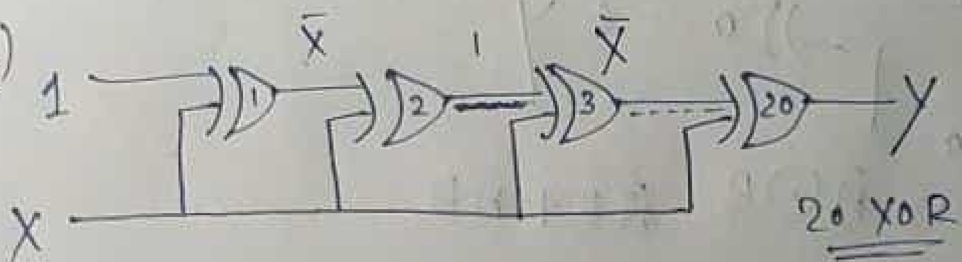
Department of Computer Science & Engineering
Faculty of Engineering & Technology (ITER)

Assignment-3

1)



20 XOR

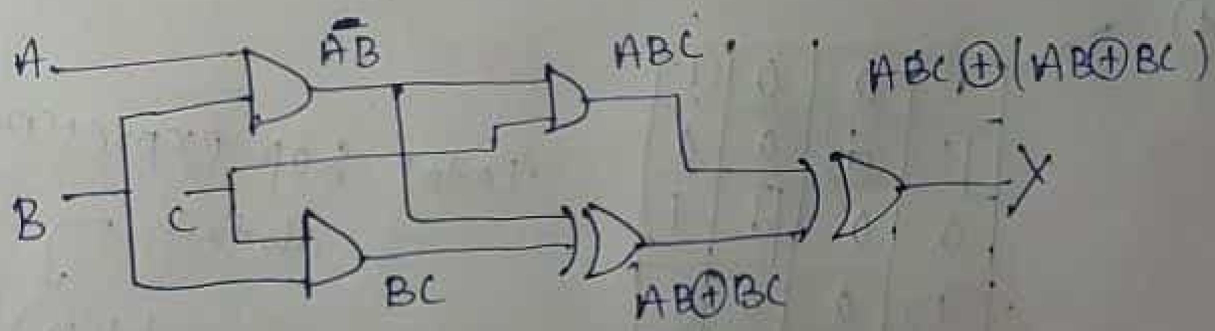
Solution

as 20 no of XOR gates

odd $\rightarrow \bar{X}$
even $\rightarrow 1$

$\boxed{Y = 1}$ Ans

2)



Soln

$$Y = (ABC)\,(AB \odot BC) + (AB \oplus BC)(\overline{ABC})$$

$AB \oplus BC$

$\bar{A}B . BC + AB . \overline{BC}$

$= (\bar{A} + \bar{B}) . BC + AB(\bar{B} + \bar{C})$

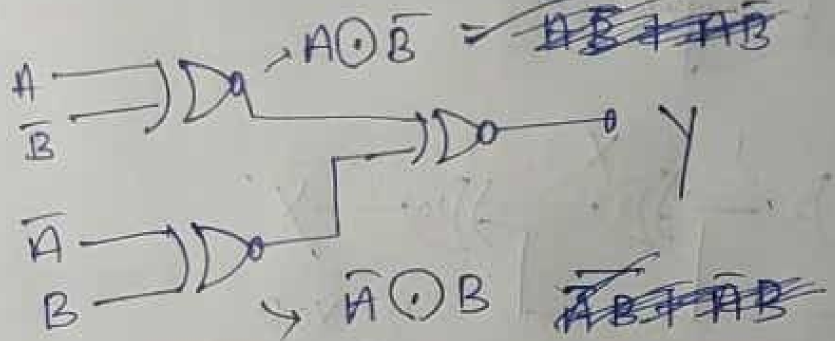
$= \bar{A}BC + AB\bar{C}$

$\hookrightarrow$ same

Option C: $B(C + A)$

Ans

(3)



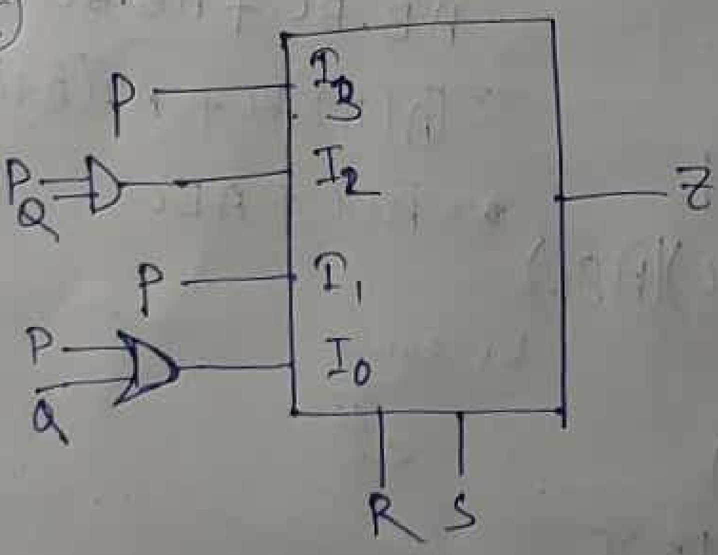
$$Y = A \odot \bar{B} \odot \bar{A} \odot B$$
$$= (A \odot \bar{A}) \odot (\bar{B} \odot B)$$
$$= 0 \odot 0$$
$$= 1 \quad \text{Ans option (b)}$$

(4)

1	0	0	1
1	d	0	0
0	0	d	1
1	0	0	1

Total SOP expression obtain → b) 3 Ans

(5)



$I_0 = P + \bar{Q}$

$I_1 = P$

$I_2 = PQ$

$I_3 = P$

Name:

Regd. Number:

$$Z = \bar{R}\bar{S}(P+\bar{Q}) + \bar{R}SP + R\bar{S}PQ + RSP$$

R	S	Z
0	0	I_0
0	1	I_1
1	0	I_2
1	1	I_3

PQ \ RS	00	01	11	10
00	1			
01				
11	1	1	1	1
10	1	1	1	

→ PQ

→ $P\bar{Q}S$

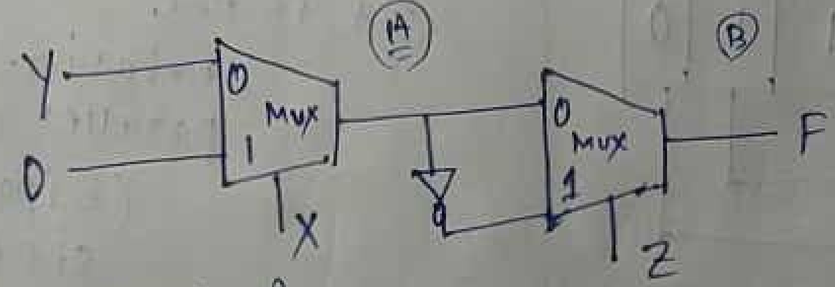
$\bar{Q}\bar{R}\bar{S}$

So,

$$Z = PQ + P\bar{Q}S + \bar{Q}\bar{R}\bar{S}$$ Ans

optional)

(6)



At point 1A
↳ expression is

$$\bar{X}Y + X.0 = \bar{X}Y$$

For second mux

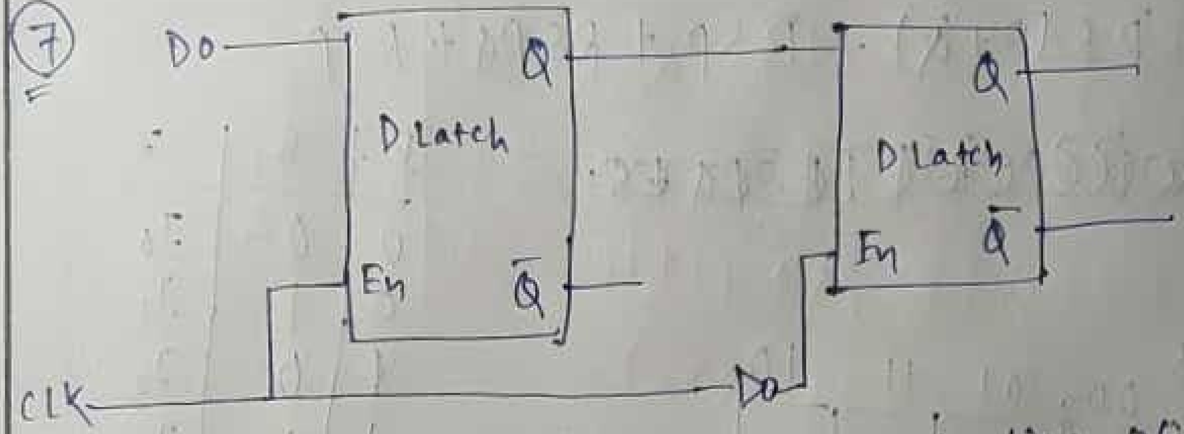
$I_0 = \bar{X}Y$

$I_1 = X+\bar{Y}$

$$F = \bar{Z}\bar{X}Y + Z(X+\bar{Y})$$
$$= \bar{Z}\bar{X}Y + ZX + \bar{Y}Z$$

optional) ans

7.

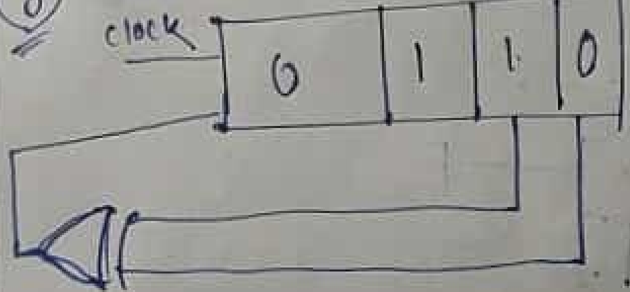


This a master slave combination of D flipflop

when CLK is 1 then first D latch is active which is the Master.

option (d) Master - Slave D flip flop ans

8.



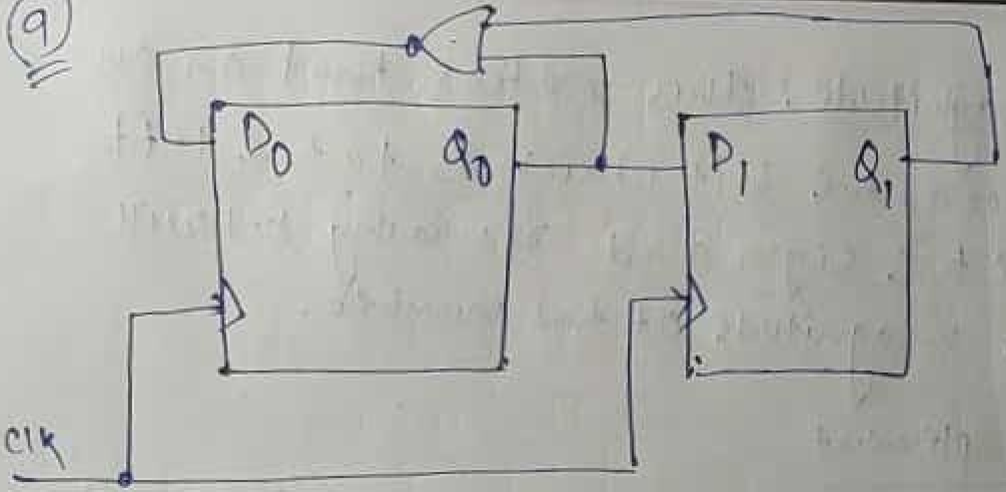
It is the serial-in-parallel out (Sipo) sift register

clock	iput	Q_3	Q_2	Q_1	Q_0
0	-	0	1	1	0
1	1	1	0	1	1
2	0	0	1	0	1
3	1	1	0	1	0

So content of shift register is 1010

ans

(9)



From the sequential circuit

$$D_0 = \overline{Q_1 + Q_0}$$
$$D_1 = Q_1$$

Present state		D_1	D_0	Next state	
Q_1	Q_0			Q_1^+	Q_0^+
0	0	0	1	0	1
0	1	1	0	1	0
1	0	0	0	0	0

like this 00, 01, 10, 00, 01 - - -

~~00, 01, 10, 00~~

option - b

Ans

Q10) Sign magnitude: This refers that on an x bit word, the bit which is to the left will be the sign and remaining x-1 will be the magnitude of the number.

Two's complement

This refers to a positive integer which is represented as a sign magnitude, while a negative number is represented as a compliment of a Boolean regarding each bit that corresponds to a positive number.

- take 1's compliment by taking $0 \to 1$, $1 \to 0$ then add 1 with it to convert it to 2's complement.

Biased

This refers to a fixed value, which is often called as bias that added to the integer.

(12) (a) 6 + 13

2's complement

6 → $(0000\ 0110)_2$ → 1111 1010

13 → $(0000\ 1101)_2$ → 1111 0011

$\boxed{1}$ 1110 1101

ignore

2's of 6 + 2's of 13 → 2's of the answer → then 2's → Final ans

2's complement

$(0001\ 0011)_2$

which is +19 (ans)

(or) we simply add the binary bit without 2's

(b) −6 + 13

6 in 2's complement → 1111 1010

13 in binary → 0000 1101

1 $\boxed{0}$ 000 0111

ignore   sign bit

which is

7 Ans

(c) 6 - 13

6 is $(0000\ 0110)_2$

-13 is $(1111\ 0011)_2$

1111 1001

sign bit (-ve)

2's complement

$(00000111)_2$

which is -7

(d) -6 - 13

-6 is 1111 1010

-13 is 1111 0011

1 1 111 01101

ignore

sign (negative)

2's complement

$(00010011)_2$ which is -19

= Ans

13 a.

$$\begin{array}{r} 111000 \rightarrow M \\ -110011 \rightarrow N \\ \hline \end{array}$$

→ 2's complement → 001101

So

$$\begin{array}{r} 111000 \\ +\ 001101 \\ \hline 1000101 \end{array}$$

end carry (discard)

Ans $\boxed{(000101)_2}$

b.

$$\begin{array}{r} 11001100 \rightarrow M \\ -\ 00101110 \rightarrow N \\ \hline \end{array}$$

→ 2's complement → (11010010)

$$\begin{array}{r} 11001100 \\ +\ 11010010 \\ \hline 110011110 \end{array}$$

end carry

→ Ans is $\boxed{(10011110)}_2$

c. 1111 0000 1111 → M
− 1100 1111 0011 → N → 2's complement

001100001101

1111 0000 1111
0011 0000 1101

1 001000011100 → ans
(001000011100)$_2$

d. 11000011
− 11101000 → 2's complement

(00011000)

11000011
00011000

11011011 → again 2's complement

$\boxed{(00100101)_2}$ ans

(14) Express in IEEE 32-bit floating point

a. 2.5

2 is binary → 10

sign bit → 0

Before normalization $(10.1)_2$ → 1.01×2^1 ← using implicit (1.M)

exponent adjust

$1 + 2^{(8-1)} - 1$

$1+127$

$= \underline{128}$

exponent is 1000 0000

$S = 0$

In IEEE 754 single precision

Sign - 1 bit

exponent - 8 bit

23 bit mantissa

S	E	M
1 bit	8 bit	23 bit

Answer is

$(\underset{S}{0}\ \underbrace{1000\,0000}_{E}\ \underbrace{010\,0000\,0000\,0000\,0000\,0000}_{M})$

(b) $-(1/32)$ $1/32 = 0.03125$

convert it to binary

before normalize

$\hookrightarrow (0.00001)_2$

(as implicit)

1×2^{-5}

Sign bit

$\hookrightarrow$ 1 (as negative)

bias = 127

exponent $= -5 + 127$

$= 122$

in binary

0111 1010

1 - 01111010 - 000 0000 0000
0000 0000 0000

Ans

(15)

1 10010010 01 000 000 000 000 000 000 000

S E M

Sign bit is 1 so -ve no

$E = (10010010)_{10} = 146$ bias = 127

Assuming implicit 1.M $e = 146 - 127$

$= 19$

$1.01 \ldots\ldots \times 2^{19}$

in binary $\hookrightarrow$ $= (10100000000000000000.0000)_2$

decimal $\hookrightarrow$ $= -655360$ (Ans)