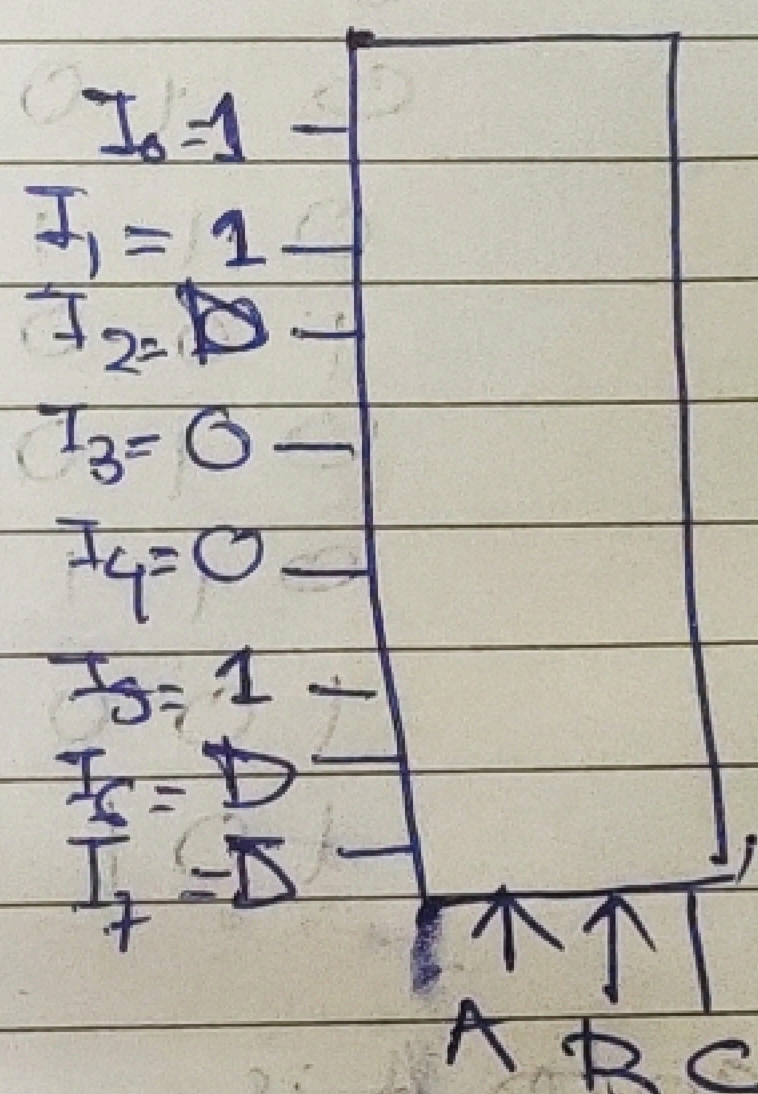
COA Assignment

1. $F=(A,B,C,D)=\sum m(1,3,5,10,11,13,14)+d(0,2)$

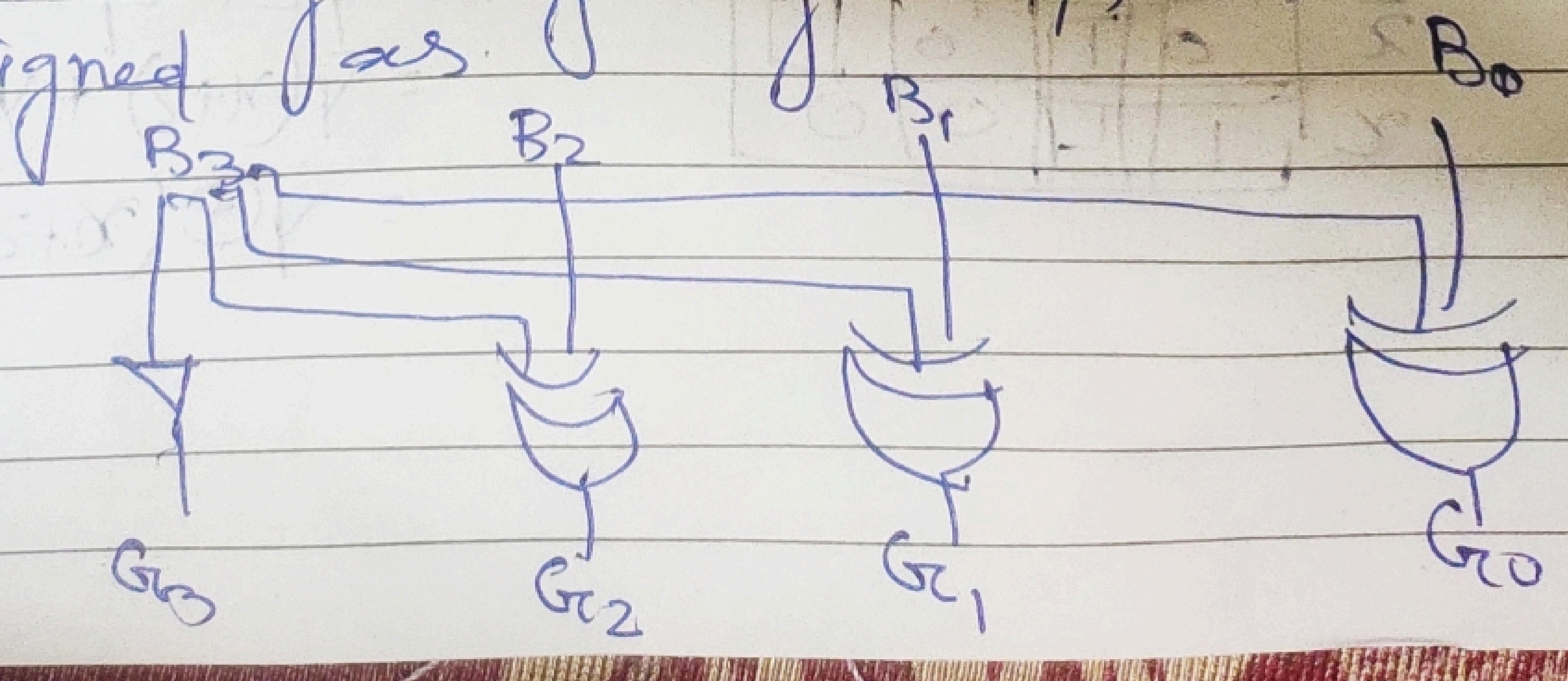
	A	B	C	D	F
0	0	0	0	0	X
1	0	0	0	1	1
2	0	0	1	0	X
3	0	0	1	1	1
4	0	1	0	0	0
5	0	1	0	1	1
6	0	1	1	0	0
7	1	0	0	0	0
8	0	1	1	1	0
9	1	0	0	1	0
10	1	0	1	0	1
11	1	0	1	1	1
12	1	1	0	0	0
13	1	1	0	1	1
14	1	1	1	0	1
15	1	1	1	1	0

	I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
$\bar{D}$	0	2	4	6	8	10	12	14
D	1	3	5	7	9	11	13	15

Now the 8' MUX will be like



2. Let the 4 bit binary no be denoted as $B_3B_2B_1B_0$ Where B_3 is MSB
As in Gray Code B_3 is added to Rest of the digit neglecting carry, it can be designed as



Where the output
$G_3 G_2 G_1 G_0$ is the Gray Code.

3. Given,
input x, y, z output - A, B, C
When binary input is 0, 1, 2, 3, the output is one greater when input is 4, 5, 6, 7 output is two less.

	x	y	z	A	B	C	
0	0	0	0	0	0	1	= 1
1	0	0	1	0	1	0	= 2
2	0	1	0	0	1	1	= 3
3	0	1	1	1	0	0	= 4
4	1	0	0	0	1	0	= 2
5	1	0	1	0	1	1	= 3
6	1	1	0	1	0	0	= 4
7	1	1	1	1	0	1	= 5

Now K-Map for A is.

	$\bar{y}\bar{z}$	$\bar{y}z$	yz	$y\bar{z}$
$\bar{x}$	0	0	1	0
x	0	0	1	1

$A = xy + yz = y(x+z)$

Now K-Map for B is

	$\bar{y}\bar{z}$	$\bar{y}z$	yz	$y\bar{z}$
$\bar{x}$	0	1	0	1
x	1	1	0	0

$B = \bar{y}z + x\bar{y} + \bar{x}y\bar{z}$
$= \bar{y}(x+z) + y\bar{x}\bar{z}$
$= y \oplus (x+z)$

Now K-Map for C is

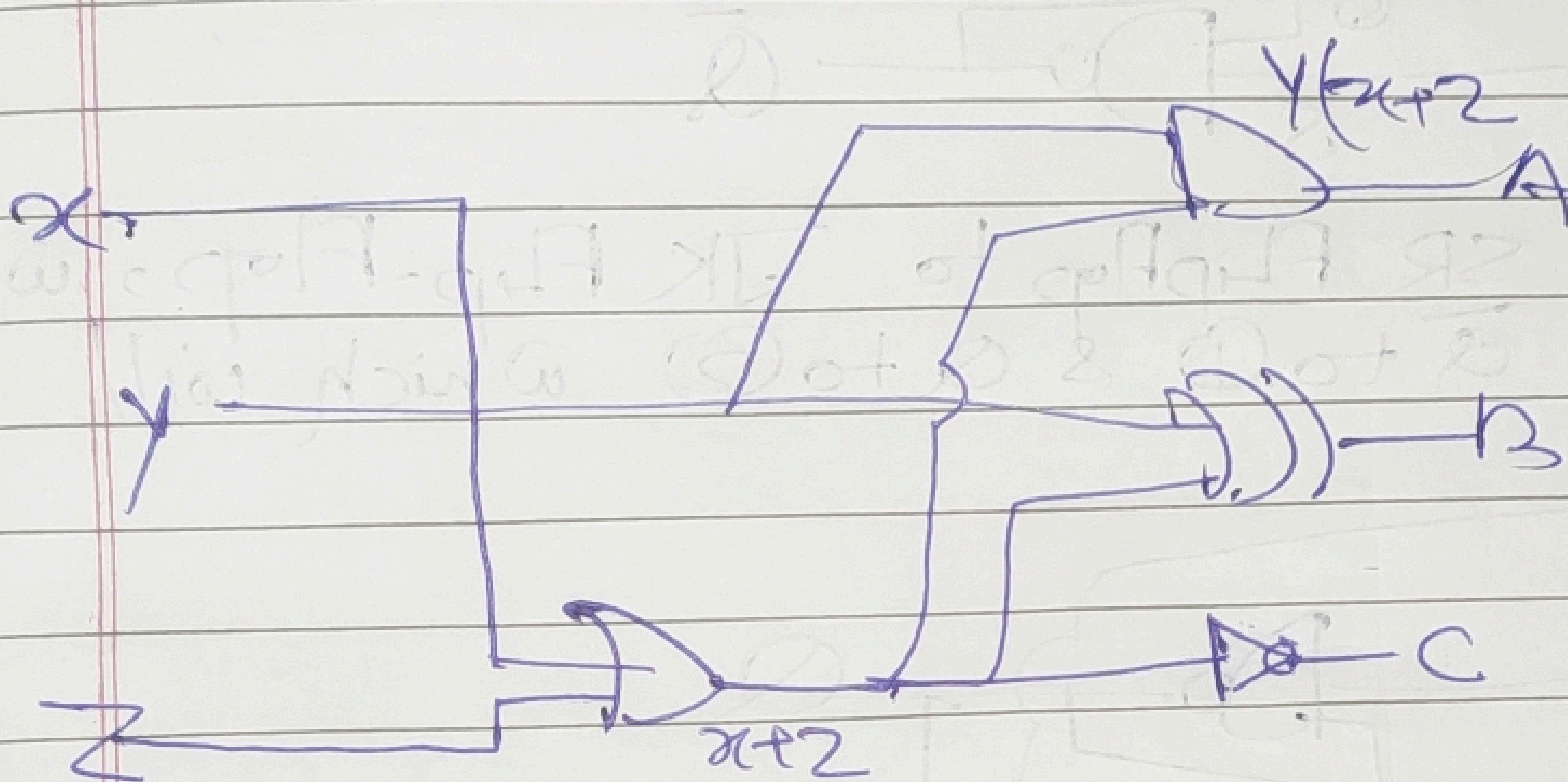
	$\bar{y}\bar{z}$	$\bar{y}z$	yz	$y\bar{z}$
$\bar{x}$	1	0	0	1
x	0	1	1	0

$C = \bar{x}\bar{z} + xz$

$= \neg(x \oplus z)$

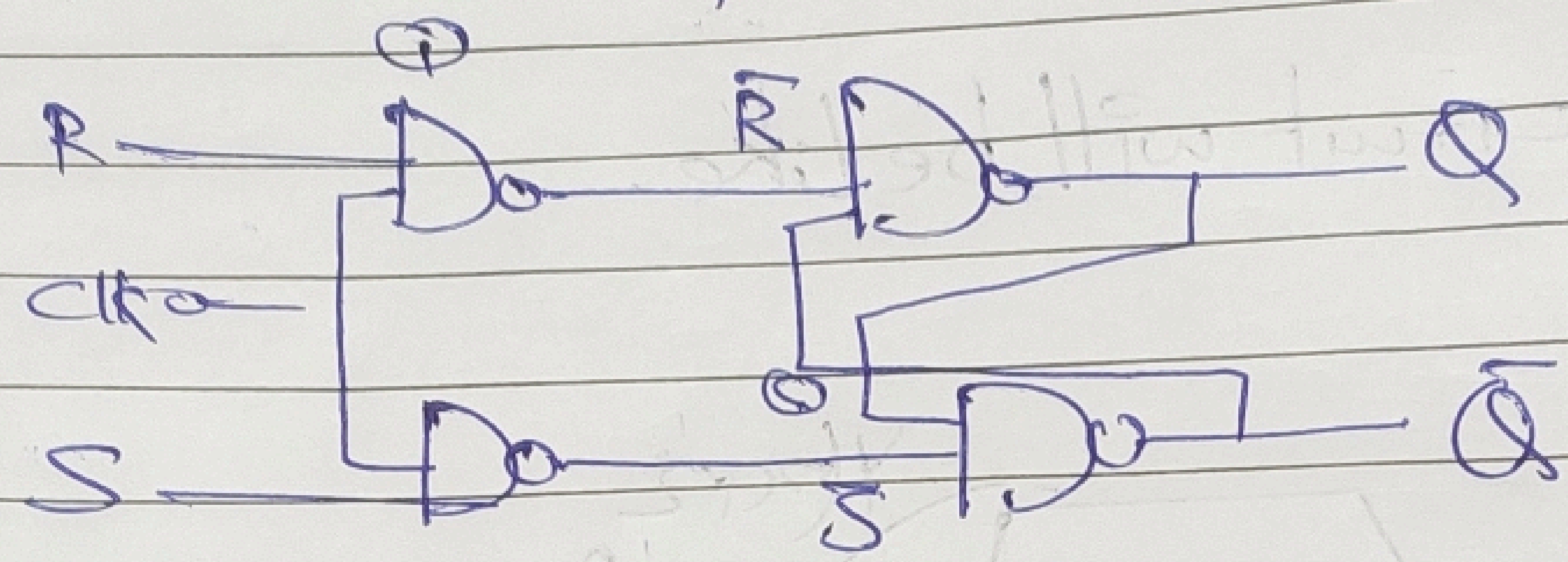
$= x \text{ XNOR } z$

So the circuit will be like.

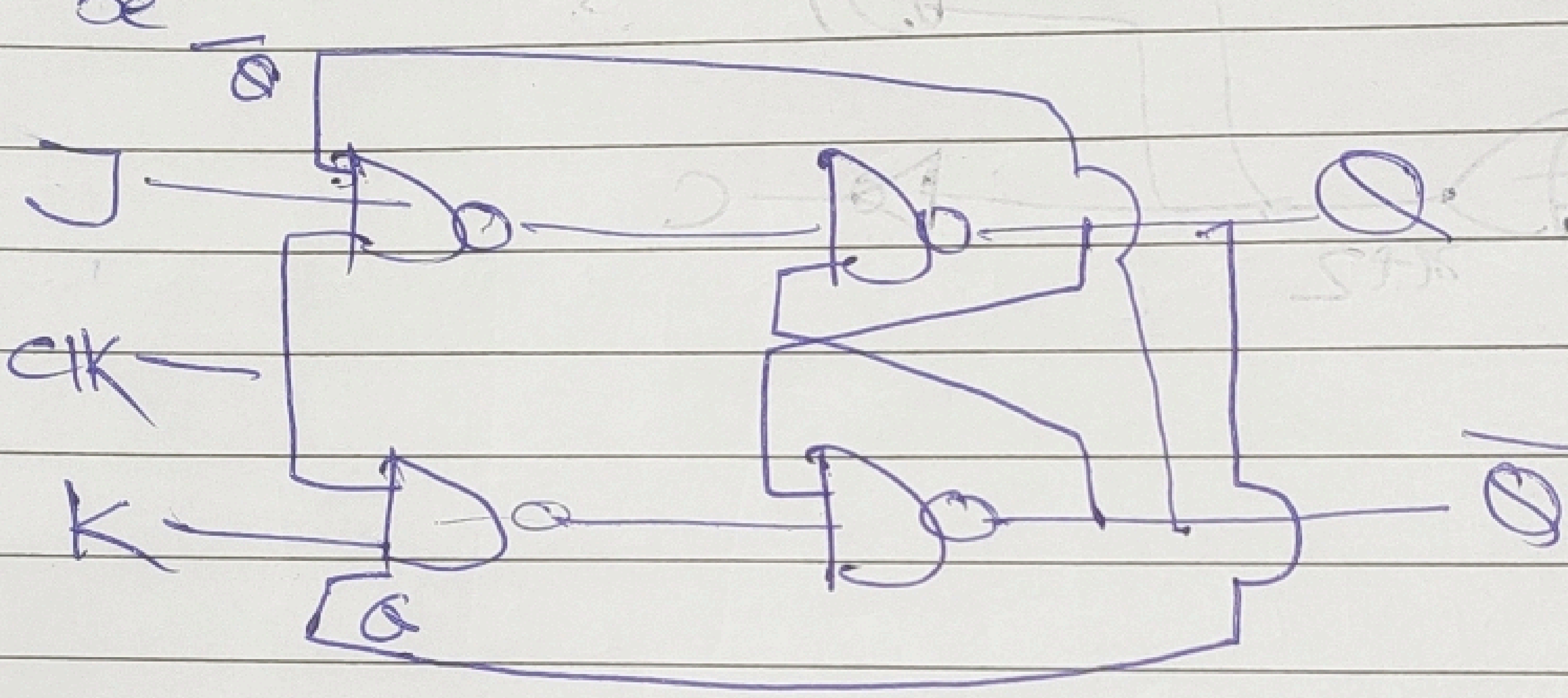


5) Connect SR FlipFlop to JK-FlipFlop.

SR Flip Flop is as follows



To convert SR Flipflop to JK Flip-Flop; we will connect $\bar{Q}$ to ① & Q to ② which will be



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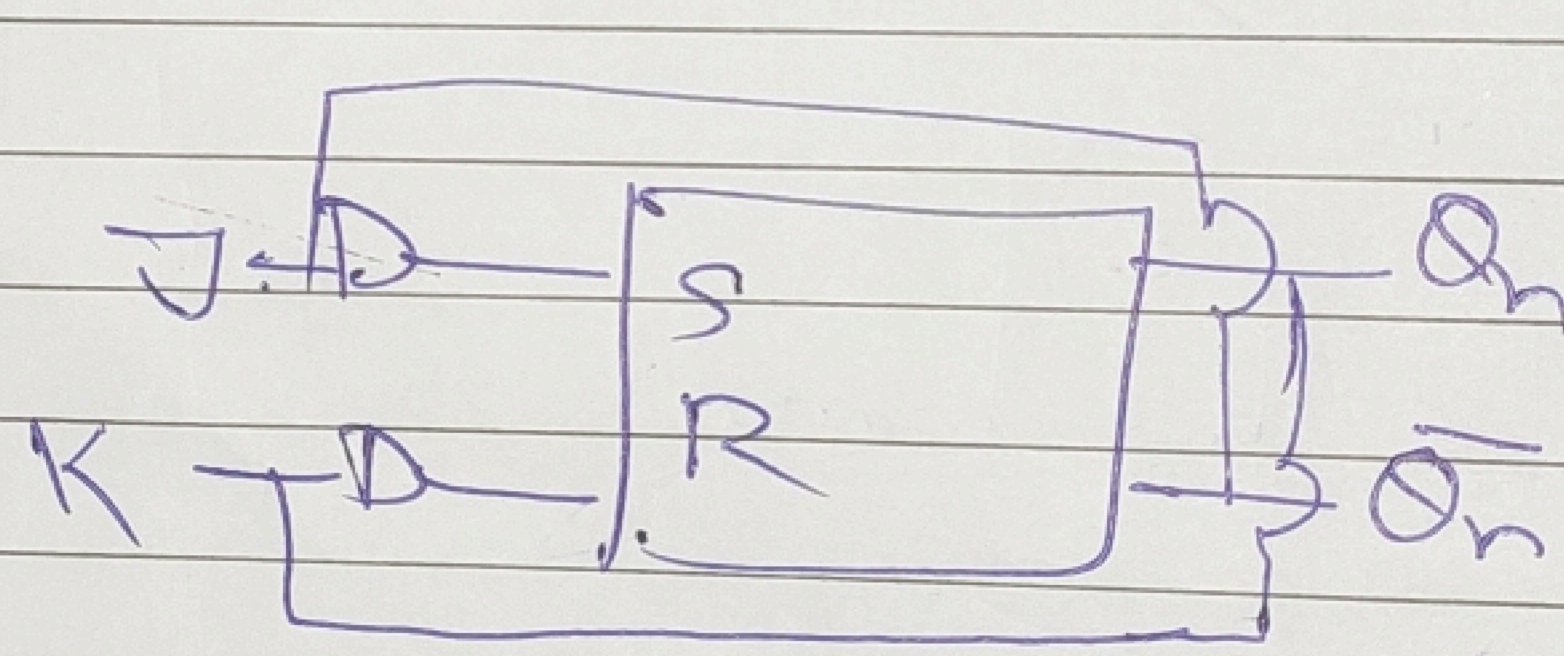

(6) $5 * (-6)$ Using Booth's Algorith
M=0101 Q=1010 count=4

A	Q	q_0	
0000	1010	0	Initial
0000	0101	0	ASR count=3
1011	0101	0	A←A-M
1101	1010	1	ASR count=2
0010	1010	1	A←A+M
0001	0101	0	ASR count=1
1100	0101	0	A←A-M
1110	0010	1	ASR count=0

$\therefore 5 * (-6) = 11100010$

Q.7 $R_1 \leftarrow \#5$
Immedial Adressing

$R_1 \leftarrow M[500]$
Direct Addressing

$R_1 \leftarrow M(R_2]$
Indireet Addressing

Q.8 57 2 address instruction $= 2^6 = 6$ bit
Max 1 address instruction $= 9-6 = 3$
$= 2^3 = 8 =$ one address.

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Q.8) Charact equati of SR Flip-Flop is as follows.

	Q_n	S	R	Q_{n+1}
0	0	0	0	0
1	0	0	1	0
2	0	1	0	1
3	0	1	1	not used
4	1	0	0	1
5	1	0	1	0
6	1	1	0	1
7	1	1	1	not used

Now Kmaps for Q_{n+1}

	$\bar{S}\bar{R}$	$\bar{S}R$	SR	$S\bar{R}$
$\bar{Q}_n$	0_0	0_1	X_3	1_2
Q_n	1_4	0_5	X_7	1_6

$Q_{n+1} = S + Q_n\bar{R}$

Charactristic equation of J-K Flip Flop is as follows

Q_n	J	K	Q_{n+1}
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

Now K-Map for Q_{n+1}

	$\bar{J}\bar{K}$	$\bar{J}K$	JK	$J\bar{K}$
$\bar{Q}_n$	0	0	1	1
Q_n	1	0	0	1

$Q_{n+1} = \bar{Q}_n J + Q\bar{K}$

The Drawback of SR flip-flop is that not all inputs are used in SR flip-flop, when both S & R are 1, different output are obtained when we first take Q & then $\bar{Q}$, & when we first take $\bar{Q}$ & than Q. This Problem is fixed in JK Flip-Flop

Q4. Characteristic equation of J-K Flipflop.

$Q_{n+1} = \bar{Q}_n J + Q_n \bar{K}$

$J_A = x \quad K_A = B$

$J_B = x \quad K_B = A$

(a) $Q_{n+1} = \bar{Q}_n J + Q_n \bar{K}$

$A_{n+1} = \bar{A}_n x + A_n \bar{B}$

$A(t+1) = \bar{A}(t) x + A(t) \bar{B}$

$B(t+1) = \bar{B}(t) x + B(t) . \bar{A}$

When $x = 0$;, $A(t+1) = A_t \bar{B}_t$

$B(t+1) = \bar{A}_t B_t$

When $x = 1$; $A_{t+1} = \bar{A}_t + \bar{B}_t A_t$

$= \bar{A}_t + \bar{B}_t$

$B_{t+1} = \bar{B}_t + B_t \bar{A}_t$

$= \bar{B}_t + \bar{A}_t = \overline{A_t B_t}$

State table

A	B	x	A(t+1)	B(t+1)
0	0	0	0	0
0	0	1	1	1
0	1	0	0	1
0	1	1	1	1
1	0	0	0	0
1	0	1	0	1
1	1	0	1	0
1	1	1	1	0

(b) State Diagram: