**Lecture week 01’s:-**

1. **Information Technology:**
   * Definition: IT involves the use of technology to process, transmit, store information.
2. **Computer System:**
   * Description: Comprises hardware (case, storage, keyboards, monitors) and software (OS, programs).
   * Functions: Instructs, identifies, accesses, processes information.

**1.2 A Computer System:**

* **Components:**
  + Hardware: Case, storage drives, keyboards, monitors, cables.
  + Software: OS and programs.
* **Operating System:**
  + Instructs computer operations.
* **Operations of Operating System:**
  + Identify, access, process information.
* **Other Programs and Applications:**
  + Perform specific assigned functions.

Contribute to overall system functionality

**1.3 Computer Cases:**

* **Purpose:**
  + Supports internal components.
  + Provides protection and cooling.
* **Characteristics:**
  + Made of plastic, steel, aluminum.
  + Variety of styles.
  + Form factor determines size/layout.
  + Also called chassis, cabinet, tower, box, housing.

**1.3 Power Supply Units:**

* **Fixed PSUs:**
  + Converts AC to DC power.
  + Provides power for current and potential components.
  + Cables not detachable.
  + Connectors keyed for one-direction insertion.
* **Modular PSUs:**
  + Some/all cables detachable.
  + Space-saving and better cable management.
  + Higher priced.

**1.3 PSU Connectors:**

* **Main Connector (P1/20-pin, P1/24-pin):**
  + Provides power to most motherboard components.
  + Extra pins for load balance with added components.
* **Molex Connector (4-pin):**
  + Powers PATA hard disks.
* **SATA Connector (15-pin):**
  + Powers SATA hard disks and drives.
* **PCIe Connectors (6-pin, 8-pin):**
  + Powers PCIe cards.
* **Power Connector (4-pin):**
  + Powers processor voltage regulator.

**1.4 Internal Components: Motherboard:**

* **Definition:**
  + Main PCB with buses, CPU socket, RAM slots, expansion slots, BIOS chip, chipsets, I/Os.
* **Motherboard Form Factors:**
  + Common types: AT, ATX.
* **Chipsets:**
  + Control system interaction with CPU and board.
  + Divided into Northbridge and Southbridge.
* **Functionality:**
  + Northbridge controls RAM, video card, CPU communication speed.
  + Southbridge allows CPU communication with hard drives, sound card, USB ports, and other I/O ports.

**1.4 Internal Components contd.:**

* **Motherboard Form Factors (Continued):**
  + Varieties exist; AT and ATX are common.
* **Chipsets (Continued):**
  + Northbridge controls RAM, video, CPU speed.
  + Southbridge manages CPU communication with peripherals.
  + Chipsets vary between manufacturers.

**Tutorial of week 1:-**

**Question 01: What is a form factor? Elaborate on the basis of computer cases.**

* **Answer:** A form factor refers to the size, layout, and shape of a computer case. It determines the compatibility of internal components such as motherboards and power supply units (PSUs). Computer cases are made in various form factors, including ATX, micro ATX, and mini-ITX, influencing the overall size and design.

**Question 02: Explain in depth, the most common types of power connectors that are there in a power supply unit. Also, describe how modular PSUs can help keep a case’s temperature in an optimal range.**

* **Answer:**
  + **Common Power Connectors:**
    - *Main Connector (P1/20-pin, P1/24-pin):* Powers most motherboard components.
    - *Molex Connector (4-pin):* Powers PATA hard disks.
    - *SATA Connector (15-pin):* Powers SATA hard disks and drives.
    - *PCIe Connectors (6-pin, 8-pin):* Powers PCIe cards.
    - *Power Connector (4-pin):* Powers processor voltage regulator.
  + **Modular PSUs and Temperature Management:**
    - Modular PSUs have detachable cables.
    - Better cable management saves space and enhances airflow inside the case.
    - Improved airflow helps in maintaining an optimal temperature by preventing heat buildup.

**Question 03: Elaborate the use of NB and SB chipsets in a computer’s motherboard.**

* **Answer:**
  + **Northbridge (NB):**
    - Controls access to RAM, video card, and CPU communication speed.
    - Manages high-speed components directly connected to the CPU.
  + **Southbridge (SB):**
    - Enables communication between the CPU and slower peripherals like hard drives, USB ports, and sound cards.
    - Manages I/O functions and devices connected to the motherboard.

**Question 04: List out the common differences between a LGA and a PGA CPU socket.**

* **Answer:**
  + **LGA (Land Grid Array):**
    - Pins are on the motherboard socket.
    - The CPU has contact points.
    - Easier CPU replacement.
  + **PGA (Pin Grid Array):**
    - Pins are on the CPU.
    - The socket has holes.
    - Bent pins on the CPU are more challenging to fix.

**Question 05: Find out how to power on the PSU without connecting to the motherboard for testing purpose.**

* **Answer:**
  + To power on the PSU without connecting to the motherboard for testing, you can perform the paperclip test. Short the green wire (PS\_ON) and any black wire (COM) on the 24-pin motherboard connector using a paperclip. This simulates the motherboard's signal to the PSU, turning it on. Ensure safety precautions are followed during this test.

**Lecture 02 Objectives: Unveiling Computer Systems**

In this session, we'll delve into the intricate world of computer systems, covering essential concepts such as the central processing unit (CPU), diverse CPU sockets, advanced CPU features, the realm of computer memory, classifications of RAM, and the internal components residing within the motherboard.

**2.1 Internal Components: The Heart of It All - CPU**

The central processing unit (CPU), often hailed as the brain of the computer, orchestrates the majority of calculations. CPUs come in various form factors, each demanding a specific slot or socket on the motherboard.

Unlike their slot-based counterparts, contemporary CPU sockets and processors predominantly embrace the Pin Grid Array (PGA) architecture. This design involves inserting pins on the underside of the processor into the socket, typically facilitated by a Zero Insertion Force (ZIF) mechanism. The CPU functions by executing a sequence of stored instructions known as a program.

**2.2 Motherboard Components: CPU Sockets**

CPU sockets, the sites where CPUs find their home on the motherboard, commonly adopt Land Grid Array (LGA) or PGA designs, often featuring a ZIF mechanism. Renowned CPU manufacturers like Intel and AMD offer a spectrum of sockets.

Common Intel Sockets:

* Socket AM2
* Socket AM3
* Socket AM3+
* Socket FM1
* Socket FM2
* Socket FM2+

Common AMD Sockets:

* LGA 775
* LGA 1156
* LGA 1366
* LGA 1155
* LGA 2011
* LGA 1150

**2.3 CPU - Beyond the Basics**

As the CPU executes program steps, additional instructions and data find refuge in cache memory. The CPU architecture distinguishes between x86 (32-bit) and x64 (64-bit) designs. The former accommodates values up to 2^32, while the latter extends its capacity to 2^64. Hyper-threading, a feature enhancing CPU performance, simulates dual CPUs to the operating system.

**CPU Speed and Power Metrics**

A CPU's prowess is gauged by its clock speed, measured in cycles per second (MHz, GHz), and its data processing capacity. The amount of data processed hinges on factors like the processor data bus (FSB) size or the system crystal.

**Overclocking and CPU Throttling**

While overclocking accelerates a processor beyond its standard speed, it comes with the caveat of potential damage. On the flip side, CPU throttling reduces processor speed to save power, commonly employed in laptops and mobile devices.

**2.4 CPU - Cores: The Multitasking Virtuosos**

CPUs comprise one or more cores, each functioning as an execution block. Multiple cores facilitate the simultaneous execution of diverse instructions. Core types range from single-core configurations to hexa, octa, deca, and dodeca cores.

**2.5 Internal Components: Keeping It Cool**

The electronic components generate heat, demanding efficient cooling systems. Case fans, CPU fans, and graphics card cooling systems dissipate heat. High-performance systems may even adopt water-cooling, utilizing a metal plate over the processor.

**2.6 Computer Memory: The Essence of Processing**

Computer memory, categorized into primary and secondary, plays a pivotal role in system operation. Primary memory, directly accessed by the CPU, includes Read-Only Memory (ROM), Read Access Memory (RAM), and cache memory. Notably, RAM and cache are volatile, while ROM is non-volatile.

**2.7 Primary Memory: ROM - Immutable Instructions**

Read-Only Memory (ROM) contains instructions directly accessible by the CPU, residing on the motherboard. It stores fundamental instructions for booting the computer and loading the operating system. ROM comes in various types, including ROM, PROM, EPROM, and EEPROM, with contents resistant to normal erasure methods.

**2.8 Primary Memory: RAM - Dynamic Storage**

Random Access Memory (RAM), the temporary storage for actively used data and programs, enhances a computer's capacity to handle large programs and files, contributing to overall system performance. RAM types include SRAM, DRAM, SDRAM, and various generations of DDR (1, 2, 3, and 4) RAM.

**Memory Modules and DRAM Types**

Modern memory modules, such as DIMM, SODIMM, and SIMM, house memory chips on a specialized circuit board. Different DRAM types, including Dynamic RAM (DRAM), Synchronous Dynamic RAM (SDRAM), and various DDR generations, each with distinct pin configurations, cater to evolving memory needs.

**Comparison of DDR Types**

* DDR - SDRAM (184-pins)
* DDR2 - SDRAM (240-pins)
* DDR3 - SDRAM (240-pins)
* DDR4 - SDRAM (288-pins)
* DDR5 - SDRAM (288-pins)

**Cache Memory: A Swift Repository**

Cache memory, specifically SRAM, serves as a repository for frequently used data, providing the processor with rapid access. Different cache levels, including L1, L2, and L3, optimize data retrieval efficiency.

**2.10 Internal Components: Adapter Cards**

Adapter cards amplify a computer's functionality by integrating controllers for specific devices or replacing malfunctioning ports. Examples include NIC, Wireless NIC, Sound and Video adapters, TV Tuner, Modem adapter, and USB (Universal Serial Bus).

**2.11 Motherboard Components: Expansion Slots**

Expansion slots on motherboards facilitate the integration of additional components. Three common types are PCI (Peripheral Component Interconnect), AGP (Advanced Graphics Port), and PCIe (Peripheral Component Interconnect Express).

* PCI: A 32-bit expansion slot widely used in most computers.
* AGP: A 32-bit slot designed for video adapters.
* PCIe: A serial bus expansion slot replacing AGP for video adapters and supporting various other adapters.

**2.13 Internal Components: Storage Drives**

Storage drives, pivotal in reading/writing information, adopt magnetic, chip-based, or optical storage media. Floppy drives, though nearly obsolete, and hard drives are traditional storage solutions. The newer Solid State Drives (SSDs) exhibit energy efficiency and can replace traditional magnetic drives.

**2.14 Internal Components: Storage Drives - The Heart of Data Storage**

Storage drives play a crucial role in the computer's ability to read and write information. They interact with magnetic, chip-based, or optical storage media, serving to store data permanently or retrieve information from media disks.

**Floppy Drive - A Relic of the Past**

The floppy drive, utilizing removable 3.5-inch floppy disks (with the 5.25-inch version now obsolete), was a staple in early storage solutions. Its data capacity typically ranged from 720 KB to 1.44 MB.

**Hard Drive - Magnetic Storage Powerhouse**

The hard drive, or hard disk drive (HDD), is a magnetic storage device installed inside the computer. It acts as permanent storage for data, with its capacity measured in gigabytes (GB). The speed of a hard drive is measured in revolutions per minute (RPM), and adding multiple hard drives can enhance overall storage capacity.

**SSDs: The Evolution in Storage Technology**

Modern hard disk drives are being increasingly replaced by Solid State Drives (SSDs). SSDs consume less energy than traditional magnetic drives while maintaining the same form factor and utilizing ATA or SATA interfaces. This technology provides a more efficient and reliable alternative to traditional storage solutions.

This overview of storage drives encompasses the evolution from the legacy floppy drives to the robust hard disk drives and the contemporary Solid State Drives, showcasing the continuous advancement in storage technology.

**Summary and Conclusion: Mastering Computer Components**

In conclusion, this comprehensive exploration has unveiled the intricacies of computer components, from the central processing unit (CPU) to storage drives. Let's recap the key points:

1. **CPU and Motherboard Interaction:** The CPU, often regarded as the computer's brain, executes instructions in a sequence called a program. Motherboards host CPUs in sockets, commonly LGA or PGA, fostering a symbiotic relationship.
2. **Advanced CPU Features:** Understanding CPU architecture, such as x86 and x64, is crucial. Hyperthreading enhances performance, simulating multiple CPUs. Speed, measured in MHz or GHz, and the delicate balance in overclocking and CPU throttling contribute to optimal functionality.
3. **CPU Cores and Cooling Systems:** The number of cores in a CPU determines its multitasking capabilities. Cooling systems, including case fans, CPU fans, and advanced water-cooling solutions, manage heat generated by electronic components.
4. **Memory Management:** Computer memory, divided into primary (RAM, ROM) and secondary (storage drives), is fundamental. RAM, a dynamic temporary storage, and ROM, a non-volatile instruction repository, play vital roles.
5. **RAM Types and Modules:** The evolution of RAM, from SRAM to DDR5, involves various types and pin configurations. Memory modules, like DIMM and SODIMM, accommodate these advancements, shaping the landscape of memory technology.
6. **Cache Memory Efficiency:** SRAM, employed in cache memory, ensures swift access to frequently used data. Multiple cache levels, such as L1, L2, and L3, contribute to optimized data retrieval.
7. **Adapter Cards and Expansion Slots:** Adapter cards, including NIC and video adapters, enhance a computer's capabilities. Motherboard expansion slots like PCI, AGP, and PCIe facilitate the integration of these cards.
8. **Storage Drives Evolution:** The journey from floppy drives to hard disk drives and the contemporary SSDs showcases the dynamic evolution in storage technology. SSDs, with their energy efficiency and reliability, represent the pinnacle of this progression.