OCW SHORT NOTES

UNIT:1

1)Generations of computers:

First Generation (1940s-1950s):

- Vacuum tubes used for electronic components.
- Large and expensive machines.
- Limited programming capabilities.
- Machine language is used
- Examples: ENIAC and UNIVAC.

- **Second Generation (1950s-1960s):**
  - Transistors replaced vacuum tubes, leading to smaller and more reliable computers.
  - Assembly language as well as machine language are used.
  - Batch processing and early operating systems.
  - Examples: IBM 1401, IBM 7090.
- **Third Generation (1960s-1970s):**
  - Integrated circuits (ICs) introduced, enabling further miniaturization and increased processing power.
  - High-level programming languages (e.g., COBOL, FORTRAN).
  - Multiprogramming and time-sharing systems.
  - Examples: IBM System/360, DEC PDP-11.
- **Fourth Generation (1970s-1980s):**
  - Microprocessors emerged, leading to personal computers.
  - GUI (Graphical User Interface) and desktop computing.
  - Networking and the internet began to develop.
  - Examples: Apple II, IBM PC.
- **Fifth Generation (1980s-Present):**
  - Advances in microprocessors, memory, and storage.
  - AI and expert systems development.
  - Internet and mobile computing revolution.
  - Examples: Modern PCs, smartphones, and supercomputers.
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****BATCH PROCESSING AND PIPELINE PROCESSING:****

1)**Batch Processing (Definition):**

Batch processing is a computer processing method where a group of tasks or data is collected, processed, and executed together as a batch, without the need for real-time user interaction. It is often used for repetitive, resource-intensive, or non-time-sensitive tasks.

Use of Batch Processing (Example): In banking, batch processing is used to process all the overnight transactions together, such as updating account balances, verifying transactions, and generating account statements. This ensures accuracy and efficiency in handling a large volume of financial data while minimizing the need for real-time processing.

2)**Pipeline Processing (Definition):**

Pipeline processing is a computer processing technique where a complex task is divided into smaller, sequential stages, and each stage is processed simultaneously by different components or units. This approach aims to enhance processing speed and efficiency by allowing multiple tasks to overlap in execution.
Here are the key stages typically found in a simple instruction pipeline:

- **Instruction Fetch (IF):** Fetch the next instruction from memory.
- **Instruction Decode (ID):** Decode and analyze the fetched instruction to determine the operation to be performed and the required operands.
- **Execution (EX):** Execute the operation specified by the instruction, which may involve arithmetic, logic, or data manipulation.
- **Memory Access (MEM):** Perform memory-related operations, such as loading data from memory or storing data into memory.
- **Write Back (WB):** Write the results of the instruction execution back to registers or memory.
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Pipeline processing is commonly used in modern microprocessor and CPU designs to maximize the CPU's performance

2)Basics of computer organisation:

1)CPU(CENTRAL PROCESSING UNIT):

The CPU (Central Processing Unit) is the primary component responsible for executing instructions and performing calculations in a computer. It consists of several main components, including:

- **Control Unit (CU):** The control unit manages and coordinates the execution of instructions. It fetches instructions from memory, decodes them, and controls the flow of data within the CPU.
- **Arithmetic Logic Unit (ALU):** The ALU performs mathematical calculations (arithmetic) and logical operations (e.g., AND, OR) as instructed by the control unit. It's responsible for carrying out the actual data processing.
- **Registers:** Registers are small, high-speed storage locations within the CPU. They are used to store data temporarily during processing. Common types of registers include the following:
    - **Program Counter (PC):** Keeps track of the memory address of the next instruction to be fetched.
    - **Instruction Register (IR):** Holds the current instruction being executed.
    - **General-Purpose Registers:** Used for various data manipulation tasks during program execution.
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2)MEMORY:

Memory in computing refers to the storage and retrieval of data and instructions that the computer's central processing unit (CPU) can access quickly. There are several types of memory in a typical computer system, each serving a different purpose:

1. **Primary Memory:**

- **RAM (Random Access Memory):** RAM is volatile memory used for temporarily storing data that the CPU needs for current operations. It provides fast access but loses its contents when the computer is turned off or restarted.

Ram is of two types.they are

Static RAM (SRAM):

- **Operation:** SRAM uses flip-flops to store data, which doesn't require refreshing.
- **Speed:** SRAM is faster and provides low-latency access to data.
- **Stability:** Data remains stable as long as power is supplied.
- **Complexity:** SRAM is more complex, requiring more transistors per bit of storage.
- **Usage:** Commonly used in CPU caches and high-speed registers.

Dynamic RAM (DRAM):

- **Operation:** DRAM stores data as electrical charges in capacitors, requiring periodic refreshing.
- **Speed:** DRAM is slower than SRAM.
- **Stability:** Data in DRAM cells must be constantly refreshed to prevent data loss.
- **Density:** DRAM is more space-efficient, allowing for larger memory capacities on a single chip.
- **Usage:** commonly used for RAM in computers and mobile devices due to cost-effectiveness and capacity.

- **ROM (Read-Only Memory):** ROM is non-volatile memory that contains firmware or software instructions required for booting up the computer. It cannot be written to or modified by regular software.

Rom is further classified as

- **Mask ROM (MROM):** Mask ROM is a type of non-volatile memory where data is permanently encoded during manufacturing, making it unchangeable and ideal for storing critical firmware and system software.
- **Programmable ROM (PROM):** PROM allows users to program data onto the memory once, after which it becomes permanent and unalterable. It's used for software distribution and firmware storage.
- **Erasable Programmable ROM (EPROM) and Electrically Erasable Programmable ROM (EEPROM):** EPROM can be erased using ultraviolet light and then reprogrammed, while EEPROM allows for electrical erasure and reprogramming, making them suitable for applications that require occasional updates or modifications.

2. **Secondary Memory or storage devices:**

- **Hard Disk Drive (HDD):** HDDs are magnetic storage devices that provide high-capacity, non-volatile storage for long-term data. They are relatively slow compared to RAM but are suitable for large files and long-term storage.

- **Solid-State Drive (SSD):** SSDs use flash memory to store data, offering faster access times and better durability than HDDs. They are commonly used for faster storage and as a boot drive in modern computers.
- **Optical Drives (CD/DVD/Blu-ray):** These use laser technology to read and write data on optical discs. They are used for data backup, media playback, and software installation.
- **USB Flash Drives:** USB drives are portable and use flash memory for data storage. They are convenient for transferring files and carrying data on the go.
- **Memory Cards:** Memory cards, like SD cards, are used in devic
es such as digital cameras and smartphones to store photos, videos, and other data.

3. **Cache Memory:**
- **L1, L2, and L3 Cache:** Cache memory is a high-speed, small-capacity memory located closer to the CPU. It stores frequently accessed data and instructions to speed up CPU operations.

4. **Virtual Memory:**
* Virtual memory is a portion of the hard drive or SSD used as an extension of RAM. It allows the computer to use disk space to supplement RAM when it runs out of physical memory.

5. **Registers:** Registers are small, high-speed memory locations within the CPU used for storing data temporarily during processing.

These memory types work together to enable a computer to function efficiently. RAM provides the CPU with fast, temporary storage for actively used data and instructions, while secondary storage devices like HDDs, SSDs, and optical drives store data for the long term. Cache memory and registers help bridge the speed gap between RAM and the CPU, optimizing performance.

3)INPUT AND OUTPUT DEVICES:

These are devices that allow the computer to interact with the external world, such as keyboards, mice, monitors, printers, and network connections.

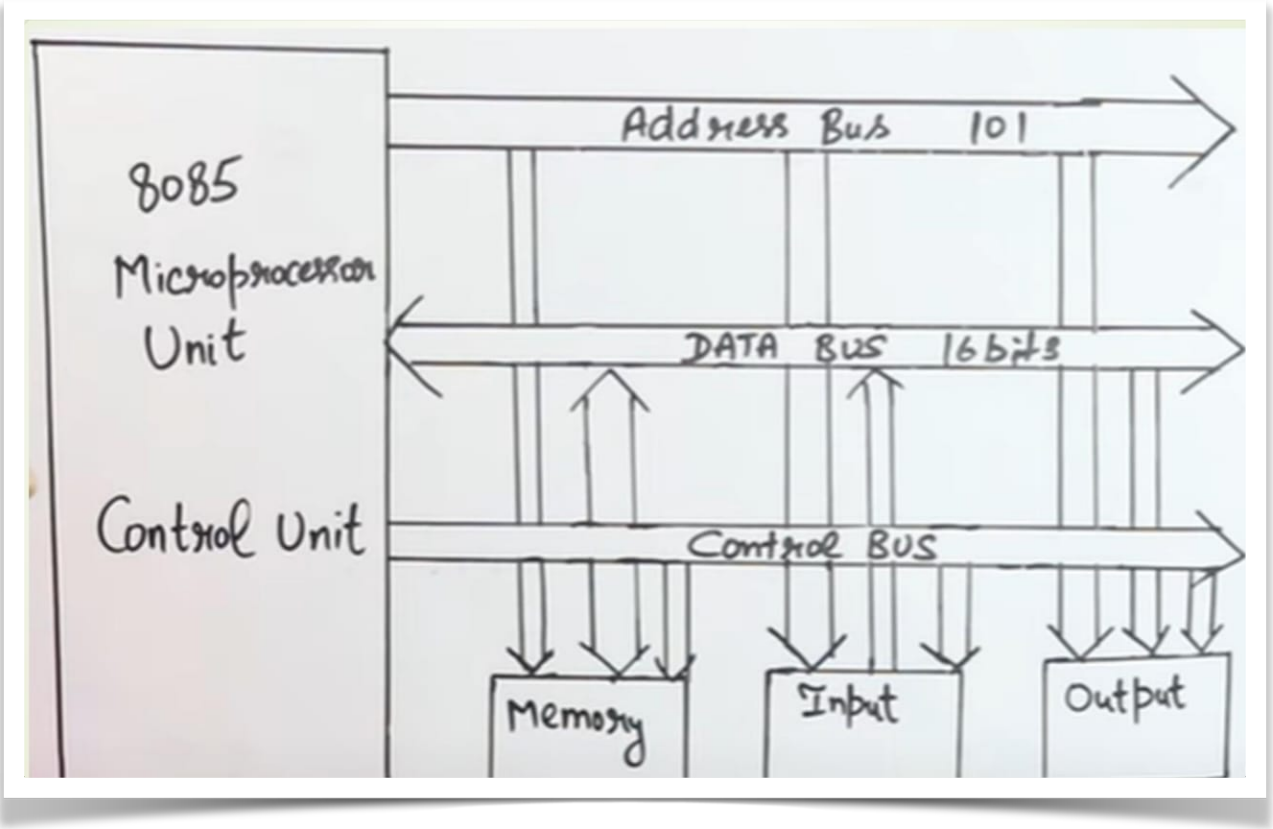
3)NUMBER SYSTEM :

Refer DLD notes for number system detailed information.

4)BUSES:

In computer architecture, buses are communication pathways that allow data and control signals to flow between various components of a computer.There are two main types of buses in computer they are 1.system bus
2.I/O bus or expansion bus

- 1.**System Bus:** The system bus is a collection of various buses that connect the CPU, memory, and peripheral devices.



- DIAGRAM OF SYSTEM BUS ARCHITECTURE
- It includes the data bus, address bus, and control bus.
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- **Data Bus:** The data bus carries data between the CPU (Central Processing Unit) and memory or between other components. It is a bidirectional bus.Its width, measured in bits, determines how much data can be transferred simultaneously.

- **Address Bus:** The address bus carries memory addresses from the CPU to memory and peripheral devices. It specifies the location in memory for data read or written.It is a unidirectional bus.
- **Control Bus:** The control bus carries control signals between the CPU and other devices, indicating actions such as read, write, or reset. It manages the flow of data and control within the computer.
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- 2.**Expansion Bus:** An expansion bus allows additional components, such as graphics cards, network cards, and storage controllers, to be added to the computer. Common expansion bus standards include PCI and PCIe.
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Understanding these buses is crucial for computer architects and hardware engineers as they design and optimize the flow of data and control signals within a computer system. The characteristics of these buses, such as their width and speed, impact the overall performance and capabilities of a computer.

5)INTERFACE:

An interface is a boundary or connection point that enables communication between different components, systems, or devices. It defines the methods or protocols that components must follow to interact with each other. Interfaces are used for interoperability, enabling different software or hardware entities to work together seamlessly, share data, or perform coordinated tasks, enhancing flexibility and compatibility in various applications.

6)MOTHERBOARD:

A motherboard is the central circuit board of a computer, serving as the main platform for connecting and powering all internal hardware components. Key points about motherboards include:

1. **Form Factor:** Motherboards come in various sizes and shapes known as form factors (e.g., ATX, MicroATX). The form factor dictates the motherboard's physical dimensions and layout.

2. **CPU Socket:** The motherboard features a CPU socket, where the central processor (CPU) is installed. It determines compatibility with specific CPU models.

3. **RAM Slots:** Motherboards have slots for installing RAM (Random Access Memory) modules, which provide temporary storage for data and instructions for the CPU.

4. **Expansion Slots:** These slots allow for the connection of additional hardware components like graphics cards, sound cards, and network cards.

5. **Chipset:** The chipset is a set of integrated circuits responsible for managing data flow between the CPU, RAM, storage devices, and peripherals.

6. **Connectors:** Motherboards offer various connectors, including USB, SATA, and PCIe, to connect storage drives, peripherals, and expansion cards.

7. **Power Connectors:** The motherboard has connectors for receiving power from the power supply unit (PSU) and distributing it to other components.

8. **BIOS/UEFI:** Motherboards contain firmware (BIOS or UEFI) responsible for booting the computer and managing hardware settings.

9. **I/O Ports:** On the rear I/O panel, motherboards feature ports for connecting external devices like monitors, keyboards, and USB devices.

10. **Integrated Components:** Some motherboards come with built-in components like audio controllers, LAN ports, and Wi-Fi modules.

11. **Overclocking Support:** High-end motherboards often provide features for enthusiasts to overclock the CPU and RAM for improved performance.

12. **CMOS Battery:** A small battery on the motherboard powers the CMOS memory, which stores BIOS settings and the system's real-time clock.

Motherboards serve as the foundation for building a computer system, determining compatibility between components and influencing system performance and functionality. Choosing the right motherboard is essential when building or upgrading a computer.

7)PORTS,CONNECTORS AND JUMPERS:

Ports: Ports are physical interfaces on a computer or device used for connecting external peripherals and accessories. They facilitate data transfer, power delivery, or other functions. Common examples include USB ports, HDMI ports, Ethernet ports, and audio ports.

Connectors: Connectors are the specific plugs or receptacles that fit into ports to establish a connection. They have distinct shapes and sizes to ensure compatibility with corresponding ports, allowing different devices to communicate or share resources

Jumpers: A jumper is a small device used on computer hardware to create or break electrical connections.They help users to set up or customize how a device works by connecting or disconnecting certain parts on the device's circuit board. By changing jumpers, you can change how the hardware behaves without needing to change the actual components.

8)HTTP,HTTPS,URL,DNS AND SERVERS:

- **HTTP (Hypertext Transfer Protocol) and HTTPS (Hypertext Transfer Protocol Secure):**
- HTTP is a protocol used for transferring data over the internet. It is the foundation of data communication on the World Wide Web.
- HTTPS is a secure version of HTTP that encrypts data during transmission, ensuring privacy and security for users.
- **URL (Uniform Resource Locator**):

- A URL is a web address that specifies the location of a resource on the internet. It consists of a protocol (e.g., HTTP or HTTPS), a domain name (e.g., www.example.com), and a path to the resource

DNS(Domain name system):

DNS is like the internet's address book. It translates human-readable domain names like "www.google.com" into machine-readable IP addresses like "172.217.14.238". This allows us to access websites by typing in their domain names instead of their IP addresses.

When you type a domain name into your web browser, your browser sends a request to a DNS server. The DNS server looks up the domain name in its database and returns the corresponding IP address. Your browser then uses the IP address to connect to the website.

DNS is a critical part of the internet. Without DNS, we would have to remember long strings of numbers to access websites. DNS makes it possible to use human-readable names, which makes the internet much more user-friendly.

SERVERS:

A server is a specialized computer or software system designed to provide services, resources, or data to other computers, known as clients, over a network. Servers play a crucial role in the functioning of networks and the internet. Here are some key aspects of servers:

- **Types of Servers:**
  - **Web Servers:** These servers store and serve web pages and web applications to users' browsers. Apache and Nginx are popular web server software.
  - **Email Servers:** They handle email communication, storing and forwarding messages. Examples include Microsoft Exchange and Postfix.
  - **File Servers:** These servers store and manage files, allowing users to access shared files and documents over a network.
  - **Database Servers:** They manage and provide access to databases, allowing applications to store and retrieve data efficiently. MySQL and PostgreSQL are common database server software.
  - **Application Servers:** These servers run applications and provide services to clients. They are commonly used in enterprise environments.
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- **Server Security:** Servers are a prime target for cyberattacks, so robust security measures are essential. This includes firewalls, intrusion detection systems, encryption, and regular software updates.
- **Scalability:** Servers should be designed to handle increasing workloads. Scalability can be achieved through techniques like load balancing and clustering.

9)BOOTLOADER:

A bootloader is a small program that is responsible for loading the operating system (OS) into the computer's memory. It is the first program that runs when the computer is turned on.

The bootloader typically resides in a special area of the computer's memory called the Master Boot Record (MBR). The MBR is located at the beginning of the hard drive.

When the computer is turned on, the BIOS (Basic Input/Output System) loads the bootloader from the MBR. The bootloader then loads the operating system into memory and starts it running.

The one more important component of the boot process in a computer is POST(Power-on-self-test).POST is a part of BIOS. It is a series of tests that the BIOS runs when the computer is turned on. It checks the hardware to make sure that it is working properly.

Here is a simplified explanation of what happens in a bootloader:

1. The BIOS checks the hardware and initializes it.
2. The BIOS loads the bootloader from the MBR.
3. The bootloader scans the hard drive for operating systems.
4. The bootloader allows the user to choose which operating system to boot.
5. The bootloader loads the selected operating system into memory.
6. The operating system starts running.

The bootloader is an essential part of the boot process. It ensures that the operating system is loaded and started correctly. Without a bootloader, the computer would not be able to boot up.