Microprocessor TCS-403

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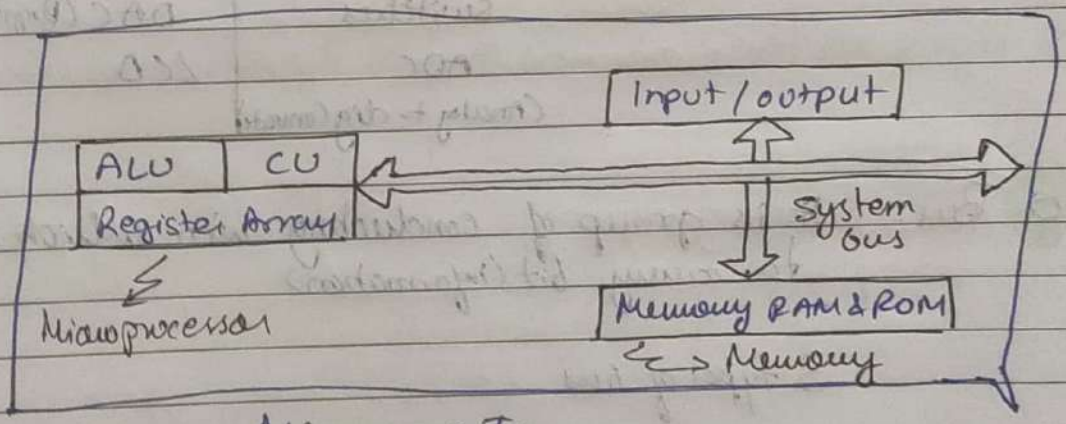
Microprocessor :- Its a CPU on a single chip. It contains registers (as internal memory), CU (to control all associated peripherals connected with MP) and ALU (to perform arithmatic & logical operations)

* Its a multipurpose, programmable, clock deriven semiconductor device which takes input in binary form and process according to given instructions & generate output in binary form

Microcomputer :- A digital computer whose CPU is a microprocessor is called a microcomputer.



Microcomputer

ALU :- Various computing functions are performed on data such as addition, subtraction, logical operations (AND, OR and exclusive OR)

Register Array :- Used to store data temporarily during execution of program & are accessible to users through instructions. RA are identified by B, C, D, E, H & L

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④ Control Unit :- Provides the necessary timing and control signals to all the operations in the computer.
* Controls the flow of data b/w µp and memory & peripheral

⑤ Memory :-

→ ROM (read only memory) (code memory)
→ RAM (random access memory) (data memory)

⑥ Input/Output

devices :-

INPUT	OUTPUT
keyboard	LED
switches	DAC (Digital to Analog conv)
ADC (Analog to dig Convert)	LCD

⑦ Bus :- It is group of conducting wire which is used to carry bit (information)

3 types of bus

(a) Address bus (in 8085 → 16 bit)

(b) Data bus (in 8085 → 8 bit)

(c) Control bus (to generate timing & control signals)

Microprocessor	Microcontroller
Contains only CPU	Contains CPU, memory, I/O all integrated on single chip
Heart of computer system	Heart of embedded system
Used in PC	Used in embedded system
Uses external control bus to interface to RAM, ROM	Microcontroller uses internal controlling bus
Based on Von Neumann model (only 1 system bus)	Based on Harvard architecture (seperate address & data bus)
Cannot be used as single IC	Can be used as single IC

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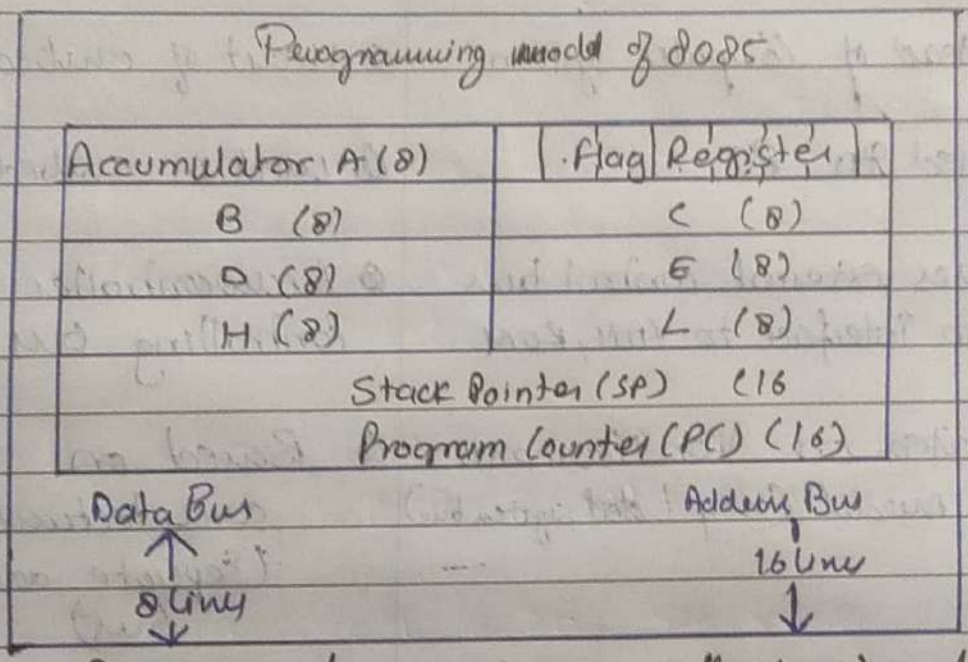
Programming model of 8085

- Information needed to write an assembly language programme is called programming model



Memory capacity = 2^{AB}	AB = Length of Address Bus in 8085 AB = 16 bit

8085 has 64 Kb memory capacity

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* Registers of 8085

1. General Purpose Registers :- To store temporary data during execution of a program.
   There are :- B, C, D, E, H, L
   These can be combined together as register pairs
   BC
   DE } to perform 16-bit operations.
   HL

2. Memory Registers :- There are 2 16-bit registers (SP & PC) used to hold memory address

   (a) Program Counter (PC) :- It holds the memory address of next instruction which has to be fetched. It is incremented by n if size of next instruction is n bytes

   (b) Stack Pointer (SP) :- Points to memory location in RAM called the stack.
   It's always incremented / decremented by 2 during push and pop operation

3. Specific Purpose Registers :-

   (a) Accumulator :- Part of ALU. After performing ALU operation result is stored in Accumulator
   In 8085 destination operand must be Acc

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(b) Flag Register :-

B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0
S	Z	—	AC	—	P	—	CY

Bit position of various flags in flag Register of 8085

* It consists of 8 bits and only 5 bits are useful
* These 5 are set and reset

if flag = 0 ⇒ reset
" = 1 ⇒ set

1. Sign flag (S) :- if MSB (B(7)) = 1 ⇒ -ve = set
if MSB (B(7)) = 0 ⇒ +ve = reset

- from 00H to 7F, S = 0
- from 80H to FF, S = 1

2. Zero flag (Z) :- if result is 0 (00)H, Z = 1 = set
else Z = 0 = reset

- 00H Z = 1
- from 01H to FF, Z = 0

use of zero flag :- while applying loop in Assembly languages

3. Auxillary carry flag (AC) :- Used in BCD (0-9)

if after an operation D(3) generate any carry and passes on to B(4) AC = 1 = set
else AC = 0 = reset

* Only FR cannot accessed by programmer.

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4 Parity flag (P) :- If after ALU operation it

- no of 1's = even = set = 1
- else = reset = 0

5 Carry flag (CY) :- After any operation if carry is generated

CY = 1 = set

else CY = 0 = reset

* during addition if $(n+1)^{th}$ bit is generated during n bit operation CY = 1 = set

* during subtraction if (A-B)

if A > B CY = 0 = reset

else if A < B CY = 1 = set

Ex

2000 : MVI A 25H

2002 : MVI B 30H

2004 : ADD B

25 = 00100101

\+ 30 = 00110101

10 1100010

S = 0

Z = 0

AC = 1

P = 0

CY = 0

4 A = F1 = 11110001

B = 0F = 00001111

100000000

S = 0 , Z = 1 , AC = 1 , P = 1 , CY = 1

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8085 Instruction Set

* An instruction is a binary pattern designed inside a microprocessor to perform a specific function.

* The entire group of instructions that a MP supports is called instruction set.

* 8085 has 246 instructions

* Each instruction is represented by an 8-bit binary value

* The 8-bit binary value are called Op-code or Instruction byte.

Mnemonic : MOV (A, B) → operands

Classification of Instruction Set

- **Data transfer Instructions**
  - These instructions move data b/w registers or b/w memory and registers.
  - These instruction copy data from source to destination
  - Content of source are not modified.

	Opcode	Operand	Description
1	MOV	Rd, Rs	Copy from source to destination
		M, Rs	" " " " Memory
		Rd M	" " Memory location to destination

* Size of each operand should be same.

MOV B, C

B = C

2	MVI	Rd, data M, data	move Immediate 8-bit

* Source is always data.

MVI B, 57H

B = 57

3	LDA	16-bit Address	Load Accumulator

* LDA 2034 H (Content of 2034 location copied to Accumulator)

A ← 2034

4	LDAX	B/D Register Pair	Load Accumulator indirect

* LDAX B

if B = 20, C = 50 then the content of 2050, will be copied to Accumulator.

* When we use register pair in instruction we always mention high order register.

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Opcode	operand	Description:
5. LXI	Reg pair 16 bit data	Load register pair immediate

* LXI H, 2034H → This represents data
  (2034H → If I)
* Contains of HL pair register Ps memory location.

6	LHLD	16 bit address	Load H-L register direct

* default register pair in 8085 is H-L

LHLD 2040H → Its address
L ← 2040
H ← 2041

7	STA	16 bit address	Store Accumulator direct

* STA 2500H { contains of Accumulator will be copied to 2500 memory location }

8.	STAX	Reg pair	Store Accumulator direct

* STAX B

Contains of ~~register~~ Accumulator will be copied to B-C pair address

9. SHLD	16 bit address	Stores H-L register direct

* SHLD 2550H

Contains of L will be stored to 2550
" " H " " " " 2551

◎ When we have to perform 16 bit operation we have to use LHLD & SHLD. to load & store respectively.

10 XCHG	None	Exchange H-L with D-E

in this we use two temporary registers.

11 SPHL	None	Copy H-L pair to stack Pointer

* SPHL

LXI H2050
SPHL
SP = 2050

12 XTHL	None	Exchange H-L with to of stack

* XTHL

Contents of L are exchanged with location pointed out by the contents of SP
Contents of H register are exchanged with the next location (SP+1)

13	PCHL	None	Load program counter with H-L contents

* Contents of H and L are copied to Program Counter.

LXI H 2050
PCHL
PC = 2050

14	PUSH	Reg Pair	Push register pair onto stack

15	POP	Reg Pair	Pop stack to registerpair

16	OUT	8 bit port Address	Copy data from Accumulator to a port with 8 bit address

* OUT (78)H → its address
78H ← A

17	IN	8 bit address	Copy data ~~from~~ to Accumulator from a port with 8 bit address

* IN (8C)H → Input port address
A ← 8CH