

3) Logical Group :-

- The instruction of this group perform logical operation such as AND, OR, EX-OR, compare, rotate or implement of data in register or memory.
- Most of the instruction affect all flags.

Logical Group

AND	OR	EX-OR	Complement	Set	Compare	Rotate
ANA &	ORA &	XRA &	CMA	STC	CMPI &	RLC
AN A M	ORA M	XRA M	CMC		CMPI M	RRC
ANI data	ORI data	XRI data			CMP data	RAL

S.NO.	Instruction	Description	No. of Addressing Mode	Before Execution	After Execution
1.	ANA & [A] ← [A] ∧ &	The content of & is logically ANDed with the content of acc. The result is stored in accumulator.	1 Register	[A] = 78H	[A] = 08H [B] = OB H [B] = OB H
2.	ANA M [A] ← [A] ∧ [HL]	The content of memory location addressed by HL pair is logically ANDed with the content of accumulator. The result is stored in accumulator.	1 Indirect	ANA HL = 7500H [7500] = OFH [A] = [89]	M HL = 7500H [7500] = OFH [A] = [09.H]
3.	ANI data [A] ← [A] ∧ Data	The data is logically ANDed with the content of accumulator. The result is stored in accumulator.	2 Immediate	ANA FO [A] = 89H	[A] = 80 H
4.	ORA & [A] ← [A] ∨ &	The content of & is logically ORed with the content of acc. The result is stored in acc.	1 Register	ORA [A] = 78H [B] = 56H	B [A] = 7E H [B] = 56 H
5.	ORA M [A] ← [A] ∨ [HL]	The content of memory location addressed by HL pair is logically ORed with the content of accumulator.	1 Indirect	ORA M HL = 7500H [7500] = SS H [A] = AAH	HL = 7500H [7500] = SS H [A] = FF H

6.	ORI data $[A] \leftarrow [A] \vee \text{data}$	The data is logically ORed with the content of accumulator. The result is stored in accumulator.	2	Immediate	$[A] = 00H$	$[A] = 77H$
7.	XRA x $[A] \leftarrow [A] \oplus x$	The content of register x is logically EX-ORed with the content of acc. The result is stored in accumulator.	1	Register	$XRA B$ $[A] = 55H$ $[B] = AAH$	$[A] = F8H$ $[B] = AAH$
8.	XRA M	The content of memory location add. by HL pair is logically EX-ORed with the content of accumulator. The result is stored in accumulator.	1	Indirect	$XRA M$ $HL = 7500H$ $[7500] = 55H$	$HL = 7500H$ $[7500] = 55H$
9.	XRI data $[A] \leftarrow [A] \oplus \text{data}$	The data is logically EX-ORed with the content of accumulator. The result is stored in accumulator.	2	Immediate	$XRI 78$ $[A] = 00H$	$[A] = 78H$
10.	CMA	1's complement of the content of the accumulator is obtained and the result is stored in accumulator.	1	Implicit	CMA $[A] = 55H$	$[A] = AAH$
11.	CMC	Complement Carry Status $[CY] \leftarrow [\overline{CY}]$ The CY flag is complemented.	1	Implicit	CMC $[CY] = 1$	$[CY] = 0$
12.	STC $CY \leftarrow 1$	Set Carry Flag The carry flag is set to 1.	1	Implicit	STC $[CY] = 0$	$[CY] = 1$
13.	CMP x $[A] - [x]$ $A > x, CY=0$ $A < x, CY=1$ $A = x, Z=1$	The content of register x is sub. from content of accumulator. The result is not stored anywhere.	1	Register	$CMP B$ $[A] = 77H$ $[B] = 99H$	$[A] = 77H$ $[B] = 99H$ $CY = 1$
14.	CMP M $[A] - [HL]$ $A > M, CY=0$ $A < M, CY=1$ $A = M, Z=1$	The content of memory location addressed by HL pair is subtracted from the content of accumulator. The result is not stored anywhere.	1	Indirect	$CMP M$ $HL = 5000H$ $[5000] = 32H$	$HL = 5000H$ $[5000] = 32H$

15. CPI data The data is subtracted from the 2 immediate CPI 57

[A] - data Content of accumulator. The

[A] = 57H [A] = 57H

$A > \text{data}$, $CY = 0$ result is not stored anywhere.

$A < \text{data}$, $CY = 1$ The content of accumulator

$A = \text{data}$, $Z = 1$ remain unchanged.

$Z = 1$

16. RLC

(Rotate Accumulator left)

1 Implicit RLC

$D_{n+1} \leftarrow D_n$

The content of accumulator is

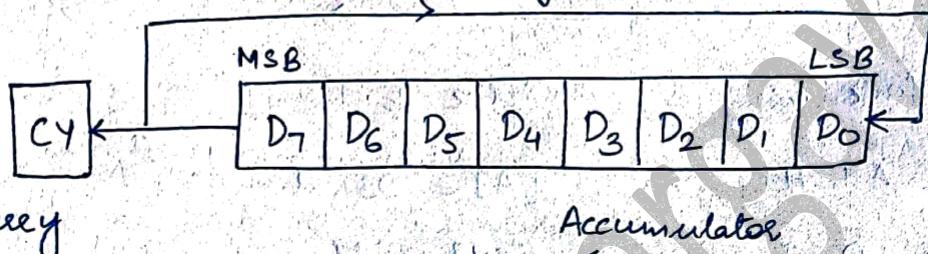
[A] = A7H [A] = 4FH

$D_0 \leftarrow D_7$

rotated towards left by one bit.

[CY] = 0 [CY] = 1

$CY \leftarrow D_7$



eg

0 1010 0111
0 A7H

RLC

1 0100 1111
1 4 F H

17. RAL

(Rotate Accumulator left through Carry)

1 Implicit

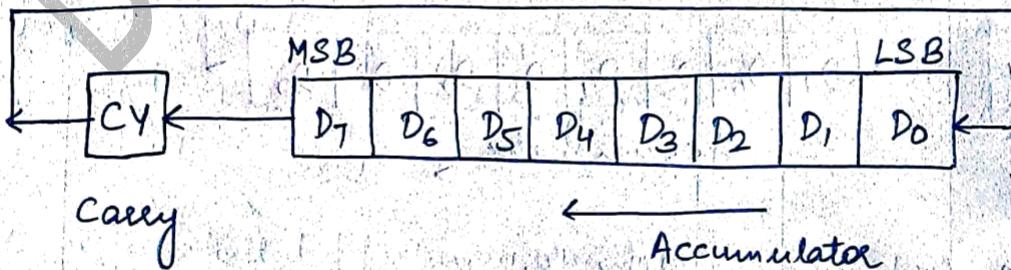
$D_{n+1} \leftarrow D_n$ The content of the accumulator is rotated

$CY \leftarrow D_7$ towards left through carry. The seventh bit

$D_0 \leftarrow CY$ of accumulator is moved to carry, and

the carry bit is move to zero bit of

accumulator.



Before E.

[A] = A7H

[CY] = 0

0 1010 0111

A7H

After E.

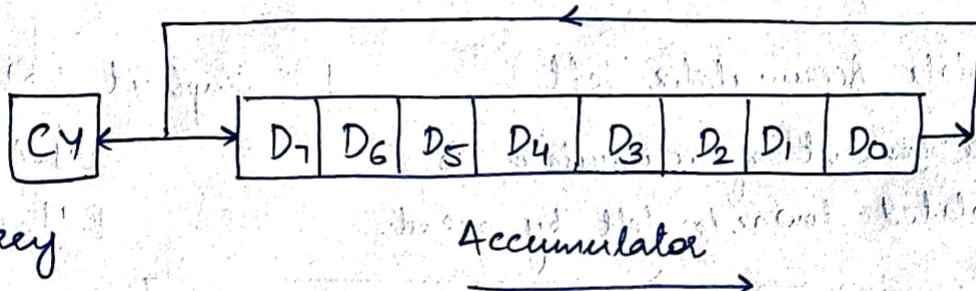
[A] = 4EH

[CY] = 1

1 0100 1110

4E H

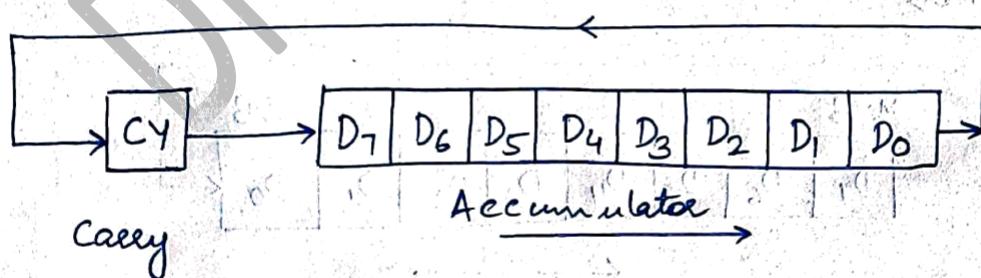
18. RRC (Rotate Accumulator Right) 1 Implicit
- $[D_{n-1}] \leftarrow [D_n]$ The content of accumulator is rotated towards right by one bit. The zero bit of the acc. is moved to the seventh bit of the acc. as well as to carry bit.
 - $[D_7] \leftarrow [D_0]$
 - $[CY] \leftarrow [D_0]$



Before E.	After E.
$[A] = A7H$	$[A] = D3H$
$[CY] = 0$	$[CY] = 1$

$010100111 \xrightarrow{\text{RRC}} 111010011$

19. RAR (Rotate Accumulator Right through Carry) 1 Implicit
- $[D_{n-1}] \leftarrow [D_n]$ The content of accumulator is rotated towards right by one bit. The zero bit of the acc. is moved to carry, and the carry bit is moved to the seventh bit of accumulator.
 - $[CY] \leftarrow [D_0]$
 - $[D_7] \leftarrow CY$



Before E.	After E.
$[A] = A7H$	$[A] = S3H$
$[CY] = 0$	$[CY] = 1$

$010100111 \xrightarrow{\text{RAR}} 1101010011$