Microprocessor 8085 Instruction Set - Logical Instructions

Types of Instruction

Since the 8085 is and 8-bit device it can have up to 2^8 (256) instructions.

- However, the 8085 only uses 246 combinations that represent a total of 74 instructions.

Types of instruction sets

- Data transfer operations
- Arithmetic operations
- Logic operations
- Branch operations
- Machine control operations

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Logical Instructions

These instructions perform the logical operations on data stored in registers, memory and status flags:

The logical operations are:

- AND
- OR
- XOR
- Rotate
- Compare
- Complement

Compare instruction - CMP

Opcode	operand	Description	Hex code
CMP	R M	Compare register or memory with accumulator	B B8 C B9 D BA E BB H BC L BD M BE A BF

- The contents of register or memory are compared with the contents of the accumulator
- The result of the comparison is shown by setting the flags of the PSW as follows:

Compare instruction - CMP

- The result of the comparison is shown by setting the flags of the PSW as follows:
  - If (A) < (reg / mem) : carry flag is set
  - If (A) = (reg / mem) : zero flag is set
  - If (A) > (reg / mem) : carry and zero flags are reset

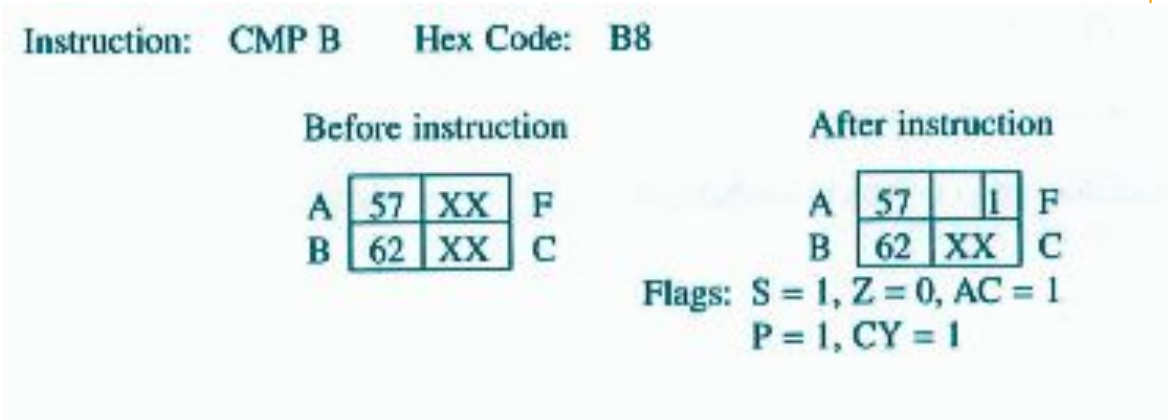
Example : CMP B or CMP M

B= 62H

A=57H

Compare the contents

Results :



- No contents are changed
- Carry flag is set because (A) < (B)
- S, Z, P, Ac flags are modified

Compare instruction - CPI

Opcode	operand	Description	Hex code
CPI	8-bit	Compare 8-bit data immediate with accumulator	FE

- The contents of register or memory are compared with the contents of the accumulator
- The result of the comparison is shown by setting the flags of the PSW as follows:
- If (A) < (reg / mem) : carry flag is set
- If (A) = (reg / mem) : zero flag is set
- If (A) > (reg / mem) : carry and zero flags are reset

Compare instruction - CPI

Let A= C2H. compare 98H with accumulator contents

Instruction : CPI 98H Hex code : FE 98

Results after executing the instructions:

- The accumulator contents remain unchanged
- Z and CY flags are reset because (A) > Data
- Other flags : S= 0, AC=0, P=0

Example : compare C2H with content of accumulator

Instruction : CPI C2H Hexcode : FE C2

- The accumulator contents remain unchanged
- Z flag is set because (A)= Data
- Other flags : S= 0, AC=1, P=1, CY=0

ANA - Logical AND

Opcode	operand	Description	Hex code
ANA	Rt M	Logical AND register or memory with accumulator	B A0 C A1 D A2 E A3 H A4 L A5 M A6 A A7

- The contents of accumulator are logically ANDed with the contents of register or memory
- The result is placed in the accumulator
- If the operand is a memory location, its address is specified by the contents of HL pair
- S, Z, P are modified to reflect the result of the operation
- CY is reset and AC is set

Example : ANA B, ANA M

ANA - Logical AND

Instruction : ANA D hexcode: A2

Register contents before instruction	Logical AND	Register contents after instruction
A 54 X F	54H = 0 1 0 1 0 1 0 0	A 00 0 1 1 1 0 F
	AND	
D 82 X E	82H = 1 0 0 0 0 0 1 0	D 82 E
	0 0 0 0 0 0 0 0	

SZ AC P CY

Flags: S = 0, Z = 1, P = 1
AC = 1, CY = 0
(for 8080A, AC = 0)

ANI - Logical AND

Opcode	operand	Description	Hex code
ANA	8- bit data	Logical AND immediate with accumulator	E6

- The contents of accumulator are logically ANDed with the 8-bit data
- The result is placed in the accumulator
- S, Z, P are modified to reflect the result of the operation
- CY is reset and AC is set

Example : ANI 86H

ANI - Logical AND

Opcode	operand	Description	Hex code
ANA	8- bit data	Logical AND immediate with accumulator	

Instruction : ANI 97H Hex code: E6 97

Logical AND:

(A) : A3H = 1 0 1 0 0 0 1 1

AND

(Data) : 97H = 1 0 0 1 0 1 1 1

1 0 0 0 0 0 1 1

		S	Z	AC	P	CY	
A	83	1	0	1	0	0	F

CALL: Unconditional Subroutine Call

Opcode	Operand	Bytes	M-Cycles	T-States	Hex Code
CALL	16-bit address	3	5	18	CD

ORA - Logical OR

Opcode	operand	Description	Hex code
ORA	Rt M	Logical OR register or memory with accumulator	

- The contents of accumulator are logically ORed with the contents of register or memory
- The result is placed in the accumulator
- If the operand is a memory location, its address is specified by the contents of HL pair
- S, Z, P are modified to reflect the result of the operation
- CY is reset and AC is reset

Example : ORA B, ORA M

ORI - Logical OR

Opcode	operand	Description	Hex code
ORI	8- bit data	Logical OR immediate with accumulator	

- The contents of accumulator are logically ORed with the 8-bit data
- The result is placed in the accumulator
- S, Z, P are modified to reflect the result of the operation
- CY is reset and AC is reset

Example : ORI 86H

ORA , XRA, CMA

B=93H, A= 15H

ORA B

	(B) = 1 0 0 1 0 0 1 1	(93H)
OR		
	(A) = 0 0 0 1 0 1 0 1	(15H)
	(A) = 1 0 0 1 0 1 1 1	(97H)

Flag Status: S = 1, Z = 0, CY = 0

XOR B

	(B) = 1 0 0 1 0 0 1 1	(93H)
X-OR		
	(A) = 0 0 0 1 0 1 0 1	(15H)
	(A) = 1 0 0 0 0 1 1 0	(86H)

Flag Status: S = 1, Z = 0, CY = 0

CMA

	(A) = 0 0 0 1 0 1 0 1	(15H)
CMA		
	(A) = 1 1 1 0 1 0 1 0	(EAH)

Setting and resetting specific bits

OR- used to set bit AND - used to reset the bits

To set the bit D4

		D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
IN 00H:	(A) =	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
ORI 10H:	=	0	0	0	1	0	0	0	0
	(A) =	D_7	D_6	D_5	1	D_3	D_2	D_1	D_0

Flag Status: CY = 0; others will depend on data.

To reset bit D7

		D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
IN 00H:	(A) =	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
ANI 7FH:	=	0	1	1	1	1	1	1	1
		0	D_6	D_5	D_4	D_3	D_2	D_1	D_0

Flag Status: CY = 0; others will depend on the data bits.