CS & IT ENGINEERING

DIGITAL LOGIC

Combinational Circuit

Lecture No. 6

By- CHANDAN SIR

01 DMux

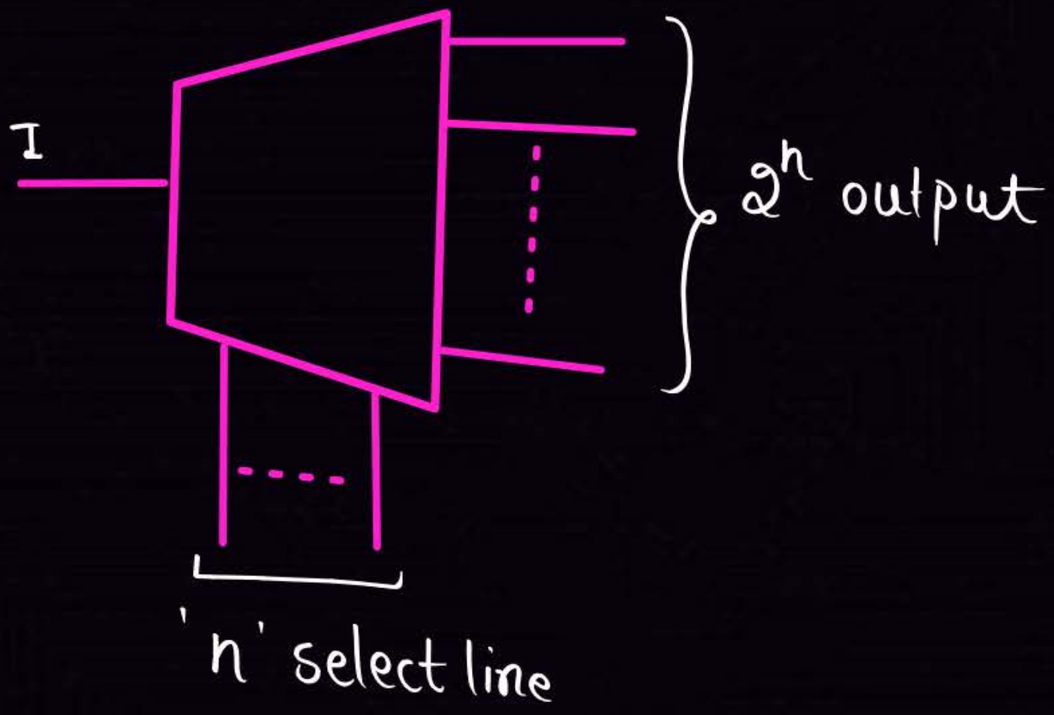
02 Encoder

03 questons

05 Discussion

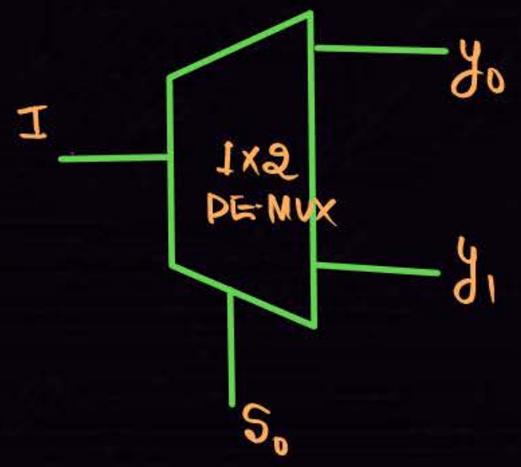
DE-MUX :→

→ DE-MUX is called AND Logic



Q. Design 1x2 DE-MUX?

Step 1 :→



Step 2:

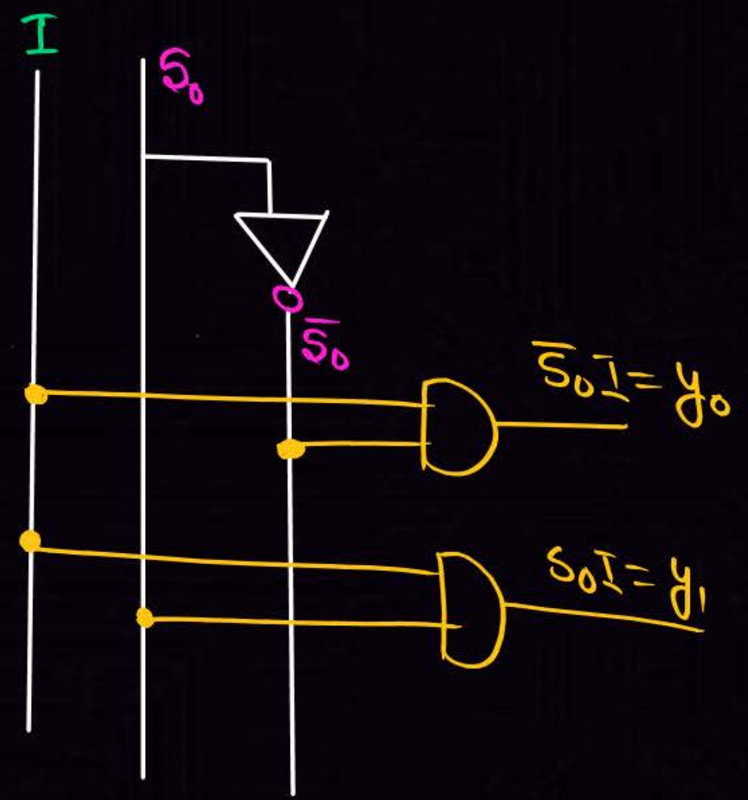
S_0	y_0	y_1
0	I	0
1	0	I

Step 3:- $y_0 = \overline{S_0} I$

$y_1 = S_0 I$

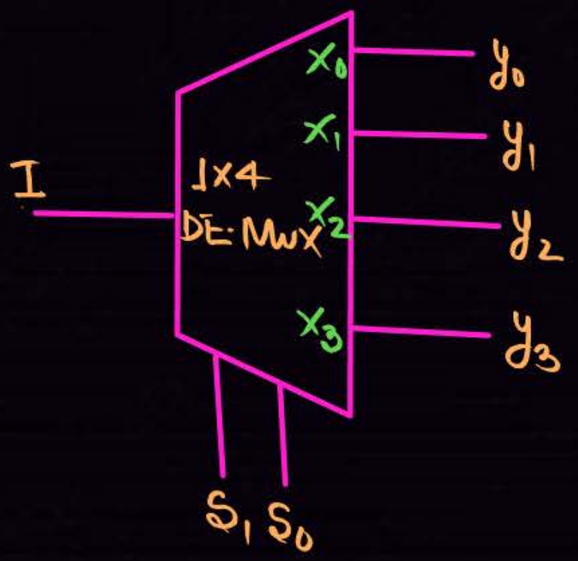
Step 4:-

Step 5:



Q Design a 1X4 DEMUX?

Step 1:



Step 2:

S_1	S_0	y_0	y_1	y_2	y_3
0	0	I	0	0	0
0	1	0	I	0	0
1	0	0	0	I	0
1	1	0	0	0	I

Step 3:-

$$y_0 = \bar{S}_1 \bar{S}_0 I$$

$$y_1 = \bar{S}_1 S_0 I$$

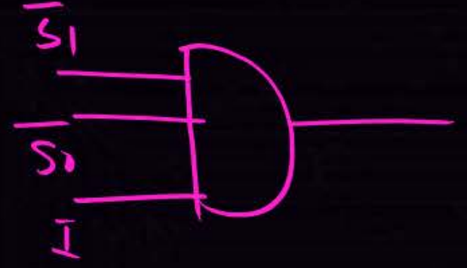
$$y_2 = S_1 \bar{S}_0 I$$

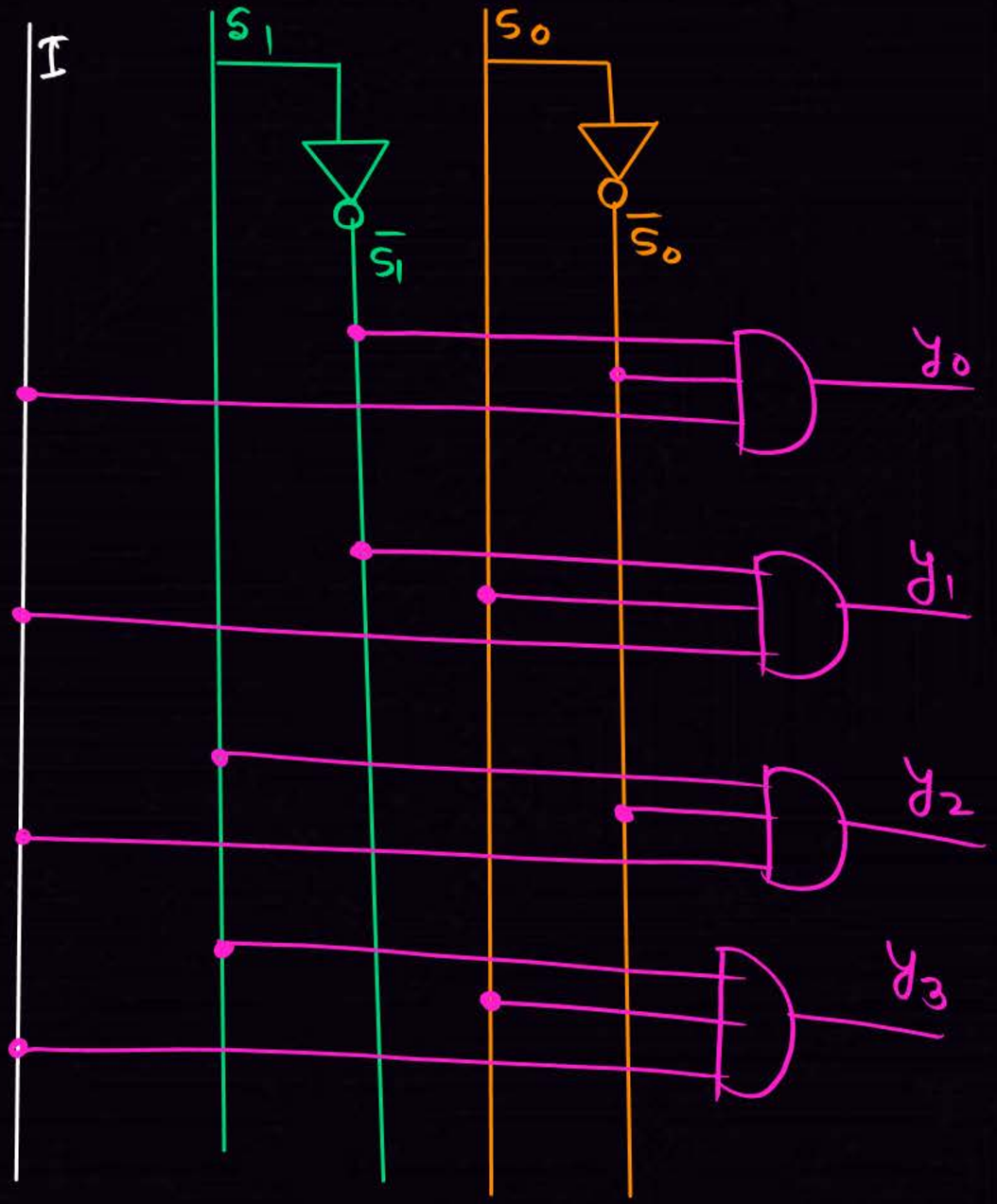
$$y_3 = S_1 S_0 I$$

Step 4:

Step 5 :

$y_0 = \bar{S_1}\,\bar{S_0}\,I$



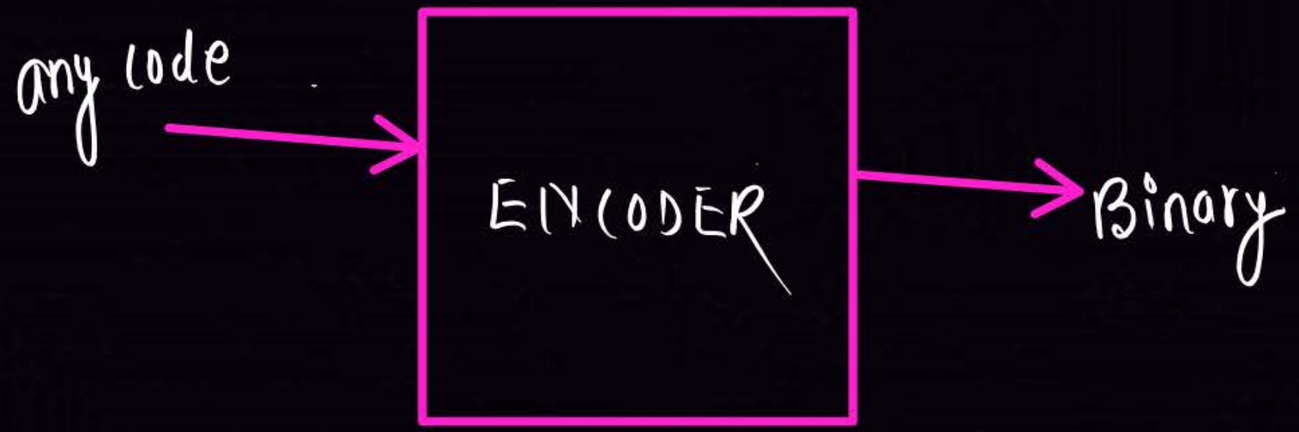


✓ Q Design a 1X8 DE-MUX

✓ Q Design a 1X16 DE-MUX.

ENCODER

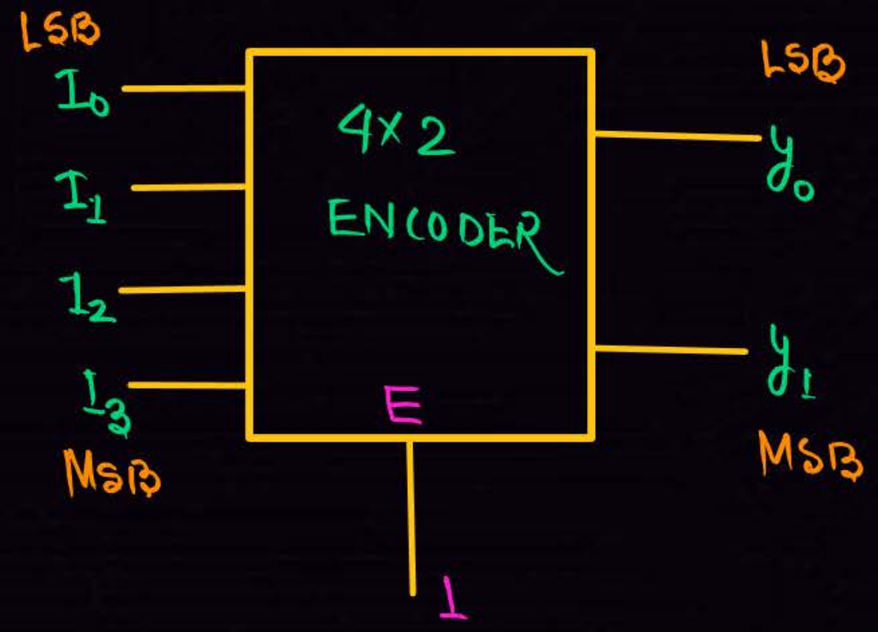
↳ A circuit which is use to convert any code into Binary are called Encoder.



- 1) 4 X 2 Encoder (Quad to Binary)
- 2) 8 X 3 Encoder (octa to Binary)
- 3) 16 X 4 Encoder (Hexa to Binary)

Q Design a 4x2 Encoder

Step 1 :→



Step 2 :-

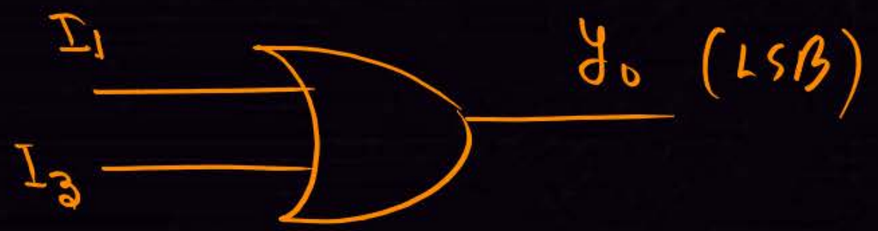
I_3	I_2	I_1	I_0	y_1	y_0
0	0	0	1	0	0
0	0	1	0	0	1
0	1	0	0	1	0
1	0	0	0	1	1

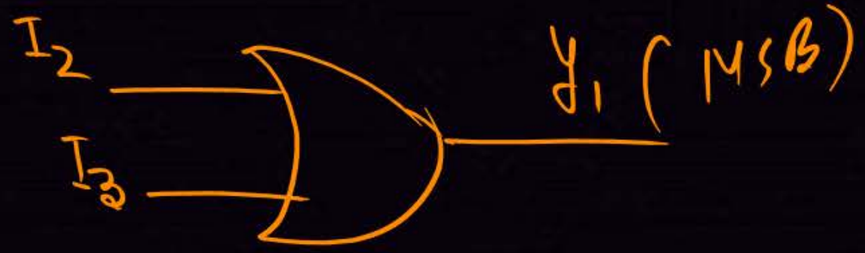
$y_0 = I_1 + I_3$

Step 3: $y_1 = I_2 + I_3$

Step 4:

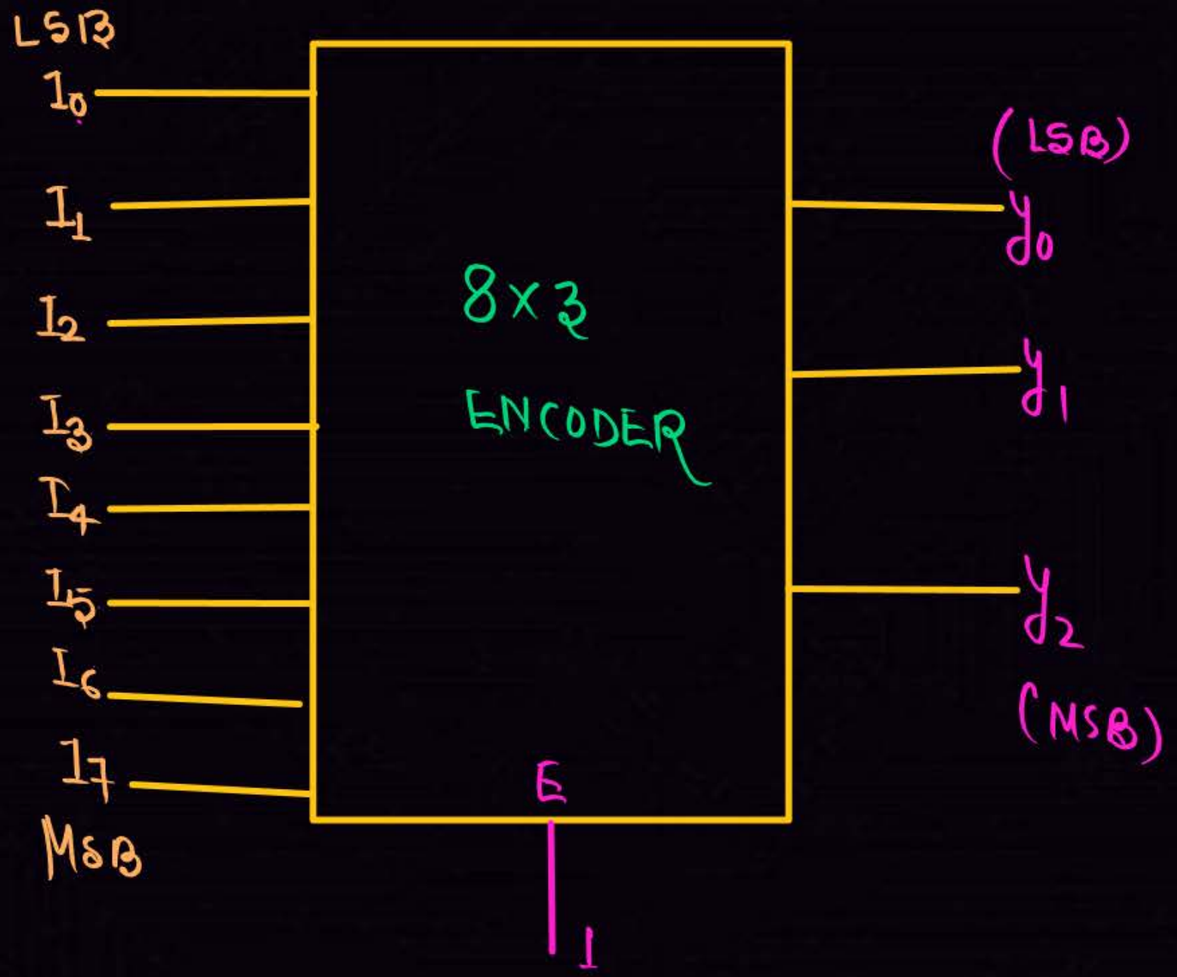
Step 5:





Q Design a 8×3 Encoder?

Step 1:



Step 2:

MSB							LSB	MSB		LSB
I_7	I_6	I_5	I_4	I_3	I_2	I_1	I_0	y_2	y_1	y_0
0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	1	0	0	0	1
0	0	0	0	0	1	0	0	0	1	0
0	0	0	0	1	0	0	0	0	1	1
0	0	0	1	0	0	0	0	1	0	0
0	0	1	0	0	0	0	0	1	0	1
0	1	0	0	0	0	0	0	1	1	0
1	0	0	0	0	0	0	0	1	1	1

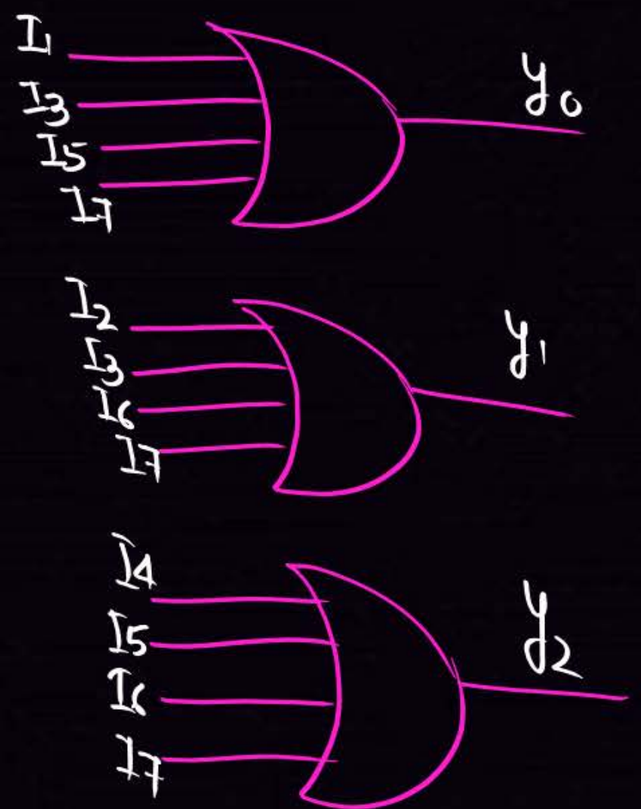
Step3: $y_0 = I_1 + I_3 + I_5 + I_7$

$y_1 = I_2 + I_3 + I_6 + I_7$

$y_2 = I_4 + I_5 + I_6 + I_7$

Step4:

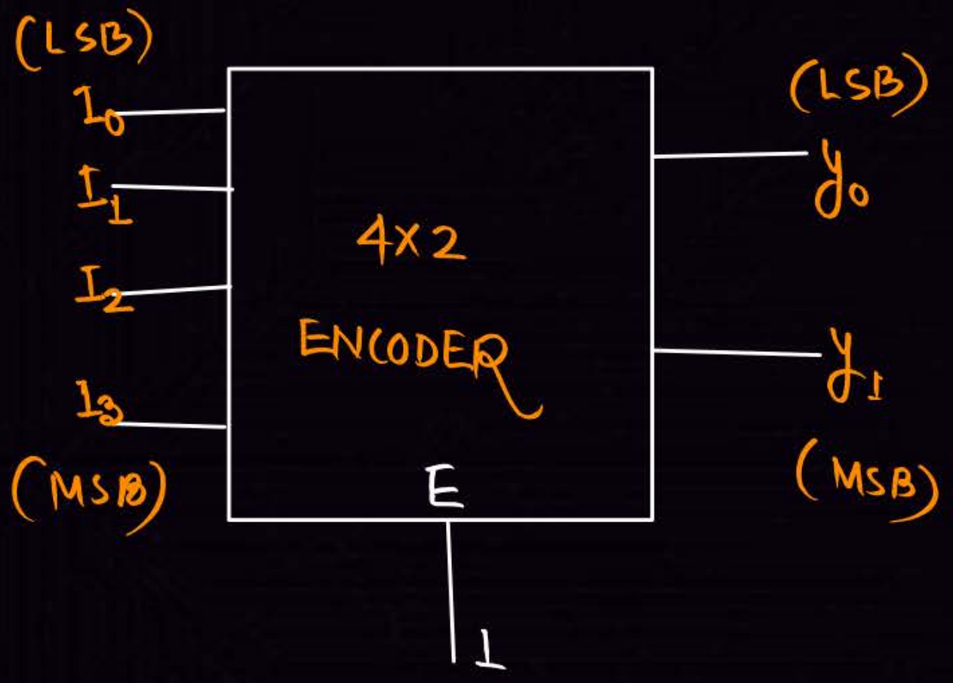
Step5:



HW

Q Design a 16x4 ENCODER

NOTE :- PRIORITY ENCODER



LSB priority Encoder

MSB LSB

I_3	I_2	I_1	I_0	y_1	y_0
X	X	X	1	0	0
X	X	1	0	0	1
X	1	0	0	1	0
1	0	0	0	1	1

→ weighted, self complemented

Decimal	BCD	Excess-3 code	4 2 2 1	Gray code
0	0000	0011	0000	
1	0001	0100	0001	
2	0010	0101	0010	
3	0011	0110	0011	
4	0100	0111	0110	
5	0101	1000	1001	
6	0110	1001	1100	
7	0111	1010	1101	
8	1000	1011	1110	
9	1001	1100	1111	

Decimal → Weighted code
Decimal → Self complemented

r → Base (Radix)

10^3 10^2 10^1 1

a_3 a_2 a_1 a_0

5231

Complement

$(r-1)$'s

r's complement

	$(r-1)$'s	r's complement
$r=2$	1's	2's
$r=8$	7's	8's
$r=10$	9's	10's

3 —9's complement→ ?

6

$$\begin{array}{r} 9 \\ -\ 3 \\ \hline 6 \end{array}$$

$$\begin{array}{r} 9 \\ -\ 6 \\ \hline 3 \end{array}$$

$$\begin{array}{r} 999 \\ -\ 236 \\ \hline 763 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ -\ 0 \\ \hline 9 \end{array} \longleftrightarrow \begin{array}{r} 9 \\ -\ 9 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 9 \\ -\ 1 \\ \hline 8 \end{array} \longleftrightarrow \begin{array}{r} 9 \\ -\ 8 \\ \hline 1 \end{array}$$

BCD → weighted code
BCD → Not a self complemented code
BCD → Binary Coded Decimal
→ Each decimal numbers are represented by 4 bits.

{ Decimal → 0
BCD → 0000

{ Decimal → 3
BCD → 0011

{ Decimal → 9
BCD → 1001

Decimal → 10
BCD → 00010000

{ Decimal → 29
BCD → 00101001

Excess-3 code :→

- It is not a weighted code
- Self complemented code

Thank you

GW

Soldiers !