1)partition(1)\WINDOWS="Microsoft Windows XP
Home
Edition" /fastdetect
```

In the above example, the boot.ini contains two sections, the "[boot loader]", and "[operating systems]". Within the boot loader section there are two lines. The "timeout" line is used for how long the boot menu time should be displayed, in seconds; we recommend that the timeout be set to at least five if you wish the computer to boot faster and commonly use the default operating systems. The "default" line is the default operating system that the boot.ini will load. If multiple operating systems are in the boot.ini, the default operating system will be automatically selected and used if the user does not specify a different operating system by the time the timeout value expires.

How to modify the boot.ini:

The boot.ini file is a hidden system file located in the root directory of your primary hard disk drive. To edit this file we recommend you follow the below steps.

1. From Windows, open an MS-DOS prompt by clicking "Start" and then "Run" and typing "cmd" in the text box. If you are

not able to get into a MS-DOS prompt to edit the boot.ini file, boot into the recovery console to edit the file.

2. At the MS-DOS prompt, type:
   c: <press enter>
   cd\ <press enter>
   attrib -r -a -s -h boot.ini <press enter>
   edit boot.ini <press enter>

✓ **Windows restarts without warning**

This issue could be caused by any of the below possibilities

1. Software issue or error
2. Hardware issue or error
3. Heat related issue.
4. Computer virus.
5. Issue with operating system.

✓ **Error messages while windows loading**

1. If you have recently installed or changed something that could have caused normal windows to stop loading, try loading the last known good configuration
2. If you are unable to get into Normal windows and believe that removing or uninstalling a program or changing a setting may help enable you to get into windows, boot the computer into Windows OS safe mode
3. If your computer has worked fine in the past but recently has been experiencing the issue you are encountering run the system restore option to restore the computer to an earlier date

Other error messages that occur while windows is loading or after windows is loaded

1. If error occurs but windows still loads, verify no issues or conflict exits in device manager
2. Ensure that if programs are loading automatically that these errors are not associated with these programs
3. Make sure Windows OS is up to date by checking Microsoft windows update page
4. If your computer has virus protection installed make sure that it is up to date and that no virus are being detected
5. If your computer has worked fine in the past but recently has been experiencing the issue you are encountering run the system restore option to restore the computer to an earlier date

Viva questions:

1) Define a software
2) How to perform BIOS update?

3) What are the general software problems we encounter?
4) Define virus
5) What is the minimum free space required?
6) What are the reasons for slow running ?

Criteria (20)	Developing (1-7 mark)	Achieving (8-14 marks)	Excelling (15-20 marks)	Score
Tools for Software Comparability .	Student was unable to identify the tools needed to resolve software issues.	Student was able to identify the tools needed to resolve software issues. Student was unable to briefly describe the approach.	Student was able to successfully identify the tools needed to resolve software issues. Student was successfully able to briefly describe the approach and to resolving these issues.	
Identify the Software problems	Students discuss the common software problems and identify the strategies for troubleshooting software issues	Students recognize the common software problems and identify the strategies for troubleshooting software	Students describe strategies for identifying, solving and preventing software problems.	
Meets Computational Specifications	The program is produces incorrect results, has several bugs	The program produces correct results for most computational specs, has a few bugs	The program meets all of the computational specifications	
Displays Output Correctly	The program does not display results correctly and does not meet most display specs	The program displays results clearly and meets many of the display specifications	The program displays results very clearly and intuitively, and meets all display specifications	
Reusability	The code is not organized for reusability	Some parts of the code could be reused in other programs	The code could be reused as a whole and each routine could be reused	
			Total	

Ex.No 7:Providing Internet connectivity

Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there are no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN

AIM: To learn Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email

THEORY:

The internet is a worldwide, publicly network of interconnected computer networks

Network Cables

Several standard types of **network cables** exist, each designed for specific purposes.

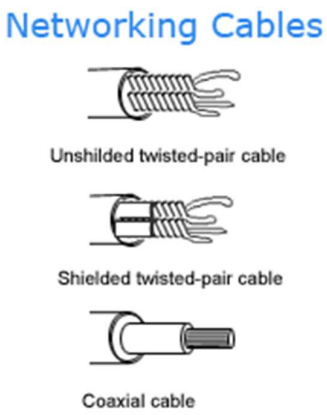
Coaxial Cables

A Coaxial cable is a cable used in the transmission of video, communications, and audio. This cable has high bandwidths and greater transmission capacity. Most users relate to a coaxial or coax cable as a cable used to connect their TVs to a cable TV service. However, these cables are also used in networks and what allow a broadband cable Internet connection using a cable modem. The picture is an example of a coaxial cable. As can be seen in this picture, the cable is a thick cable with a metal male connector end that is screwed onto a female connector.

Twisted-pair cable

A twisted-pair cable is a cable made by intertwining two separate insulated wires. There are two twisted pair types: shielded and unshielded. A Shielded Twisted Pair (STP) has a fine wire mesh surrounding the wires to protect the transmission;

an Unshielded Twisted Pair (UTP) do not. Shielded cable is used in older telephone networks, as well as network and data communications to reduce outside interference. The illustration gives an example of how the inside of these looks.



Straight Through

A network cabling that connects a computer to a network device. For example, straight through cables connect a computer to a network hub, network switch, and network routers.

Crossover Cable

Networking cable that connects two computers or network devices directly to one another. When purchasing this cable, the packaging must indicate that it's a crossover cable for the required network interface; otherwise, it's likely a typical straight through cable. Often, crossover cables are used to connect two computers with network cards together without using a network hub, network router, or network switch.

CAT5

Alternatively referred to as an Ethernet cable, a CAT5 or Category 5 is a description of network cabling that consists of four twisted pairs of copper wire terminated by an RJ-45 connector. Cat5 has a maximum length of 100m, exceeding this length without the aid of bridge or other network device could cause network issues. The picture shows an example of what a CAT5 cable may look like with the connector, as well as the other end of the cable with each of the wires it contains.

Fiber Optic Cable

A fiber optic cable defined in IEEE 802.8 is cable that contains optical fibers (usually glass) coated in plastic that are used to send data by pulses of light. The coating helps protect the fibers from heat, cold,

electromagnetic interference from other types of wiring, as well as some protection from ultraviolet rays from the sun. Fiber optics allow for a much faster data transmission than standard copper wires, because they have a much higher bandwidth. They are common amongst corporate networks or world-wide networks, such as Internet backbones, because of the capabilities of the cable.

Networking Devices:

Hub

D-Link 7-Port USB Hub

When referring to a network, a hub is the most basic networking device that connects multiple computers or other network devices together. Unlike a network switch or router, a network hub has no routing tables or intelligence on where to send information and broadcasts all network data across each connection. Most hubs can detect basic network errors such as collisions, but having all information broadcast to multiple ports can be a security risk and cause bottlenecks. In the past, network hubs were popular because they were cheaper than a switch or router. Today, switches do not cost much more than a hub and are a much better solution for any network.

Switch

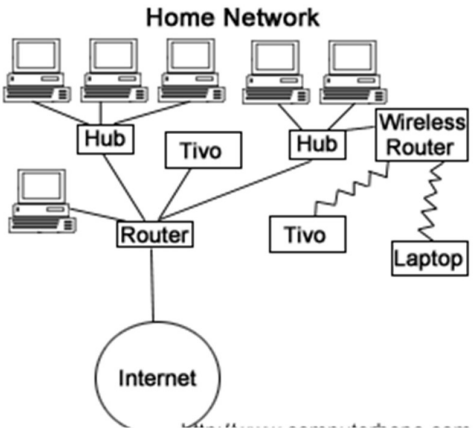
A switch is a piece of a physical circuitry component that governs the signal flow. Having a switch or toggle switch allows a connection to be opened or closed. When opened, the switch allows a signal or power to flow through the connection. When closed, the switch stops the flow and breaks the circuit connection.

NETGEAR 5 Port Network Switch

On a network, a switch is a hardware device that filters and forwards network packets, but often not capable of much more A network switch is more advanced than a hub but not as advanced as a router. The picture shows an example of a NETGEAR5 port switch.

Router

A router is hardware device designed to receive, analyze and move incoming packets to another network. It may also be used to convert the
packets to another network interface, drop them, and perform other actions relating to a network.



A router has a lot more capabilities than other network devices, such as a hub or a switch that are only able to perform basic network functions. For example, a hub is often used to transfer data between computers or network devices, but does not analyze or do anything with the data it is transferring. By contrast, routers can analyze the data being sent over a network, change how it is packaged, and send it to another network or over a different network. For example, routers are commonly used in home networks to share a single Internet connection between multiple computers.

In the above example, of a home network, there are two different types of a router: the router and the wireless router. In this example, the router allows all the computers and other network devices to access the Internet. The wireless router allows a laptop to wirelessly connect to the home network and access the Internet as well. Below are some additional examples of different types of routers used in a large network.

TCP/IP(Transmission Control Protocol/Internet Protocol): Collection of methods used to connect servers on the internet and to exchange data.
HTML(Hyper Text Markup Language): The coding used to control the look of documents on the web
HTTP(Hyper Text Transfer Protocol): Part of a url that identifies the location as one that uses HTML
IP(Internet Protocol): A format for contents and addresses of packets of information sent over the internet
IP ADDRESS: An identifier for a computer or device on a TCP/IP network

PROCUDURE:

- Goto start>control Panel
- open Network Connections
- Click create a new connection and then click next
- The new conection wizard window opens , click next to continue

- Choose one of the options in the next dialog box
- Choose one of the three options in the next dialog box
    - ✓ If you do not have an internet account click choose from a list of ISPs and then click next
    - ✓ If you have an account click Set up my connection manually
    - ✓ If you have a CD from the ISP click use the CD I got from an ISP and then click next
- Follow the next steps as per the option you selected.

LAN Proxy Settings:

- select **tools** menu in Internet Explorer
- Select **Internet Options**
- Select **Connections**
- You end up in two options
    - ✓ **Dial-up and virtual network settings**
    - ✓ **LAN setting**
- The selection at this step is dependent on the kind of connection you are trying to configure. They are:
    - ✓ **Dial-up modem connection**
    - ✓ **LAN connection**
    - ✓ **DSL or Cable modem**

Viva Questions:

1. What is subnet mask?
2. What do you mean by network?
3. Briefly describe NAT.
4. What is NIC?
5. What is a private IP address? Give some examples
6. What is DHCP?
7. What is Ping?
8. What is ipconfig?

Ex.No 9:Configuring Firewalls and installation of Antivirus software

Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to first install an anti virus software, configure their personal firewall and windows update on their computer. Then they need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms

PURPOSE: To learn various threats on the internet and configure the computer to be safe on the internet.

THEORY: Antivirus:

Antivirus software is a program that either comes installed on your computer or that you purchase and install yourself. It protects your computer against most viruses, worms, Trojan horses and other unwanted invaders that can make your computer sick.

Firewall:

A firewall is a special software or hardware designed to protect a private computer network from unauthorized access. A firewall is a set of related programs located at a network gateway server which protects the resources of the private network from users from other networks.

Software firewalls

Software firewalls are designed to protect a computer by blocking certain programs from sending and receiving information from a local network or the Internet. The image to the right shows the icon for Windows Firewall, an example of a firewall software program.

Hardware firewalls

Hardware firewalls are found on most network routers and can be configured through the router setup screen. The image shows the ZyXELZyWALL, which is a Unified Security Gateway with a firewall and other security features.

PROCEDURE:

Installing Symantec antivirus for Windows:

- Insert Symantec antivirus CD into your CD drive

- Double click on the Symantec-setup.exe
- The installer will open
- Click **next** to proceed
- License agreement will open . Click **I accept the terms of the license agreement** and then click **next.**
- Follow the instruction on the screen to complete the installation.

Get Computer Updates:

- Click **start> settings>control panel**
- Click **Automatic Updates** icon to open Automatic Updates dialog box
- Check the box **Keep my computer up to date**
- Choose a setting
- Click OK

Block Pop ups:

- In the IE open **tools>pop-up blocker**
- Click on **Turn on Pop- up blocker**

Windows Firewall:

- Go to **Start>control panel>Network and Internet Connections>windows firewall**
- In the general tab check the **On(recommended)** box
- If you don't want any exceptions check on **Don't allow exceptions box**

Viva Questions:

1) What is antivirus software?
2) Define virus
3) Define worm
4) What are the advantages of antivirus software?
5) What are the types of antivirus software's available?

RUBRICS FOR Configuring Firewalls and installation of Antivirus software

Criteria (20)	Developing (1-7 mark)	Achieving (8-14 marks)	Excelling (15-20 marks)	Score
Does the student understandtherole of firewalls.	Student doesn't know the role of firewall.	Student partially knows the role of firewall.	Student knows the role of firewall and rules for configuring firewall successfully.	
Configure the physical connectivity of the firewall which protects a client workstation. -	Student was not able to configure the physical connectivity.	Student was partially able to configure the physical connectivity.	Student was able to configure the physical connectivity.	
Install Antivirus Correctlyinstall appropriate Antivirus on the PC.	Student was unable to successfully install the appropriate Antivirus.	Student was unable to successfully install the appropriate Antivirus on the PC without close guidance and assistance	Student was able to successfully install the appropriate Antivirus with very little supervision and guidance	
Install Updates Perform all antivirus Updates.	Student was unable to install antivirus updates.	Student was able to perform antivirus updates with the guidance.	Student was able to successfully update the antivirus with all available updates.	
Timeliness	Finished installing operating system 21 mins. or further after the given time.	Finished installing operating system 11-20 mins. after the given time.	Finished installing operating system before the given time limit.	
			Total	