POSTAL BOOK PACKAGE 2024

ELECTRICAL ENGINEERING

CONVENTIONAL Practice Sets

CONTENTS

MICROPROCESSORS

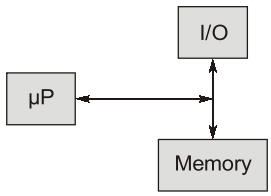
1 CHAPTER
Introduction to 8085 and its Functional Organisation

Q.1 Explain what do you understand by microprocessor. List a few of its uses.

Solution:

Microprocessor is a programmable, clocked register based electronic device that reads binary instruction from its memory and does the processing over it.

Microprocessor is an electronic chip that has a computing and decision making capability. When this microprocessor is used as a CPU in a system, then it is called as a microcomputer.



Uses of microprocessor:

(i) Industrial PID controllers
(ii) Calculators
(iii) Data acquisition systems
(iv) Laptop and personal computers

Q.2 List the registers used in 8085.

Solution:

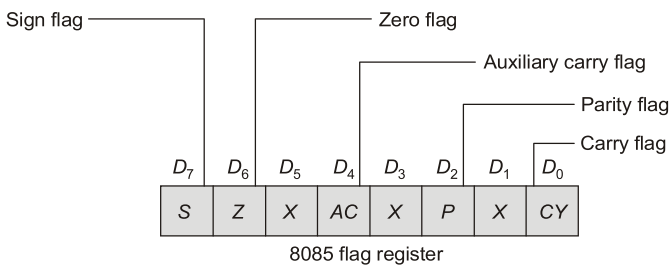
Registers are used in the microprocessor to store data temporarily during execution of program and may or may not be accessible to the users.

Important registers used in 8085 are:

(i) Accumulator (8-bit)
(ii) Register B (8-bit)
(iii) Register C (8-bit)
(iv) Register D (8-bit)
(v) Register E (8-bit)
(vi) Register H (8-bit)
(vii) Register L (8-bit)
(viii) Stack pointer (16-bit)
(ix) Program counter (16-bit)
(x) Flag register (8-bit)

Q.3 Describe the flags of 8085 microprocessor.

Solution:



The 8085 microprocessor has 5 flags:

1. **Zero:** It is set to 1 when result is zero. Otherwise it is reset to zero.
2. **Carry:** If an arithmetic operation results in carry, it is set otherwise it is reset.
3. **Auxiliary carry:** In an arithmetic operation, when carry is generated by digit D_3 and passed to digit D_4, the AC flag is set.
4. **Parity:** If the result has an even number of 1's the flag is set, for an odd number of 1's the flag is reset.
5. **Sign:** It is set if MSB of the result is 1, otherwise it is reset.

Q.4 **In 8085 microprocessor, what is the advantage of multiplexing the address bus with a data bus?**

Solution:

Advantages of multiplexing the address bus with data bus are as follows:

1. Reduction in the number of pins required in the microprocessor. We save 8 pins at the cost of 1 ALE pin by using multiplexing.
2. Reduction in cost of microprocessor.
3. Reduction in space required by the microprocessor.
4. More efficient use of address bus since if it was used only for addressing, it would have remained idle for most of the T states.
5. Multiplexing address and data buses in the microprocessor allows for multiplexing in other peripheral devices as well without additional hardware. This results in a lot of cost + space saving for the whole circuit.

Q.5 **Describe the various addressing modes in the microprocessor 8085. Give suitable examples for each addressing mode.**

Solution:

1. **Immediate addressing mode:** In this mode, the 8/16 bit data is specified in the instruction itself as one of its operand. Eg. MVI B, 20 H
2. **Register addressing mode:** In this mode, the data is copied from one register to another i.e. the operands are specified as contents of a register. **Eg.** MOV A, B
3. **Direct addressing mode:** The address of the operand is specified in the instruction.
   Eg. LDA 3000 H
4. **Indirect addressing mode:** The data is transferred from the address pointed by the data in a register to another register. The address of the operand is in a register. **Eg.** MOV A, M
5. **Implied addressing mode:** The operand is implicit in the instruction and is not given explicitly.
   Eg. RAL, CMP etc.

Q.6 **Explain different types of interrupts available in an 8085 microprocessor in details.**

Solution:

An interrupts is a signal to the processor generated by hardware or software indicating an event that needs immediate action.

Types of Interrupts:

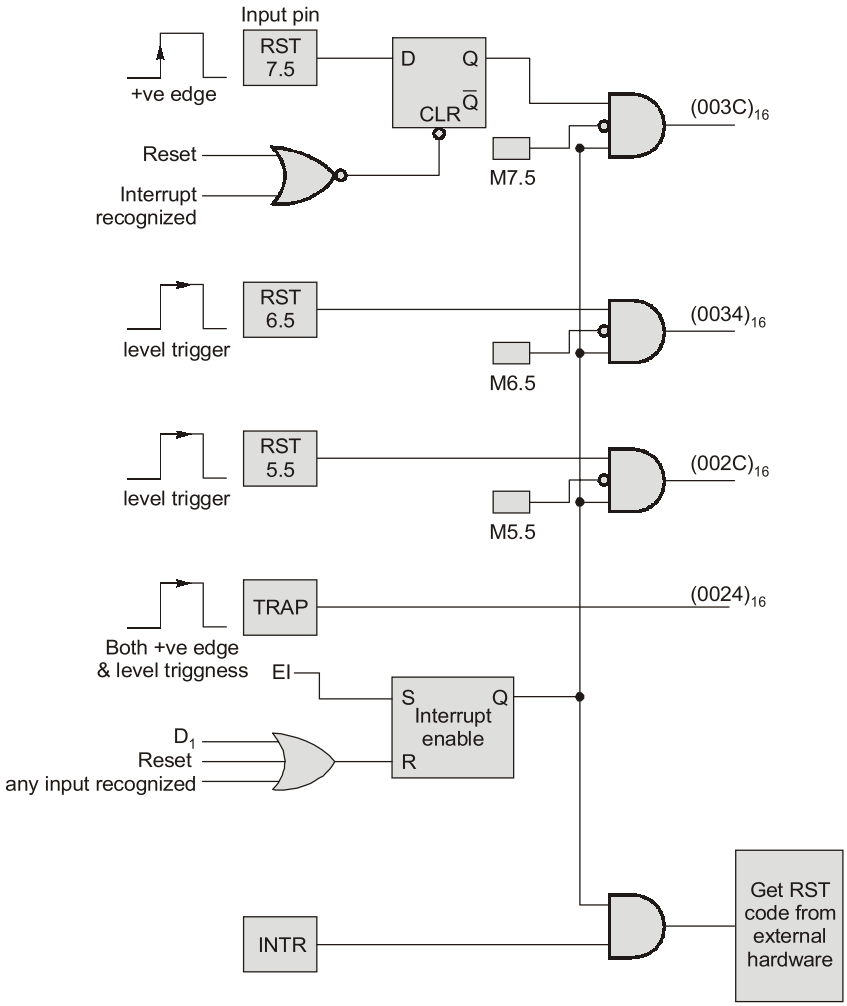
The 8085 has multilevel interrupt system. It supports two types of interrupts:

(a) Hardware **(b)** Software

Hardware: An external device initiates the hardware interrupts and placing an appropriate signal at the interrupt pin of the processor. If the interrupt is accepted, then the processor executes an interrupt service routine.

Software: The cause of the interrupt is an execution of the instruction. These are special instructions supported by the microprocessor. After execution of these instructions microprocessor completes the execution of the instruction it is currently executing and transfers the program control to sub-routine.

There are five hardware interrupts:



TRAP:

- is a non-maskable interrupt.
- TRAP has the highest priority and vectored interrupt
- +ve edge and level triggered
- in case of sudden power failure, it executes a ISR and send the data from main memory to back up memory.

RST 7.5:

- is a maskable interrupt
- has the second highest priority
- is edge sensitive
- enabled by EI instruction

RST 6.5 & 5.5:

- both are level triggered i.e. input goes to high and stay high until it recognized
- maskable interrupt
- RST 6.5 has 3rd priority and RST 5.5 has 4th priority

INTR:

- is a maskable interrupt
- enabled by EI instruction
- it is a level sensitive interrupts

Software Interrupts in 8085:

The 8085 has eight software interrupts from RST0 to RST7. The vector address for these interrupts can be calculated as:

Interrupt number × 8 = vector address

Instruction	Vector add
RST 0	0000H
RST 1	0008H
RST 2	0010H
RST 3	0018H
RST 4	0020H
RST 5	0028H
RST 6	0030H
RST 7	0038H

Q.7 What are the functions of the following pins of 8085 microprocessor?

(i) READY (ii) ALE

(iii) HOLD (iv) TRAP

Solution:

(i) **READY (Input):** It is used by the microprocessor to sense or detect whether a peripheral is ready to transfer the data or not. A slow peripheral may be connected to the microprocessor through READY Line. If READY is HIGH the peripheral devices are ready, if it is LOW then the microprocessor waits till it goes HIGH.

(ii) **ALE : (Address Latch Enable):** This is a positive going pulse or signal that is generated every time the 8085 Microprocessor begins an operation. It goes HIGH during first clock cycle of a M/C and enables the lower 8-bits of the address to be Latched either into the memory or external Latch.

(iii) **HOLD (Input):** It indicates that another device is requesting for use of the address and data bus. After receiving a HOLD request, the microprocessor relinquishes the use of the buses as soon as the current machine cycle is completed. The processor regains the bus after the removal of the HOLD signal.

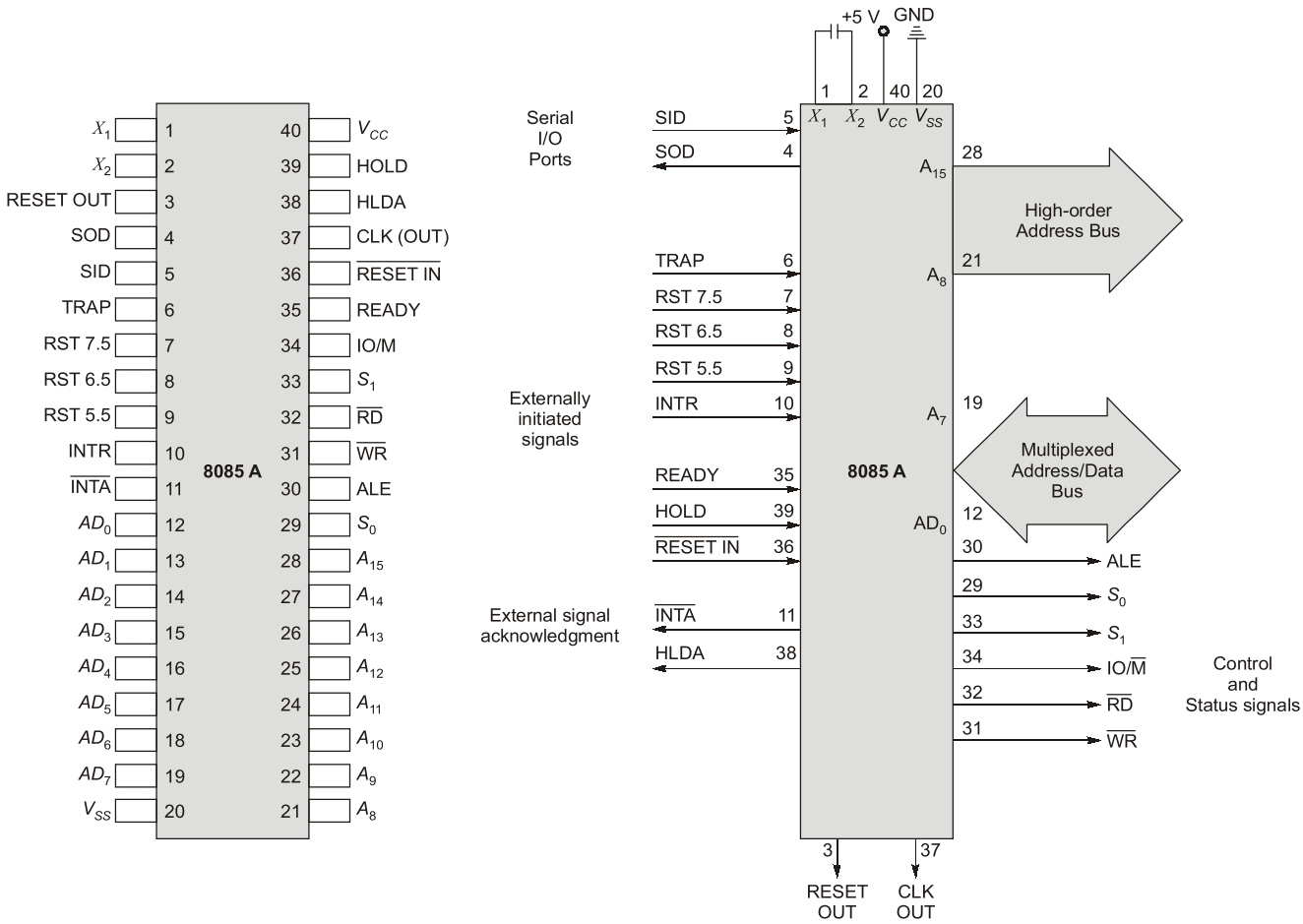
(iv) **TRAP (Input):** It is a non-maskable interrupt having the highest priority among all interrupts. It is unaffected by any mask or interrupt enable.

Q.8 Draw the Pin diagram of 8085 microprocessor and briefly explain it.

Solution:

The 8085 A (Commonly known as the 8085) is an 8-bit general purpose microprocessor, capable of addressing 64 K of memory. The device has forty (40) pins, requires a +5 V single power supply, and can operate with 3 MHz single phase clock.

- Figure below shows the pin diagram of 8085 microprocessor. All the pins can be classified into six groups:
  - ⇒ Address bus
  - ⇒ Data bus
  - ⇒ Control and Status signals
  - ⇒ Power supply and Frequency signals
  - ⇒ Externally initiated signals and
  - ⇒ Serial Input/output ports.



Address Bus:

- It is 16 bits of length.
- It is unidirectional bus.
- It is divided into two parts namely,
  Lower order address bus ($A_0 - A_7$) – called line number. Lower address bus is also multiplexed with data links.
  Higher order address bus ($A_8 - A_{15}$) – called page number.

Data Bus:

- It is 8 bits of length.
- It is bidirectional bus.
- It is multiplexed with lower order address bus with lines ($AD_0 - AD_7$).

Controls and Status Signals:

- $\overline{RD}$ and $\overline{WR}$ are called control signals.
- $IO/\overline{M}$, S_1 and S_0 are called status signals.
- ALE (Address Latch Enable) is a special signal to indicate the beginning of the operation.

$\overline{RD}$: Read:

- This is real control (active low) signal.
- It indicates that the selected I/O or memory is to be read.

$\overline{WR}$: Write

This is a write control (active low) signal. It indicates that the data on the data bus are to be written into a selected memory or I/O location.