CS & IT ENGINEERING

DIGITAL LOGIC

Combinational Circuit

Lecture No. 4

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01 DEMUX

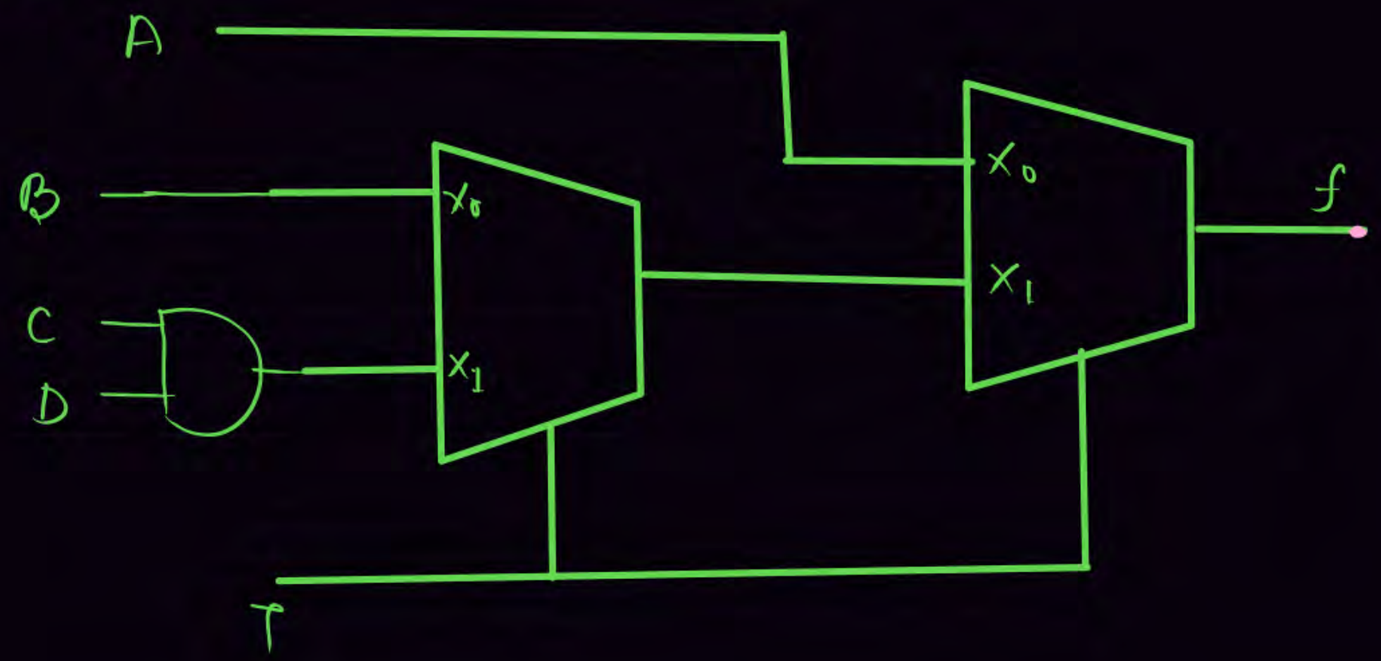
02 Question Practice

03 ENCODER

03 Discussion

Q =

$\begin{cases} T_{MUX} = 2\,\mu s \\ T_{AND} = 1\,\mu s \end{cases}$



Case(1) $T = 0$

$T = T_{MUX\text{-}2} = 2\,\mu s$

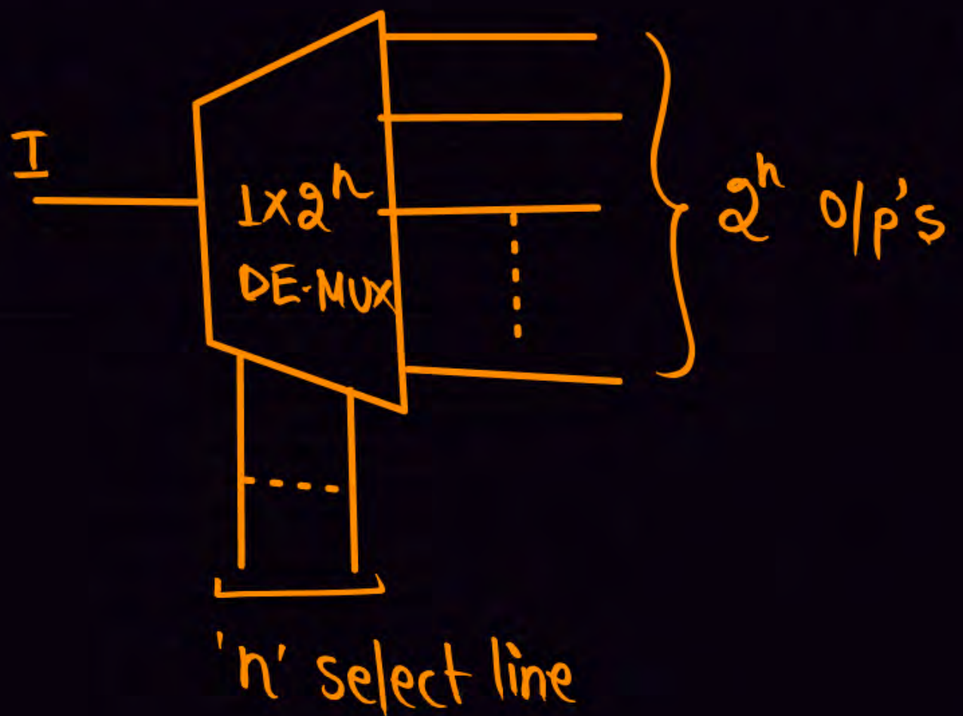
Case (2) $T = 1$

$T = T_{AND} + T_{MUX\text{-}1} + T_{MUX\text{-}2}$

$T = 1\,\mu s + 2\,\mu s + 2\,\mu s$

$T = 5\,\mu s$

DE-MUX



↳ AND Logic

DEMUX, ENCODER

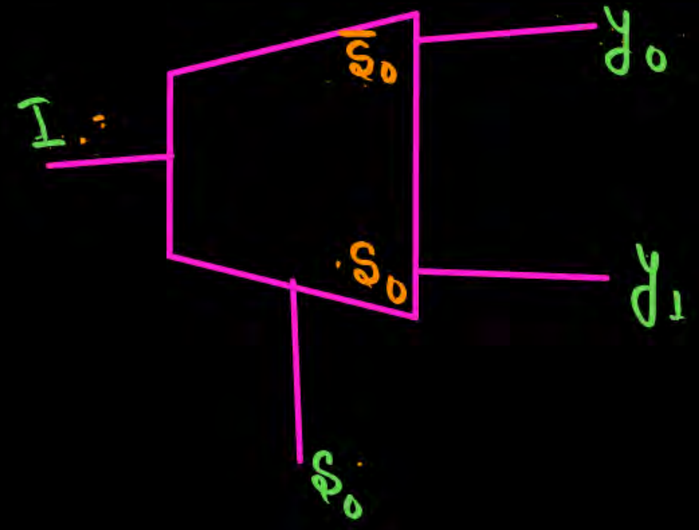
Q.2

Design a 1 x 2 DE-MUX?

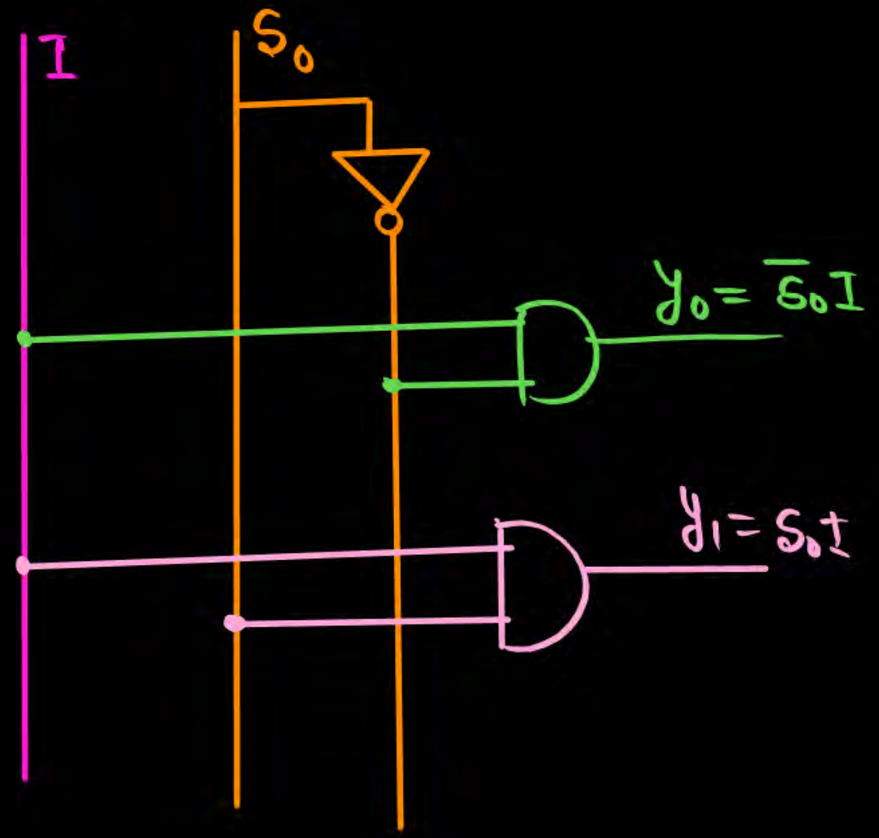
$Y_0 = \bar{S}_0 I$

$Y_1 = S_0 I$

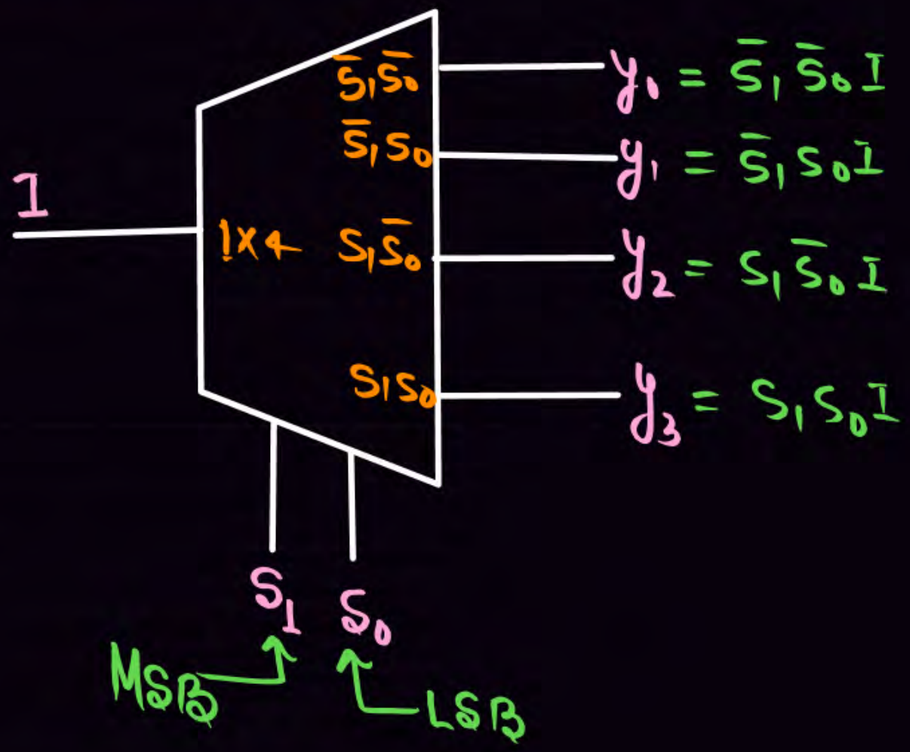
1 x 4



S_0	Y_0	Y_1
0	I	0
1	0	I



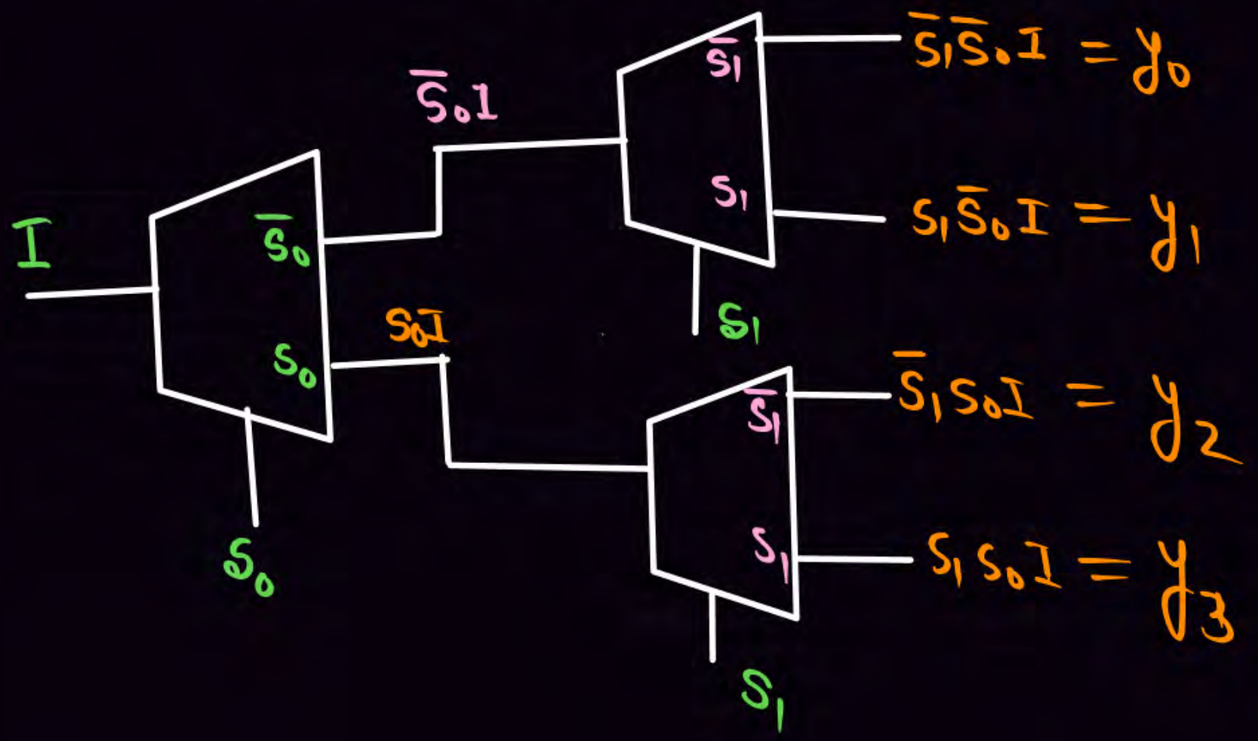
1X4 DE-MUX



HW.

1X8 DE-MUX

Q 1X2 DEMUX $\xrightarrow[2+1=(3)]{\frac{4}{2}+\frac{2}{2}}$ 1X4 DE-MUX.



Base	Digit
2	0, 1
3	0, 1, 2
4	0, 1, 2, 3
5	0, 1, 2, 3, 4
6	0, 1, 2, 3, 4, 5
7	0, 1, 2, 3, 4, 5, 6
8	0, 1, 2, 3, 4, 5, 6, 7
10	0, 1, 2, 3, 4, 5, 6, 7, 8, 9
11	0 – 9, A
12	0 – 9, A, B
13	0 – 9, A, B, C

14	0 – 9, A, B, C, D
15	0 – 9, A, B, C, D, E
16	0 – 9, A – F

$(101)_{2,3,4\cdots}$

Minimum base = 2

$(12C)_{13,14,15,16}$

Minimum base = 13

$(238)_8 \times$

DEMUX, ENCODER

ENCODER

- A circuit used to convert any code into Binary are called Encoder.
- 4 × 2 Encoder [Quad to Binary Encoder]
- 8 × 3 Encoder [Octa to Binary Encoder]
- 16 × 4 Encoder [Hexa to Binary Encoder]

8 4 2 1
0 1 1 0

Decimal	BCD	EXCESS-3	4221
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

Binary Coded Decimal → 0 to 9

↳ Each Decimal numbers will be represented by 4 bits.

Decimal	BCD
0	0000
1	0001
2	0010
3	0011
4	0100
⋮	⋮
9	1001

Decimal	BCD
10	00010000

complement

$r \rightarrow$ Base or Radix

	$(r-1)$'s complement	r's complement
$r=2$	1's complement	2's complement
$r=8$	7's complement	8's complement
$r=10$	9's complement	10's complement
$r=16$	15's complement F's	16's complement F's

1's complement

$$\begin{array}{r} 1 \\ -\ 0 \\ \hline 1 \end{array} \qquad \begin{array}{r} 1 \\ -\ 1 \\ \hline 0 \end{array}$$

9's complement

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

Self complement

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

Self complement

$$\begin{array}{r} 999 \\ -\ 723 \\ \hline 276 \end{array}$$

DEMUX, ENCODER

CODE CONVERSION

BCD CODE - It is weighted code but not self complimented

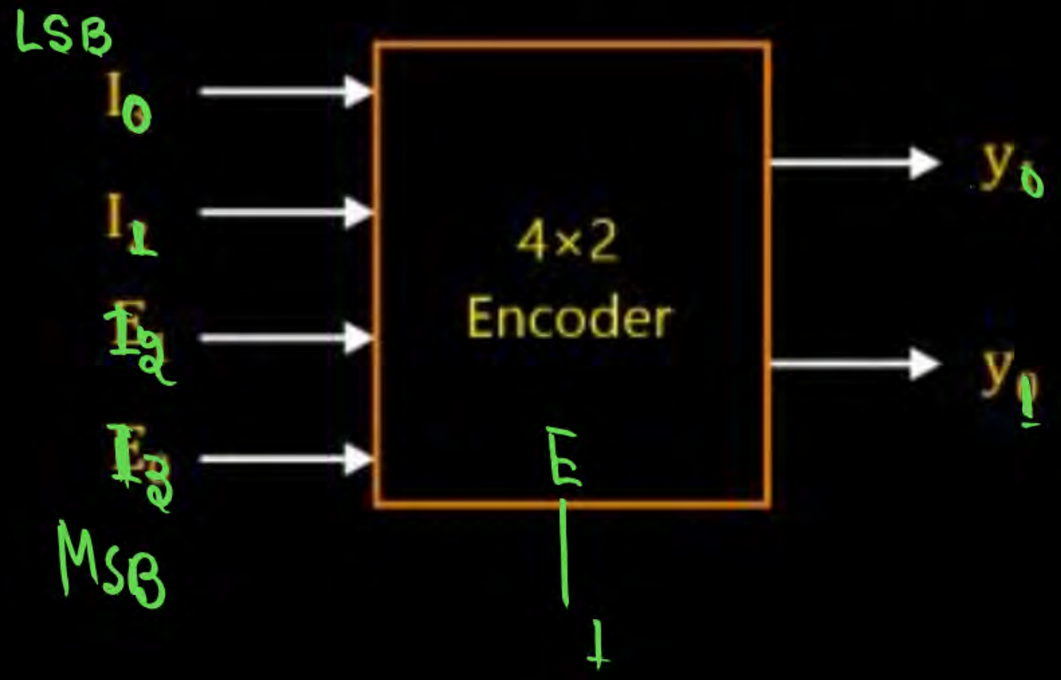
Excess 3 CODE - It is not a weighted code but self complimented code

4221 CODE - It is weighted code and self complimented code

DEMUX, ENCODER

4 × 2 ENCODER

Step 1. Find the number of inputs and outputs



DEMUX, ENCODER

4 × 2 ENCODER

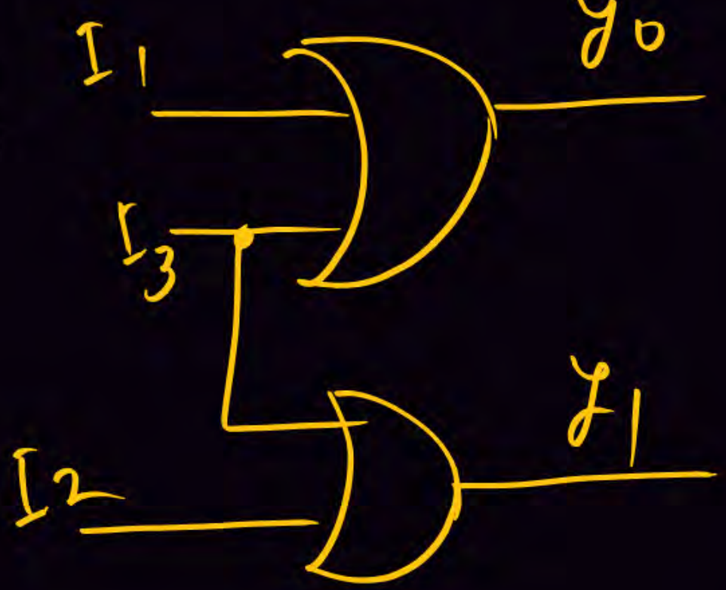
Step 2. Truth Table

SB			LSB	MSB	LSB
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

MSB I_3	I_2	I_1	LSB 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

$$y_0 = I_1 + I_3$$

$$y_1 = I_2 + I_3$$

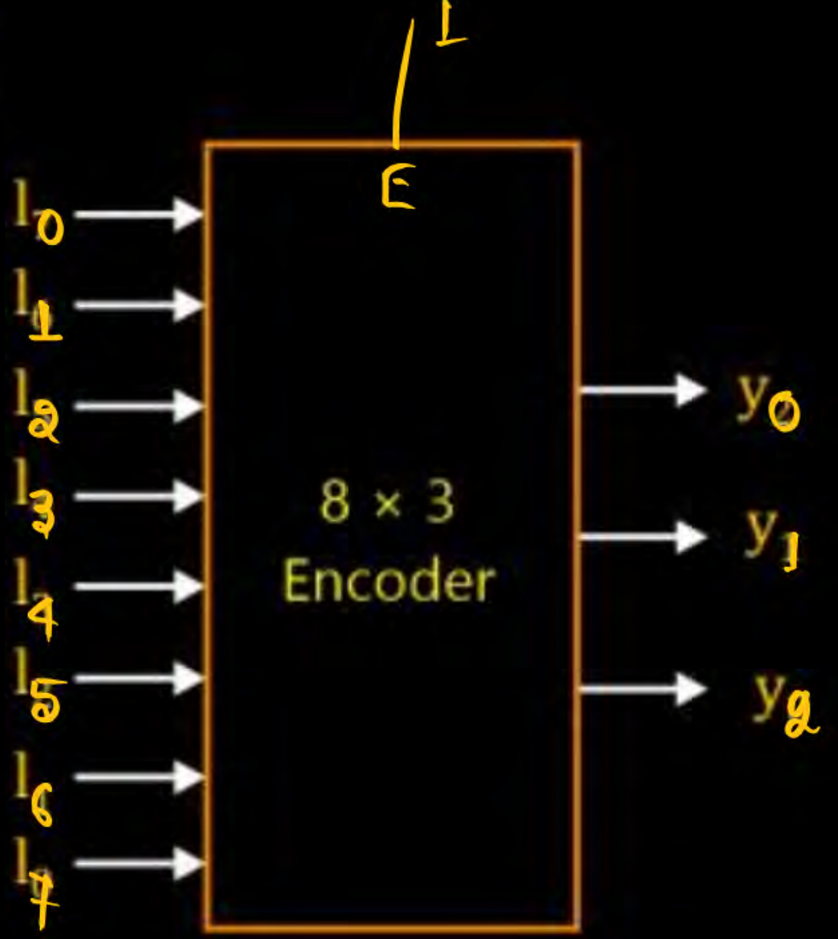


DEMUX, ENCODER

HW

8 × 3 ENCODER

Step 1.



Thank you

GW

Soldiers !