23VLS1401: Microcontroller and Computer architecture

Lecture 4 (U2)

Arithmetic instructions and programming for Microprocessor 8085

A presentation by

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Session objectives

- To learn various software instructions related to the Arithmetic operations for 8085 Microprocessor

- To learn various addressing modes related to the process Arithmetic operations

- To develop the programming technique in assembly language for given problem statement in which arithmetic operations are involved, store the source data, execute the program and observe the result in destination register or memory location.

Arithmetic instructions

- ADD

- ADI

- ADC

- ACI

- SUB

- SUI

- SBB

- SBI

- INR

- INX

- DCR

- DCX

- DAD

Arithmetic instructions

Opcode	Operand	Meaning	Explanation	Addressing mode
ADD	R M	Add the 8 bit source R/M with accumulator	This instruction adds the contents of the source register/ memory location with Accumulator and result is placed in the accumulator and Flags are modified.	Register addressing mode

- M specifies a memory location whose address is specified by the HL pair
- R specifies Registers A, B, C,D,E, H and L
- Flags are modified

Examples of ADD instruction:
ADD B

Before Execution of the instruction   **After Execution of the instruction**

A	11

A	33

ADD B

B	22

B	22

Examples of ADD instruction:
ADD M

Before Execution of the instruction	After Execution of the instruction

H	25	L	01

A	44

ADD M

A	77

2501	33

2501	33

Arithmetic instructions

Opcode	Operand	Meaning	Explanation	Addressing mode
ADI	8 bit data	Add the 8 bit data with accumulator	This instruction adds the 8 bit data with the accumulator and saves the result in accumulator	Immediate addressing mode

Examples of ADI instruction:
ADI 56H

Before Execution of the instruction

A	22

ADI 56H

After Execution of the instruction

A	78

Arithmetic instructions

Opcode	Operand	Meaning	Explanation	Addressing mode
ADC	R M	A + R/M + Previous carry >A	This instruction adds Accumulator with R/M with carry. Result is stored in the accumulator. Flags are modified.	Register addressing mode

Arithmetic instructions

Opcode	Operand	Meaning	Explanation	Addressing mode
ACI	8 bit data	Add the 8 bit data with accumulator with carry	This instruction adds the 8 bit data with the accumulator and previous carry and saves the result in accumulator. Flags are modified.	Immediate addressing mode

Arithmetic instructions

Opcode	Operand	Meaning	Explanation	Addressing mode
SUB	R M	Subtract the 8 bit source R/M from accumulator	This instruction subtracts the contents of the source register/ memory location from Accumulator and result is placed in the accumulator and Flags are modified.	Register addressing mode

- M specifies a memory location whose address is specified by the HL pair
- R specifies Registers A, B, C,D,E, H and L
- Flags are modified

Arithmetic instructions

Opcode	Operand	Meaning	Explanation	Addressing mode
SUI	8 bit data	Subtract the 8 bit data from accumulator	This instruction subtracts the 8 bit data from the accumulator and saves the result in accumulator	Immediate addressing mode

Arithmetic instructions

Opcode	Operand	Meaning	Explanation	Addressing mode
SBB	R M	A - R/M - Previous Borrow >A	This instruction subtracts R/M from Accumulator along with the borrow. Result is stored in the accumulator. Flags are modified.	Register addressing mode

Arithmetic instructions

Opcode	Operand	Meaning	Explanation	Addressing mode
SBI	8 bit data	Subtract the 8 bit data from accumulator with borrow	This instruction subtracts the 8 bit data from the accumulator and previous borrow and saves the result in accumulator. Flags are modified.	Immediate addressing mode

Arithmetic instructions

Opcode	Operand	Meaning	Explanation	Addressing mode
DAD	Rp	Add the 16 bit data in HL with Rp	This instruction adds the 16 bit data in HL with the register pair and saves the result in HL pair. Flags are modified.	Register addressing mode

1. WAP to add the 8 bit numbers stored in memory locations 2501H and 2502H. Place the sum in 2503H and carry in 2504H.

LXI H,2501H

MOV A,M

INX H

ADD M

INX H

MOV M,A

MVI A,00H

ADC A

INX H

MOV M,A

HLT

MVI C,00H
LXI H,2501H
MOV A,M
INX H
ADD M
INX H
MOV M,A
JNC AHEAD
INR C
AHEAD: INX H
MOV M,C
HLT

2. WAP to add the five 8 bit numbers stored in memory locations starting at 2501H. Place the sum in 2506H and carry in 2507H.

LXI H,2501H
MVI C,05H
LXI D,0000H
L1: MOV A,M
ADD E
MOV E,A
JNC AHEAD
INR D
AHEAD: INX H
DCR C
JNZ L1
MOV M,E
INX H
MOV M,D
HLT

LXI H,2501H
MVI C,05H
MVI A,00H
MVI B,00H
L1: ADD M
JNC AHEAD
INR B
AHEAD: INX H
DCR C
JNZ L1
MOV M,A
INX H
MOV M,B
HLT

3. Five pairs of data bytes are stored in memory locations starting at 2501H. Write a program to add the data bytes in pairs and place the result in same memory locations, i.e. sum replacing the first data byte and carry replacing the second.

LXI H,2501H

MVI C,05H

L1: MVI B,00H

    MOV A,M

    INX H

    ADD M

    JNC AHEAD

INR B

AHEAD: DCX H

    MOV M,A

    INX H

    MOV M,B

  INX H

DCR C

JNZ L1

HLT

4. WAP to add two 16 bit numbers stored in memory locations starting at 2501H. Place the sum in 2505, 2506H and carry in 2507H.

```
        MVI C,00H
        LHLD 2501H
        XCHG
        LHLD 2503H
        DAD D
        JNC AHEAD
      INR C
AHEAD: SHLD 2506
HLT
```