3. Write an assembly language program to count no. of 1's and 0's present in the binary form of a decimal number.

• CODE

```
mvi  d, 05H
mvi  b, 00H
mvi  c, 00H
mvi  e, 08H
mov  a, d
loop: rar
jnc  zero
jc   one
zero: inr b
jmp  back
one:  inr c
back: dcr e
jnz  loop
mov  a, b
sta  2409H
mov  a, c
sta  240AH
hlt
```

• SAMPLE PROBLEM

input decimal number = 5 ie (05H in hexadecimal)

Binary form = 00000101 (in 8-bit)

d is initialized with the given input, b & c act as counters & e is for counting 8 bits.

rar : rotates the accumulator right through carry. As the carry contains 0 or 1, b & c are incremented accordingly.
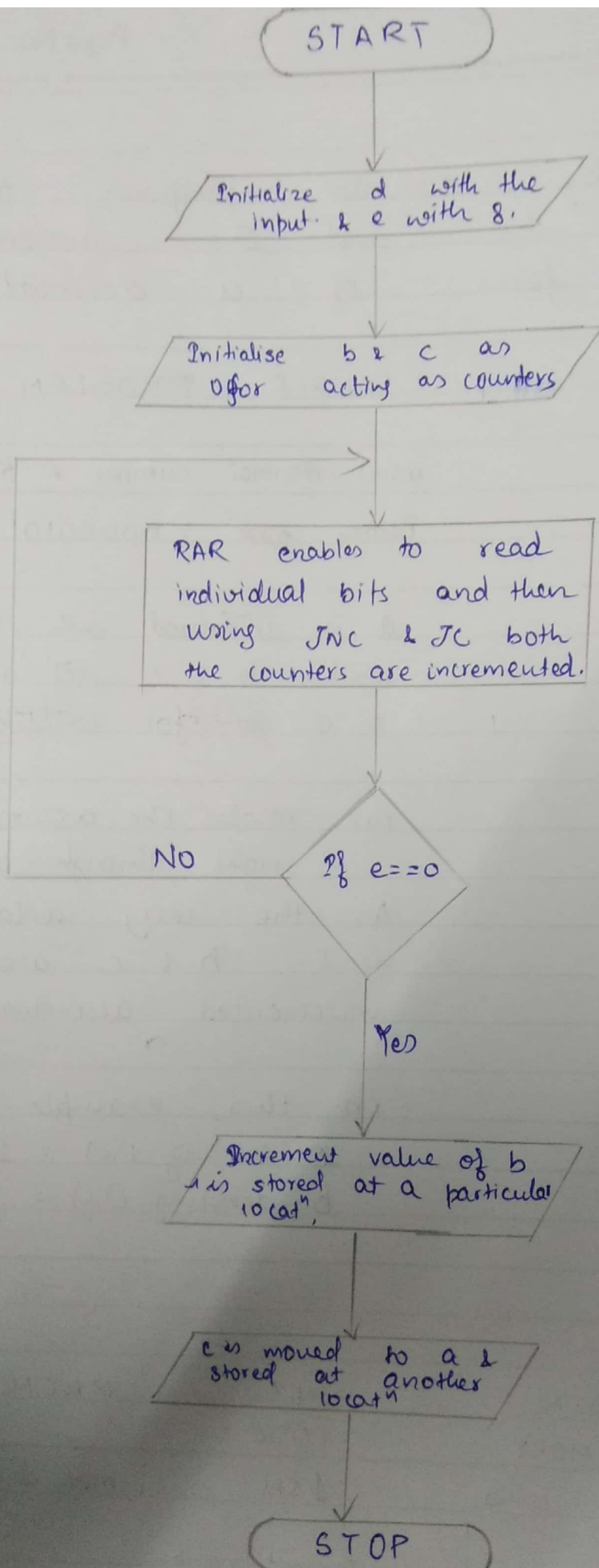
in this example -
c (denoting 1's) = 2
b (denoting 0's) = 6

PROGRAM COUNTER	MAIN MEMORY	HEX CODE	MNEMONICS
0000	0001 0110	16H	mvi d, 05H

```
                        ( START )
                            │
                            ▼
              / Initialize  d   with the   /
             /  input. & e  with 8.        /
                            │
                            ▼
           / Initialise    b &  c     as   /
          /  0 for    acting  as counters  /
                            │
          ┌─────────────────┼───────►
          │                 ▼
          │    ┌──────────────────────────────┐
          │    │  RAR    enables  to    read   │
          │    │  individual  bits    and then │
          │    │  using    JNC  & JC   both    │
          │    │  the  counters are incremented.│
          │    └──────────────────────────────┘
          │                 │
          │                 ▼
          │               ◇
     NO   │             ◇   ◇
  ────────┘          ◇ If e==0 ◇
                       ◇       ◇
                         ◇   ◇
                           ◇
                           │
                           ▼
                          Yes
                           │
                           ▼
          /  Increment  value of  b    /
         / A is stored   at a particular/
         /    10 cat",                  /
                           │
                           ▼
         /  c is moved    to a &        /
        /   stored   at   another       /
        /        locat"                 /
                           │
                           ▼
                        ( STOP )
```

	0101	05 H	
0002	0110	06 H	mvi b, 00H
	0000	00H	
0004	1110	0E H	mvi c, 00H
	0000	00H	
0006	0001 1110	1E H	mvi e, 08H
	1000	08 H	
0008	0111 1010	7A H	mov a, d
0009	0001 1111	1F H	loop: rar
000A	1101 0010	D2 H	jnc zero
	0100	04H	
	0000	0000H	
000D	1101 1010	DA H	jc one
	0000 1100	0CH	
	0000	0000H	
0010	0000 0100	04 H	zero: inr b
0011	1100 0011	C3 H	jmp back
	0001 1101	1DH	
	0000	0000H	
0014	0000 1100	0C H	one: inr c
0015	0001 1101	1D H	back: dcr e
0016	1100 0010	C2 H	jnz loop
	0001 1111	1F H	
	0000	0000H	
0019	0111 1000	78H	mov a, b
001A	0011 0010	32H	sta 2409 H
	0010 0100 0000 1001	2409H	
	0000	0000 H	

001D	0111 1001		79 H	mov a,c
001E	0011 0010		32 H	sta 240A H
	0010 0100 0000 1010		240A H	
	0000		0000H	
0021	0111 0110		76 H	hlt

```
                    ( START )
                        |
                        v
    +-------------------------------------+
    | CARRY FLAG IS SET. AND              |
    |    THEN      COMPLEMENTED.           |
    +-------------------------------------+
                        |
                        v
       / INPUT  is    LOADED            /
      /    TO THE   ACCUMULATOR        /
                        |
                        v
       / THE   VALUE    IS             /
      /    MOVED    TO      B         /
                        |
                        v
    +-------------------------------------+
    | RIGHT ROTATION THROUGH              |
    | CARRY & XOR OPERATION               |
    |       OF  A & B                      |
    +-------------------------------------+
                        |
                        v
       / STORED    IN  MEMORY          /
                        |
                        v
                    ( STOP )
```
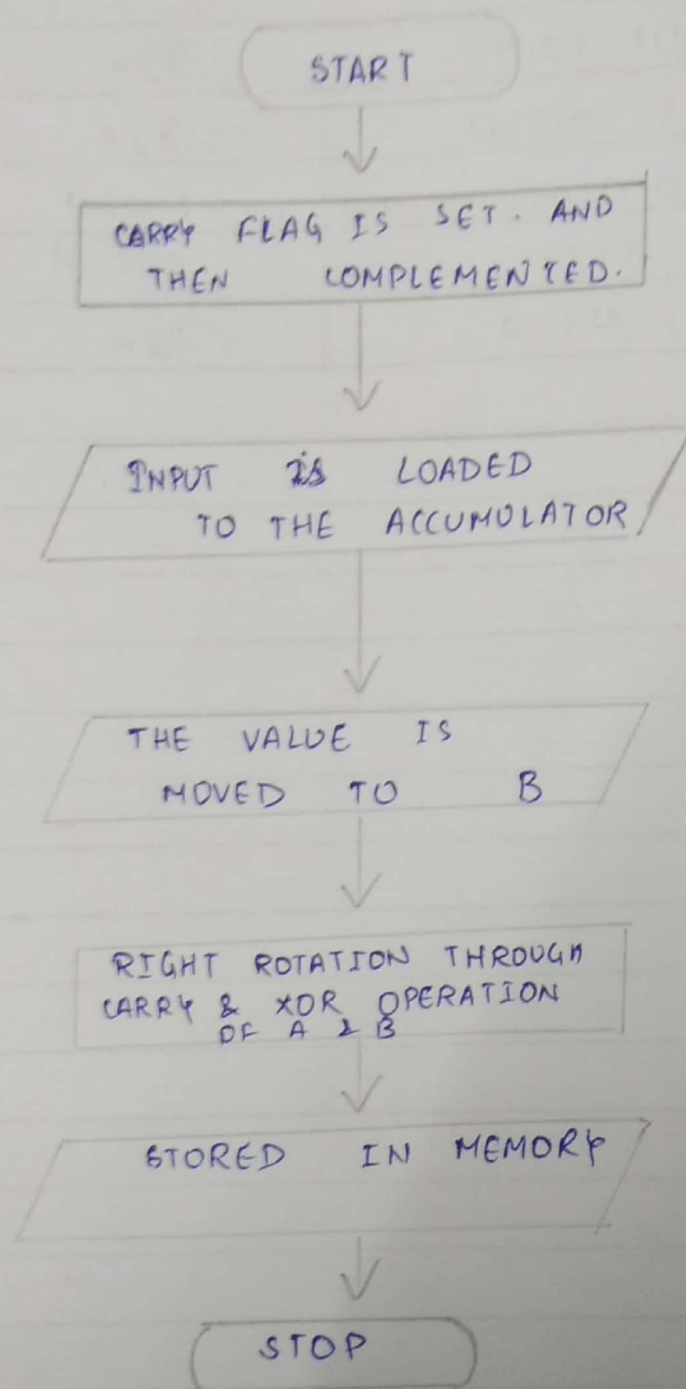
Q. Write an assembly language program to convert binary no. (decimal in binary form) to its grey code.

• CODE

STC
CMC
LDA   2040 H
MOV   B, A
RAR
XRA   B
STA   2041 H
HLT

• SAMPLE   PROBLEM

Input = $(0008)_{10}$

using RAR, the bits are shifted and XOR operation gives the required result.

Output = $(0012)_{10}$

PROGRAM COUNTER	MAIN MEMORY		HEX CODE	MNEMONICS	
0000	0011	0111	37 H	STC	
0001	0011	1111	3F H	CMC	
0002	0011 1010		3A H	LDA	2040 H
	0010 0000 0100 0000		2040 H		
	0000		0000 H		
0005	0100	0111	47 H	MOV B, A	
0006	0001	1111	1F H	RAR	
0007	1010	0100	A8 H	XRA B	
0008	0011	0010	32 H	STA	2041 H
	0010 0000 0100 0001		2041 H		
	0000		0000 H		
000 B	0111	0110	76 H	HLT	

Teacher's Signature : _____

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