GURU TEGH BAHADUR INSTITUTE OF TECHNOLOGY

M&M PRACTICAL FILE

[ETEC- 355]

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Experiment-1

AIM: Introduction to 8085 kit

Apparatus: 8085 IC, microprocessor kit, and power supply.

Theory:

Intel 8085 is an 8-bit microprocessor. It is 40-pin IC package fabricated on a single LSI chip. It uses a single +5 V supply. Its clock speed is about 3 MHz

It has the following configuration −

- 8-bit data bus
- 16-bit address bus, which can address upto 64KB
- A 16-bit program counter
- A 16-bit stack pointer
- Six 8-bit registers arranged in pairs: BC, DE, HL
- Requires +5V supply to operate at 3.2 MHZ single phase clock

It is used in washing machines, microwave ovens, mobile phones, etc.

$\Rightarrow$ **Functional Units**

8085 consists of the following functional units –

Accumulator

It is an 8-bit register used to perform arithmetic, logical, I/O & LOAD/STORE operations. It is connected to internal data bus & ALU.

Arithmetic and logic unit

As the name suggests, it performs arithmetic and logical operations like Addition, Subtraction, AND, OR, etc. on 8-bit data.

General purpose register

There are 6 general purpose registers in 8085 processor, i.e. B, C, D, E, H & L. Each register can hold 8-bit data.

These registers can work in pair to hold 16-bit data and their pairing combination is like B-C, D-E & H-L.

Program counter

It is a 16-bit register used to store the memory address location of the next instruction to be executed. Microprocessor increments the program whenever an instruction is being executed, so that the program counter points to the memory address of the next instruction that is going to be executed.

╇ Stack pointer

It is also a 16-bit register works like stack, which is always incremented/decremented by 2 during push & pop operations.

╇ Temporary register

It is an 8-bit register, which holds the temporary data of arithmetic and logical operations.

╇ Flag register

It is an 8-bit register having five 1-bit flip-flops, which holds either 0 or 1 depending upon the result stored in the accumulator.

These are the set of 5 flip-flops −

  i)   Sign (S)
 ii)   Zero (Z)
iii)   Auxiliary
 iv)   Carry (AC)
  v)   Parity (P)Carry (C)

Its bit position is shown in the following table −

D7	D6	D5	D4	D3	D2	D1	D0
S	Z		AC		P		CY

╇ Instruction register and decoder

It is an 8-bit register. When an instruction is fetched from memory then it is stored in the Instruction register. Instruction decoder decodes the information present in the Instruction register.

╇ Timing and control unit

It provides timing and control signal to the microprocessor to perform operations. Following are the timing and control signals, which control external and internal circuits −

> ➢ Control Signals: READY, RD', WR', ALE
> ➢ Status Signals: S0, S1, IO/M'
> ➢ DMA Signals: HOLD, HLDA
> ➢ RESET Signals: RESET IN, RESET OUT

╇ Interrupt control

As the name suggests it controls the interrupts during a process. When a microprocessor is executing a main program and whenever an interrupt occurs, the microprocessor shifts the control from the main program to process the incoming request. After the request is completed, the control goes back to the main program.

There are 5 interrupt signals in 8085 microprocessors: INTR, RST 7.5, RST 6.5, RST 5.5, TRAP.

✦ Serial Input/output control

It controls the serial data communication by using these two instructions: SID (Serial input data) and SOD (Serial output data).

✦ Address buffer and address-data buffer

The content stored in the stack pointer and program counter is loaded into the address buffer and address-data buffer to communicate with the CPU. The memory and I/O chips are connected to these buses; the CPU can exchange the desired data with the memory and I/O chips.

✦ Address bus and data bus

Data bus carries the data to be stored. It is bidirectional, whereas address bus carries the location to where it should be stored and it is unidirectional. It is used to transfer the data & Address I/O devices.

8085 Architecture

8085 DIAGRAM

```
  →X1    1 ┌──────────┐ 40   +5V
  →X2    2 │          │ 39   HOLD←
←RESOUT  3 │          │ 38   HLDA→
  ←SOD   4 │          │ 37   CLK→
  →SID   5 │          │ 36   RESIN←
  →TRAP  6 │          │ 35   READY←
→RST7.5  7 │          │ 34   IO/M̄→
→RST6.5  8 │          │ 33   S1→
→RST5.5  9 │  8085A   │ 32   R̄D̄→
  →INTR 10 │          │ 31   W̄R̄→
  ←INT̄Ā 11 │          │ 30   ALE→
  ↔AD0  12 │          │ 29   S0→
  ↔AD1  13 │          │ 28   A15→
  ↔AD2  14 │          │ 27   A14→
  ↔AD3  15 │          │ 26   A13→
  ↔AD4  16 │          │ 25   A12→
  ↔AD5  17 │          │ 24   A11→
  ↔AD6  18 │          │ 23   A10→
  ↔AD7  19 │          │ 22   A9→
   GND  20 └──────────┘ 21   A8→
```
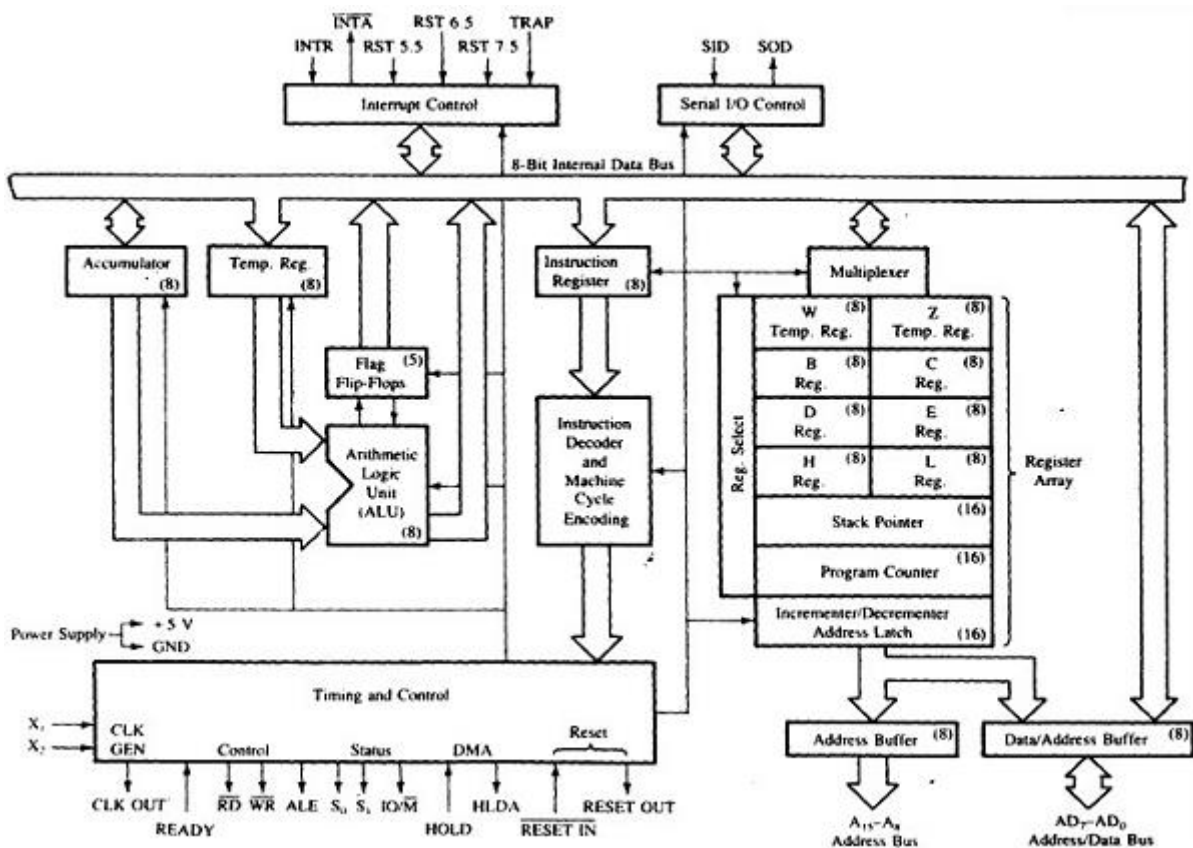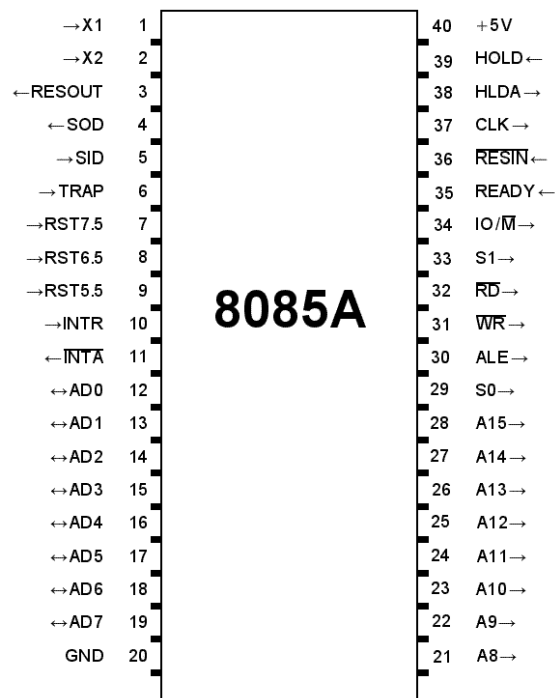
The pins of 8085 microprocessor can be classified into seven groups −

1. **Address bus**

   A15-A8, it carries the most significant 8-bits of memory/IO address.

2. **Data bus**

   AD7-AD0, it carries the least significant 8-bit address and data bus.

3. **Control and status signals**

   These signals are used to identify the nature of operation. There are 3 control signal and 3 status signals.

➢ Three control signals are RD, WR & ALE.
   ❖ **RD** − This signal indicates that the selected IO or memory device is to be read and is ready for accepting data available on the data bus.
   ❖ **WR** − This signal indicates that the data on the data bus is to be written into a selected memory or IO location.
   ❖ **ALE** − It is a positive going pulse generated when a new operation is started by the microprocessor. When the pulse goes high, it indicates address. When the pulse goes down it indicates data.

➢ Three status signals are IO/M, S0 & S1

   ❖ **IO/M**

      This signal is used to differentiate between IO and Memory operations, i.e. when it is high indicates IO operation and when it is low then it indicates memory operation.

❖ **S1 & S0**

These signals are used to identify the type of current operation.

4. <u>Power supply</u>

There are 2 power supply signals − VCC & VSS. VCC indicates +5v power supply and VSS indicates ground signal.

5. <u>Clock signals</u>

There are 3 clock signals, i.e. X1, X2, CLK OUT.

- ❖ **X1, X2** − A crystal (RC, LC N/W) is connected at these two pins and is used to set frequency of the internal clock generator. This frequency is internally divided by 2.
- ❖ **CLK OUT**− This signal is used as the system clock for devices connected with the microprocessor.

6. <u>Interrupts & externally initiated signals</u>

Interrupts are the signals generated by external devices to request the microprocessor to perform a task. There are 5 interrupt signals, i.e. TRAP, RST 7.5, RST 6.5, RST 5.5, and INTR.

- **INTA** − It is an interrupt acknowledgment signal.
- **RESET IN** − This signal is used to reset the microprocessor by setting the program counter to zero.
- **RESET OUT** − This signal is used to reset all the connected devices when the microprocessor is reset.
- **READY** − This signal indicates that the device is ready to send or receive data. If READY is low, then the CPU has to wait for READY to go high.
- **HOLD** − This signal indicates that another master is requesting the use of the address and data buses.
- **HLDA (HOLD Acknowledge)** − It indicates that the CPU has received the HOLD request and it will relinquish the bus in the next clock cycle. HLDA is set to low after the HOLD signal is removed.

7. <u>Serial I/O signals</u>

There are 2 serial signals, i.e. SID and SOD and these signals are used for serial communication.

- **SOD (Serial output data line)** − The output SOD is set/reset as specified by the SIM instruction.
- **SID (Serial input data line)** − The data on this line is loaded into accumulator whenever a RIM instruction is executed.

Experiment-2

AIM: Write a program to Add two 8-bit numbers using 8085

      a) without carry
      b) with carry

SOFTWARE USED: 8085 Simulator.

THEORY:

The Instruction set are

➥ **MVI** (Move Immediate)**:**
      This instruction is used for moving the data from Source to
      Destination.
      Eg: MVI B, 65

➥ **ADD:**
      It stands for "add register/memory to accumulator" and is used to add
      content of register or memory to accumulator.
      Eg: ADD B or ADD M

➥ **INR:**
      It stands for "Increment register/memory" which is pointed by H-L
      pair. It is used to 1 with the contents of register/memory.

➥ **HLT:**
      It is used to termination of Program.

PROGRAM:

a) **without carry**

MVI A, 10

MVI B, 25

ADD B

HLT

ADDRESS	MEMORIES	HEXCODE
2000H	MVI A,10	3E
2001H		0A
2002H	MVI B,05	06
2003H		05
2004H	ADD B	80
2005H	HLT	EF

b) with carry

MVI A, A0
MVI B, 99
ADD B
MVI C, 00
INR C
HLT

ADDRESS	MEMORIES	HEXCODE
0000	MVI A, A0	3E
0001		65
0002	MVI B, 99	06
0003		AB
0004	ADD B	80
0005	MVI C, 00	0E
0006		00
0007	INR C	0C
0008	HLT	EF

FLOWCHART:

I.   ADD
    a) without carry

b) with carry

```
                    ┌─────────────┐
                    │    Start    │
                    └─────────────┘
                           │
                           ▼
              ┌──────────────────────┐
              │   Move value to      │
              │    register A        │
              └──────────────────────┘
                           │
                           ▼
              ┌──────────────────────┐
              │   Move value to      │
              │    register B        │
              └──────────────────────┘
                           │
                           ▼
              ┌──────────────────────┐
              │     ADD B to A       │
              └──────────────────────┘
                           │
                           ▼
              ┌──────────────────────┐
              │   Move carry to      │
              │    register C        │
              └──────────────────────┘
                           │
                           ▼
              ┌──────────────────────┐
              │     Increment        │
              │    register C        │
              └──────────────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │     END     │
                    └─────────────┘
```
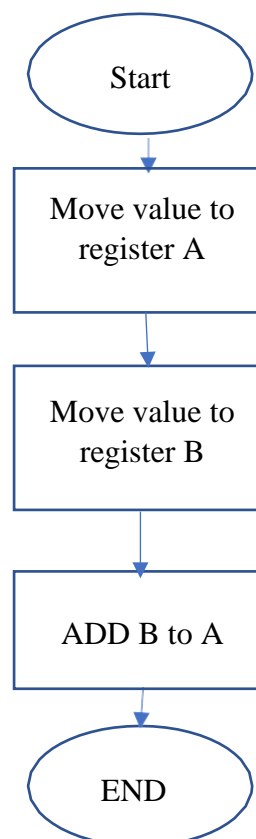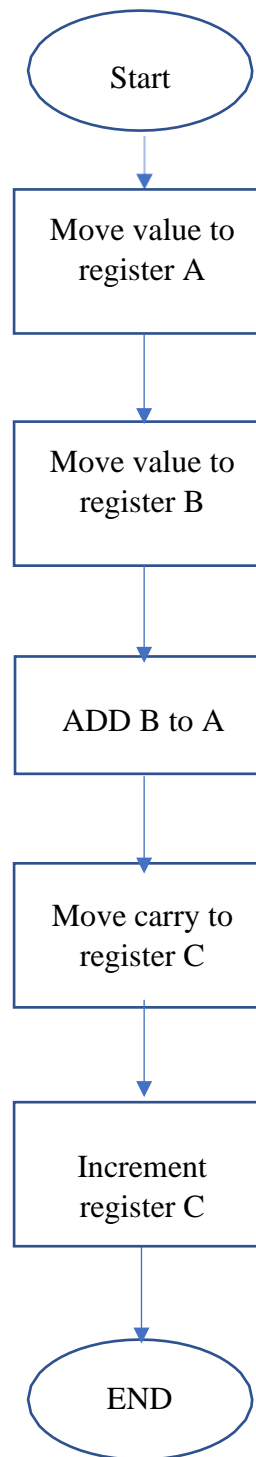
RESULT:

a) without carry
      Input: 0A & 05
      Output: 50 stored at **2000H** location.

b) with carry
      Input: A0 & 99
      Output: 11 stored at **0000** location.