COMA ASSIGNMENT 1 SOLUTIONS

Define Microprocessor:

- A microprocessor is a central processing unit (CPU) that serves as the brain of a computer or electronic device, capable of executing instructions stored in memory.

Difference between Microprocessor and Microcontroller:

- Microprocessor is primarily focused on processing data and executing instructions, while a microcontroller integrates a CPU with peripherals like memory, input/output ports, timers, and often includes built-in functions for specific applications.
- Microcontrollers are designed for embedded systems and specific tasks, offering a more compact and integrated solution, whereas microprocessors are more general-purpose.
- Microcontrollers are commonly found in devices like washing machines, microwaves, and automotive systems, whereas microprocessors are used in computers and larger computing systems.

a. **Define:**

- **Bit:** The smallest unit of data, representing a binary digit (0 or 1).
- **Nibble:** A group of 4 bits.
- **Byte:** A group of 8 bits.
- **Word:** The natural unit of data for a particular microprocessor, typically 16, 32, or 64 bits.
- **Instruction:** A binary-coded operation code that the microprocessor executes.

b. **What is the meaning of an 8-bit processor?**

- A processor that processes 8 bits of data in a single operation.

c. **What is Mnemonics?**

- Mnemonics are symbolic names used to represent machine-level instructions.

d. **Define:**

- **Assembly language:** A low-level programming language with mnemonic instructions that correspond to machine code.
- **Machine language:** The set of instructions executed directly by a computer's central processing unit (CPU).

- **High-level language:** A programming language with higher abstraction, making it easier for humans to write code.

e. **What is an Assembler?**

- An assembler is a program that translates assembly language into machine code.

f. **What is a Compiler?**

- A compiler is a program that translates high-level language code into machine code.

g. **Which information is given by the address line?**

- The address lines provide the location of data or instructions in the memory.

h. **Data bus is always bidirectional True/False**

- False

i. **Microcontroller is faster than Microprocessor, justify the statement.**

- False, as the speed of microcontrollers and microprocessors depends on various factors, and one is not inherently faster than the other.

j. **Why do we need a clock in microprocessor?**

- To synchronize and control the execution of instructions, ensuring proper coordination of various operations within the microprocessor.

l. **Advantages of Assembly Language over High-level Language:**

- Assembly language provides more direct control over hardware, efficient memory utilization, and specific optimization for a particular architecture.

m. **Full name of:**

- **RAM:** Random Access Memory
- **ROM:** Read-Only Memory
- **ALU:** Arithmetic Logic Unit
- **SSI:** Small-Scale Integration
- **MSI:** Medium-Scale Integration
- **VLSI:** Very Large Scale Integration
- **ASCII:** American Standard Code for Information Interchange

n. **What do you mean by peripherals?**

- Peripherals are external devices connected to a computer or microprocessor, providing input or receiving output.

o. **How much memory is accessed by 8085 microprocessor?**

- 64 KB of memory.

p. **ALU stands for:**

- Arithmetic Logic Unit.

q. **Purpose of Control Unit of Microprocessor:**

- It coordinates and manages the operations of the microprocessor, fetching and decoding instructions.

r. **Justify "Microprocessor is a programmable device":**

- Microprocessors can execute a variety of instructions and perform different tasks based on the programmed set of instructions.

s. **Justify "The direction of address bus is unidirectional":**

- The address bus is used to send memory addresses from the microprocessor to memory, and it doesn't need information from memory, making it unidirectional.

t. **Difference between 4-bit microprocessor and 8-bit microprocessor:**

- The main difference is in the width of data bus; 4-bit processes 4 bits at a time, while 8-bit processes 8 bits at a time.

u. **Difference between assembly language and machine language:**

- Assembly language uses mnemonics and is human-readable, while machine language is in binary code and directly understood by the computer.

v. **Use of Registers in microprocessor:**

- Registers are used to store and manage data temporarily during microprocessor operations.

w. **CISC and RISC stand for:**

- **CISC:** Complex Instruction Set Computer
- **RISC:** Reduced Instruction Set Computer

x. **What is Op-code?**

- Op-code (operation code) is a part of the machine instruction specifying the operation to be performed.

y. **What is Operand?**

- Operand is the data or variable on which the operation specified by the op-code is to be performed.

z. **Difference between general-purpose microprocessor and special-purpose microprocessor:**

- General-purpose microprocessors are designed for a variety of applications, while special-purpose microprocessors are tailored for specific tasks or functions.

1. **How many maximum memory locations and I/O devices can be addressed by an 8085 Microprocessor?**
    - The 8085 Microprocessor can address up to 64 KB of memory locations and 256 I/O devices.
2. **Explain the use of HOLD and HLDA pins of 8085 microprocessor.**
    - The HOLD pin is used by external devices to request control of the buses, and the HLDA (HOLD Acknowledge) pin indicates that the 8085 has granted control to the requesting device.
3. **State the difference between op-code fetch (OF) and memory read (MR) cycles.**
    - In the op-code fetch cycle, the microprocessor fetches the instruction code from memory, while in the memory read cycle, it retrieves data from the memory.
4. **State the importance of X1 and X2 pins of an 8085 microprocessor.**
    - X1 and X2 pins are connected to an external crystal oscillator to provide the microprocessor with a clock signal, essential for synchronization and proper operation.
5. **What is an interrupt? Enlist the hardware interrupt sources (pins) available on the 8085 Microprocessor chip.**
    - An interrupt is a mechanism that temporarily diverts the microprocessor's attention to handle a specific event. Hardware interrupt sources on the 8085 include RST7.5, RST6.5, RST5.5, INTR, and TRAP pins.
6. **Explain the use of READY pin of an 8085 microprocessor.**
    - The READY pin indicates whether the external devices and memory are ready to respond to the microprocessor's request. If READY is high, the microprocessor waits; if low, it proceeds with the operation.
7. **Explain RESETIN AND RESETOUT pin of an 8085 microprocessor.**

- RESETIN is the input pin for the reset signal, and RESETOUT is the output pin that provides a reset signal to other devices. They help in initializing and synchronizing the system.

8. **What is Instruction Cycle?**
    - The instruction cycle is the time taken by the microprocessor to fetch, decode, and execute a machine language instruction.
9. **What is Machine Cycle?**
    - A machine cycle is the time required to complete one operation of the microprocessor, consisting of one or more T-states. It includes fetch, read, and write cycles.
10. **What is T-state? What is the time period of a crystal that generates a 5MHz frequency in a Microprocessor?**
    - **T-state:** A single time unit in the microprocessor's operation.
    - The time period of a crystal generating a 5MHz frequency is 200 nanoseconds (1/5MHz).
11. **Which interrupt has the highest priority of 8085 Microprocessor?**
    - The TRAP interrupt has the highest priority among interrupts in the 8085 Microprocessor.
12. **Explain the function of the ALE and IO/M signal of the 8085 microprocessor.**
    - ALE (Address Latch Enable) is used to latch the address from the multiplexed address/data bus during the first clock cycle. IO/M (Input/Output, Memory) signal differentiates between memory and I/O operations.
13. **Define: Assembly language, machine language, high-level language**
    - **Assembly language:** Low-level programming language using mnemonic codes representing machine-level instructions.
    - **Machine language:** The binary-coded language directly understood and executed by the computer's central processing unit.
    - **High-level language:** A programming language with higher abstraction, making it more human-readable and user-friendly.
14. **Define: Assembler, Compiler, Mnemonics, Instruction.**
    - **Assembler:** A program that translates assembly language into machine code.
    - **Compiler:** A program that translates high-level language code into machine code.
    - **Mnemonics:** Symbolic names representing machine-level instructions.
    - **Instruction:** A binary-coded operation code executed by the microprocessor.
15. **Define Microprocessor and explain the difference between microprocessor and microcontroller.**
    - **Microprocessor:** A central processing unit (CPU) that executes instructions and processes data.
    - **Difference:** A microprocessor is a standalone processing unit, while a microcontroller integrates a CPU with peripherals like memory and I/O for specific tasks.
16. **If the clock frequency is 5MHz, how much time is required to execute an instruction of 18 T-States?**

- The time required is 3.6 microseconds (18 T-States * 1/5MHz).

☐

Explain Bus organization/bus structure of 8085 Microprocessor.

- The 8085 Microprocessor has a 16-bit address bus, capable of addressing 64 KB of memory. It also has an 8-bit data bus for data transfer. The address and data buses are multiplexed, sharing the same set of lines. Control signals like RD (Read), WR (Write), and IO/M (Input/Output, Memory) differentiate between memory and I/O operations, ensuring effective communication within the system.

☐ **Explain the Flag Register of 8085 Microprocessor.**

- The Flag Register in the 8085 Microprocessor contains various flags indicating the status of the ALU (Arithmetic Logic Unit) after an operation. Flags include the Zero flag (Z), Sign flag (S), Parity flag (P), Carry flag (CY), and Auxiliary Carry flag (AC). These flags are crucial for conditional branching and decision-making during program execution.

☐ **Explain the Programming model/Registers of 8085.**

- The 8085 Microprocessor has six general-purpose registers (B, C, D, E, H, and L), which can be used individually or paired as register pairs BC, DE, and HL. The Accumulator (A) is the primary register for arithmetic and logic operations. Additionally, there are two index registers, Stack Pointer (SP) and Program Counter (PC), along with a Flag Register. These registers collectively form the programming model, providing storage for data and addressing locations in memory.
- **Explain Controlling signals generating logic circuit. / Generation of Control signals in 8085.**
    - The controlling signals in 8085, such as RD, WR, IO/M, etc., are generated by a logic circuit known as the Control Signal Generator. This circuit interprets the machine cycle and status signals to produce the appropriate control signals. For instance, RD (Read) is generated during memory read cycles, and WR (Write) is generated during memory write cycles. The logic circuit ensures synchronization and proper control during various microprocessor operations.
- **Explain the De-multiplexing of data and address bus (AD7-AD0) with a neat diagram.**
    - The de-multiplexing of the data and address bus in 8085 involves using the Address/Data Latch and Demultiplexer. The AD7-AD0 bus serves as both address and data bus. The Address/Data Latch captures the address during the first clock cycle, and the Demultiplexer routes the data during subsequent cycles. This process allows time-sharing of the bus, ensuring efficient data and address transfer. A diagram illustrates the flow of control signals and data in this de-multiplexing process.
- **Explain the different addressing modes of 8085 microprocessor.**
    - The 8085 microprocessor supports various addressing modes:
        - **Immediate Addressing:** Operand is specified in the instruction.

        - **Register Addressing:** Operand is in a register.
        - **Direct Addressing:** Operand's address is given in the instruction.
        - **Indirect Addressing:** Operand's address is stored in a register or memory.
        - **Implied Addressing:** No explicit operand address in the instruction; the operation implies the addressing mode. Understanding these modes is crucial for effective programming.
- **Classify / Explain the types of instructions based on the number of bytes/words/size.**
    - Instructions in 8085 are classified based on size:
        - **One-Byte Instructions:** These occupy one byte of memory and include simple operations.
        - **Two-Byte Instructions:** Consist of an opcode followed by an immediate operand or an address.
        - **Three-Byte Instructions:** Involve an opcode followed by a 16-bit address.
        - **Multi-Byte Instructions:** Comprise more than three bytes, involving complex operations or conditional branching. Understanding instruction size is essential for efficient program organization and memory utilization.

1. **Draw the functional block diagram / Architecture of 8085 and explain its working.**
    - **Question:** Can you illustrate the functional block diagram of the 8085 Microprocessor?
    - **Answer:** The 8085 architecture consists of functional blocks like ALU, Register Array, Control Unit, and Bus Interfacing Unit. The Control Unit fetches and decodes instructions, coordinating the execution. The ALU performs arithmetic and logic operations, while registers store data temporarily. The Bus Interfacing Unit manages data and address buses, connecting the processor to memory and peripherals. The architecture's synergy enables the microprocessor to fetch, decode, and execute instructions systematically.
2. **Draw the Pin diagram of 8085 Microprocessor and explain each pin.**
    - **Question:** Provide the pin diagram of the 8085 Microprocessor and explain the purpose of each pin.
    - **Answer:** The pin diagram includes address and data buses (AD0-AD7, A8-A15), control signals (RD, WR, IO/M), and status signals (S0, S1, S2). Other essential pins are CLK (clock input), RESET (reset input), and INTA (interrupt acknowledge). The address bus carries memory addresses, while the data bus manages data transfer. Control signals regulate read/write operations. The clock input synchronizes activities, and RESET initializes the microprocessor. Understanding each pin's role is crucial for proper interfacing and system operation.

Explain the categories of 8085 instructions that manipulate data with suitable examples.

- **Data Transfer Instructions:** MOV A, B transfers the content of register B to register A.
- **Arithmetic Instructions:** ADD B adds the content of register B to the accumulator.
- **Logical Instructions:** ANI 0FH performs a logical AND operation with the immediate data and the accumulator.
- **Branching Instructions:** JMP 2050H causes an unconditional jump to the specified address.
- **Control Transfer Instructions:** CALL 3000H calls a subroutine at the specified address.
- **Stack Instructions:** PUSH B pushes the content of register B onto the stack.
- **I/O Instructions:** IN 01H reads data from input port 01H.
- **Immediate Instructions:** MVI A, 35H loads the immediate data 35H into the accumulator.

Draw the 4K RAM and 4K byte memory interfacing circuit with 8085 microprocessor.

- Unfortunately, I can't draw images, but a typical interfacing circuit involves address and data buses connected to RAM, control signals like RD, WR, and ALE, and power connections. The 8085's address bus connects to the RAM's address input, allowing the processor to select specific memory locations. The data bus facilitates the transfer of data between the microprocessor and RAM. Control signals coordinate read and write operations. Power connections ensure proper functioning. The circuit ensures seamless communication between the 8085 microprocessor and the 4K RAM.