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8085 Microprocessor

Lecture 6

المدرس ضرغام الخفاف الاسدي

Third Year lecture notes

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INSTRUCTION SET

The instruction set has been classified into following groups.

1. Data Transfer Group
2. Arithmetic Group
3. Branch Group
4. Stack, Input/Output and Machine Control Group

Arithmetic Group of Instructions

***1- ADD reg* (Add register)** where *reg = A, B, C, D, E, H or L*. It adds the content stored in given register with the accumulator. The result of this addition is stored in accumulator. All the flags are affected with this 'ADD reg' instruction.

$$[A] \leftarrow [A] + [reg]$$

Suppose before the execution of the instruction *ADD E*

$A = 10101111$
$E = 10110101$
$CY = 0, \quad S = 1, \quad Z = 0$ and $P = 1$

then after the execution of the instruction *ADD E* we get the following result:

A =		1	0	1	0	1	1	1	1
E =		1	0	1	1	0	1	0	1
A =	1	0	1	1	0	0	1	0	0
	CY								

The flags will be affected as;

$CY = 1, \quad S = 0, \quad Z = 0$ and $P = 0$

$CY = 1$ Since there is a final carry.
$S = 0$ Since Acc content is positive as MSB is zero.
$Z = 0$ Since Acc content is non zero.
$P = 0$ Since Acc content has odd parity.

***2- ADD M* (Add Memory)** This instruction is one byte instruction and adds the content of memory location whose address is given in H-L register pair with the accumulator and the answer is stored in accumulator.

$$[A] \leftarrow [A] + [M_{HL}]$$

3- ADI data (Adds immediately the data) It immediately adds the given data with the accumulator and the answer will be stored in Accumulator.

$$[A] \leftarrow [A] + data$$

***4- ADC reg/M* (Add with carry)** The format for ADC instruction is where *reg = A, B, C, D, E, H or L.* It adds the content stored in given register and content of CY flag with the content of accumulator. The result of this addition is stored in accumulator.

$$[A] \leftarrow [A] + [reg] + [CY]$$

$$[A] \leftarrow [A] + [M_{HL}] + \mathrm{CY}$$

***5- ACI data* (Adds immediately the data with Carry)** It immediately adds the given data to the accumulator with carry and the answer will be stored in Accumulator.

$$[A] \leftarrow [A] + data + \mathrm{CY}$$

6- DAD rp (Double Add) The format for this instruction is where rp stands for register pair. It may be B, D or H.

rp as B represents B-C register pair,

rp as D represents D-E register pair,

rp as H represents H-L register pair.

This instruction adds the contents of given register pair with the contents of H-L register pair. The answer will be stored in H-L register pair.

$$[HL] \leftarrow [HL] + [rp]$$

This instruction has the following combinations:

DAD B	$[HL] \leftarrow [HL] + [BC]$
DAD D	$[HL] \leftarrow [HL] + [DE]$
DAD H	$[HL] \leftarrow [HL] + [HL]$

For example before the execution of the instruction DAD D, we have the following data in different registers.

DE = 2AB6 H
HL = 012 7 H

After the execution of this instruction we HL = 2BDD H

Only carry flag will be affected in this instruction.

***7- SUB reg/M* (Subtract Register/memory)** where *reg = A, B, C, D, E, H or L.* It subtracts the contents stored in given register from the accumulator. The result of this subtraction is stored in accumulator.

$$[A] \leftarrow [A] - [reg]$$

$$[A] \leftarrow [A] - [M_{HL}]$$

All the flags are affected with this 'SUB reg' instruction.

Suppose before the execution of the instruction $SUBD$

$A = 10101111$

$D = 10110101$

$CY = 0,\quad S = 1,\quad Z = 0$ and $P = 1$

then after the execution of the instruction $SUBD$ we get the following result:

```
A =        1  0  1  0  1  1  1  1
D =        1  0  1  1  0  1  0  1
          ------------------------
A =   1    1  1  1  1  1  0  1  0
      CY
```

All flags will be affected as per the accumulator contents.

***8- SUI data* (Subtracts immediately the data)** It immediately subtracts the given data with the accumulator contents and the answer will be stored in Accumulator.

$$[A] \leftarrow [A] - data$$

***9- SBB reg/M* (Subtract with Borrow)** where *reg = A, B, C, D, E, H or L.* This instruction subtracts the contents stored in given register from the accumulator with borrow. The answer will be stored in accumulator.

$$[A] \leftarrow [A] - [reg] - [CY]$$

$$[A] \leftarrow [A] - [M_{HL}] - [CY]$$

Suppose before the execution of the instruction *SBB H*

$A = 10101111$

$H = 10110101$

$CY = 0,\quad S = 1,\quad Z = 0$ and $P = 1$

then after the execution of the instruction *SUB H* we get the following result:

```
A =          1  0  1  0  1  1  1  1
H =          1  0  1  1  0  1  0  1
CY =                              1
                  ------------------
A =    1     1  1  1  1  1  0  0  1
       CY
```

All flags will be affected as per the accumulator contents.

10- SBI data (Subtract immediate with Borrow) SBI data instruction subtracts the given data with borrow bit (carry flag) from the accumulator contents and it stores the answer in accumulator.

$$[A] \leftarrow [A] - data - [CY]$$

***11- INR reg/M* (Increment Register/Memory)** It increments the contents of given register/memory by one.

$$[reg] \leftarrow [reg] + 1$$

$$[M_{HL}] \leftarrow [M_{HL}] + 1$$

all flags except carry flag will be affected after the execution of this instruction.

***12- INX rp* (Increment register pair)** where *rp* is the register pair as B-C register pair, D-E register pair and H-L register pair. This instruction increments the contents given in register pair by one and the result is stored in the given register pair.

$$[rp] \leftarrow [rp] + 1$$

The possible combinations of this instruction are:

INX B
INX D
INX H

13- DC*R reg/M* (Decrement Register/Memory) It decrements the contents of given register by one

$$[reg] \leftarrow [reg] - 1$$

$$[M_{HL}] \leftarrow [M_{HL}] - 1$$

all flags except carry flag will be affected after the execution of this instruction.

***14- DCX rp* (Increment register pair)** where *rp* is the register pair as B-C register pair, D-E register pair and H-L register pair. This instruction decrements the contents given in register pair by one and the result is stored in the given register pair.

$$[rp] \leftarrow [rp] - 1$$

The possible combinations of this instruction are:

DCX B
DCX D
DCX H

Thank you