Chapter - 5

Binary Parallel Adder:

Subscript i	4	3	2	1	
Input carry	0	1	1	0	C_i
Augend	1	0	1	1	A_i
Addend	0	0	1	1	B_i
Sum	1	1	1	0	S_i
Output carry	0	0	1	1	C_{i+1}

56

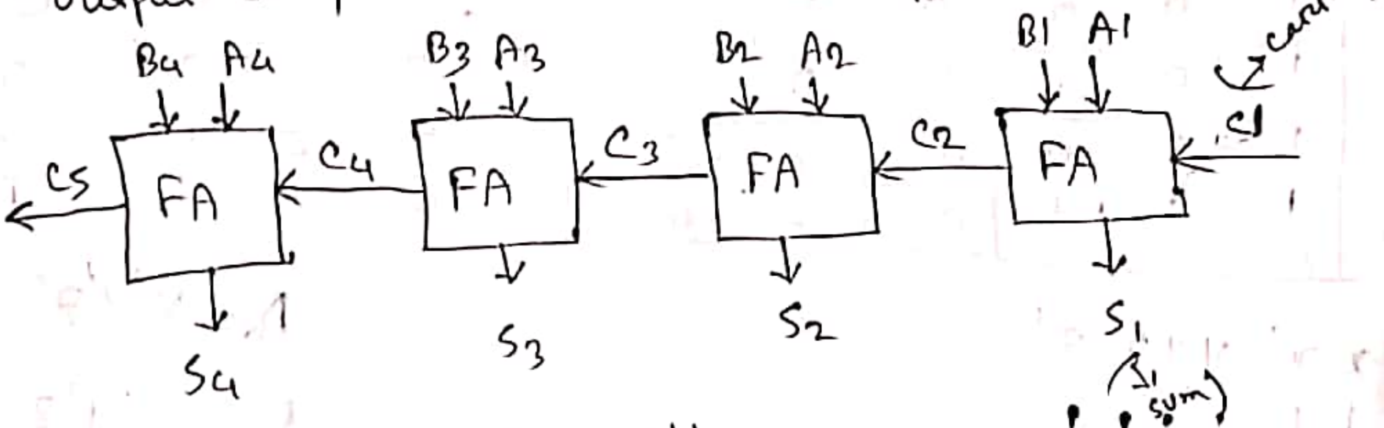
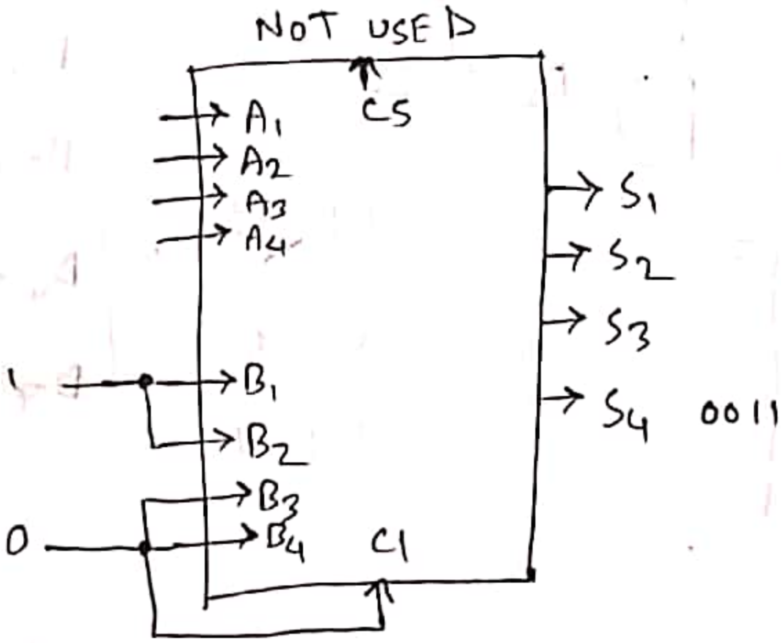


Figure : 4-bit full Adder.

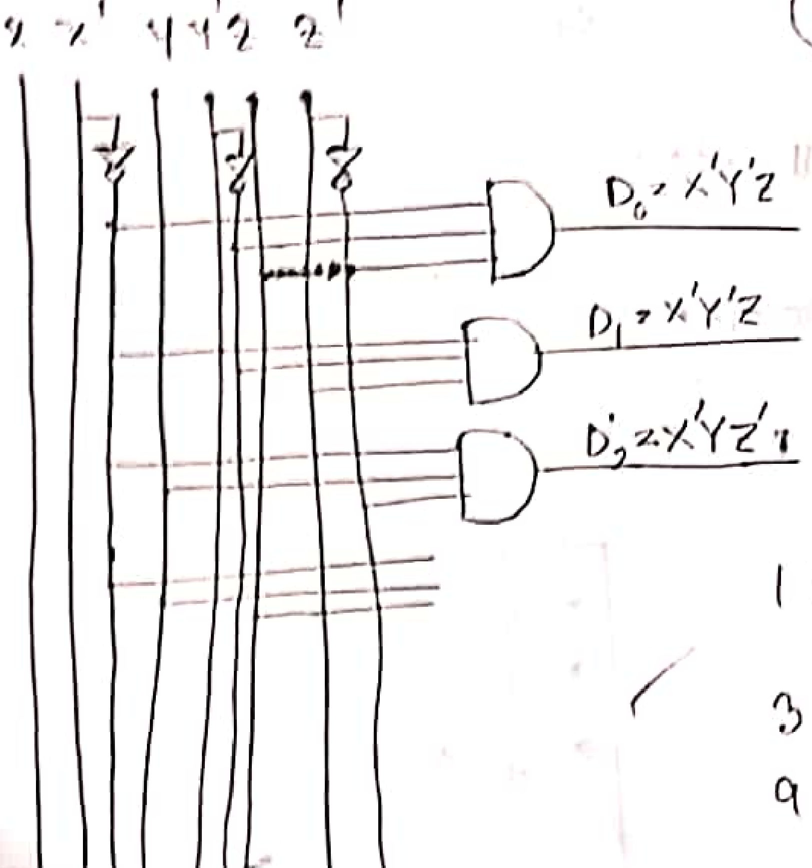
Design a BCD-to-excess-3 code converter.



Decoder: A decoder is a combinational circuit that converts binary ~~an~~ information from n input lines to a maximum of 2^n unique output lines.

x	y	z	D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0
0	1	0	0	0	1	0	0	0	0	0
0	1	1	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0
1	0	1	0	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	1	0
1	1	1	0	0	0	0	0	0	0	1

57



$D_0 = X'Y'Z'$

$D_1 = X'Y'Z$

$D_2 = X'YZ'$

$D_3 = X'YZ$

$D_4 = XY'Z'$

$D_5 = XY'Z$

$D_6 = XYZ'$

$D_7 = XYZ$

3.

1 2 13 in   12 ou

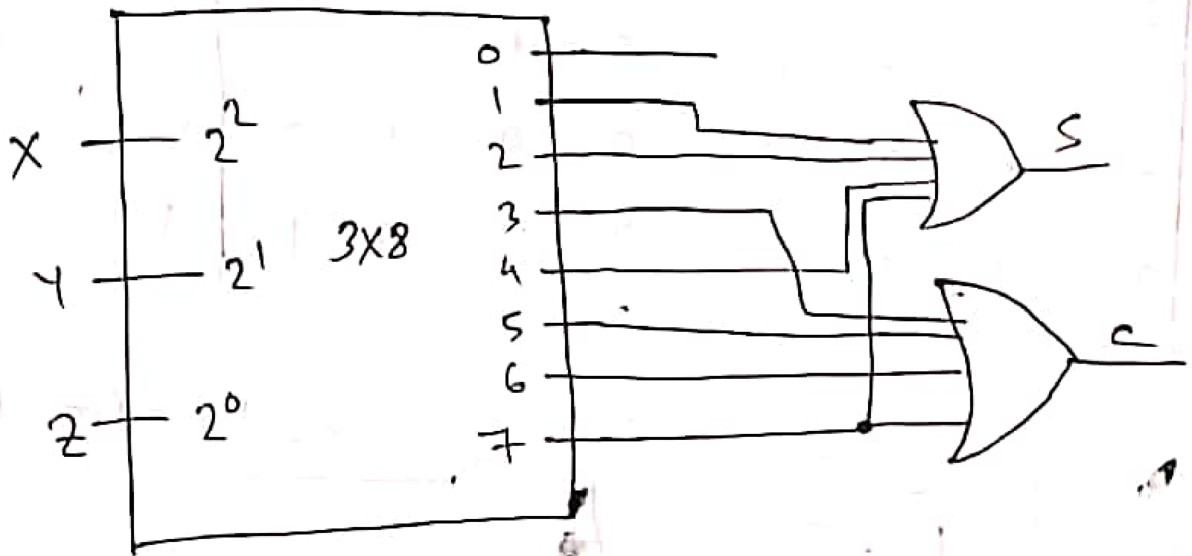
3 4 5   6

9 10 11   8

Example: Implement a full Adder circuit with a decoder & two OR Gate.

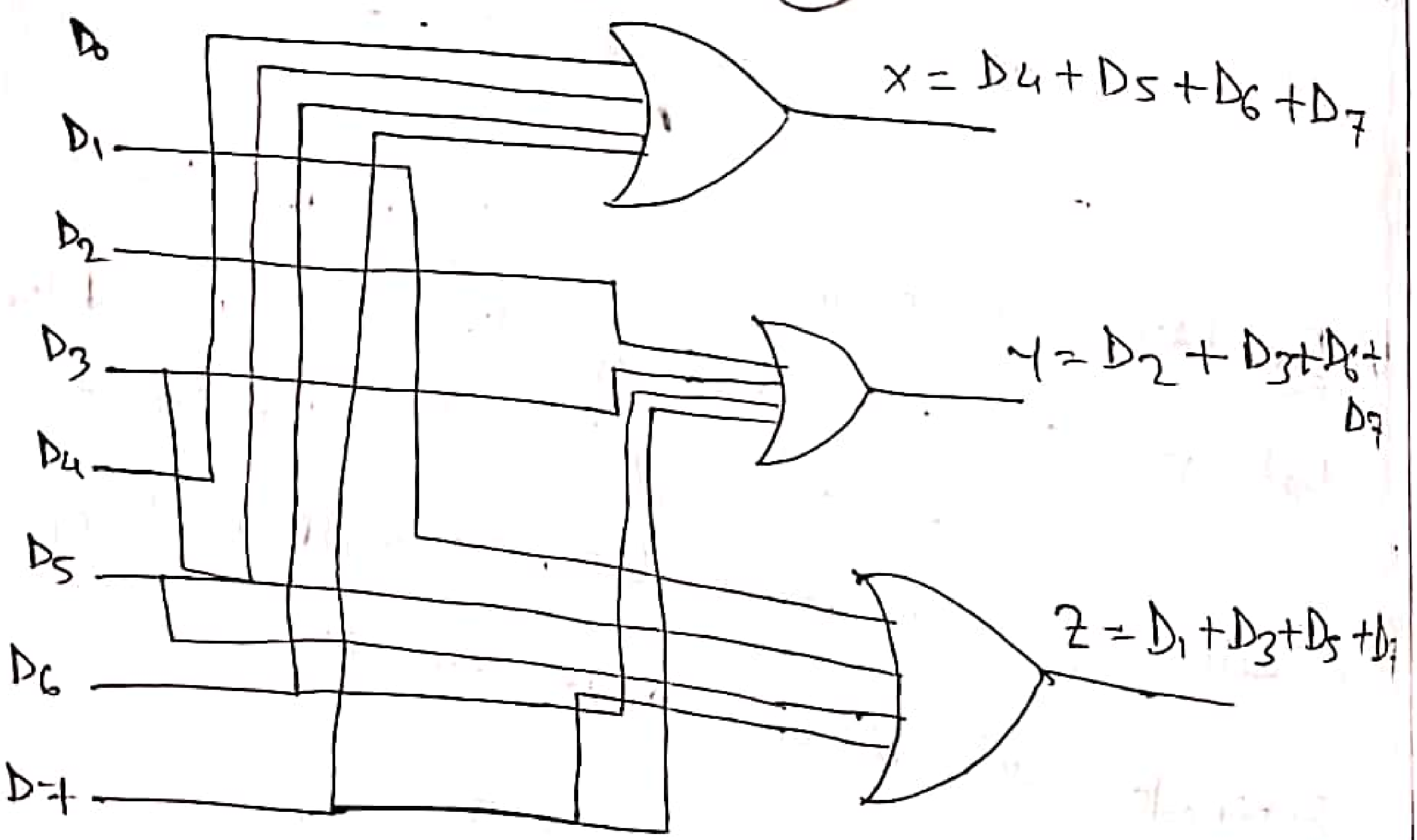
$$S(x,y,z) = \Sigma(1,2,4,7)$$ (58)

$$C(x,y,z) = \Sigma(3,5,6,7)$$



Encodder: A encoder is a digital function that produces a reverse operation from a decodnder. An encoder has has 2^n (or less) input and n ~~selection~~ output lines ~~whose bit~~. The output lines generate the binary code for the 2^n input variables.

D0	D1	D2	D3	D4	D5	D6	D7	x	y	z
1	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	1	0
0	0	0	1	0	0	0	0	0	1	1
0	0	0	0	1	0	0	0	1	0	0
0	0	0	0	0	1	0	0	1	0	1
0	0	0	0	0	0	1	0	1	1	0
0	0	0	0	0	0	0	1	1	1	1



Multiplexers:

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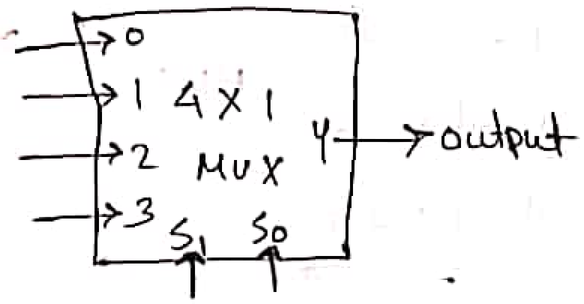
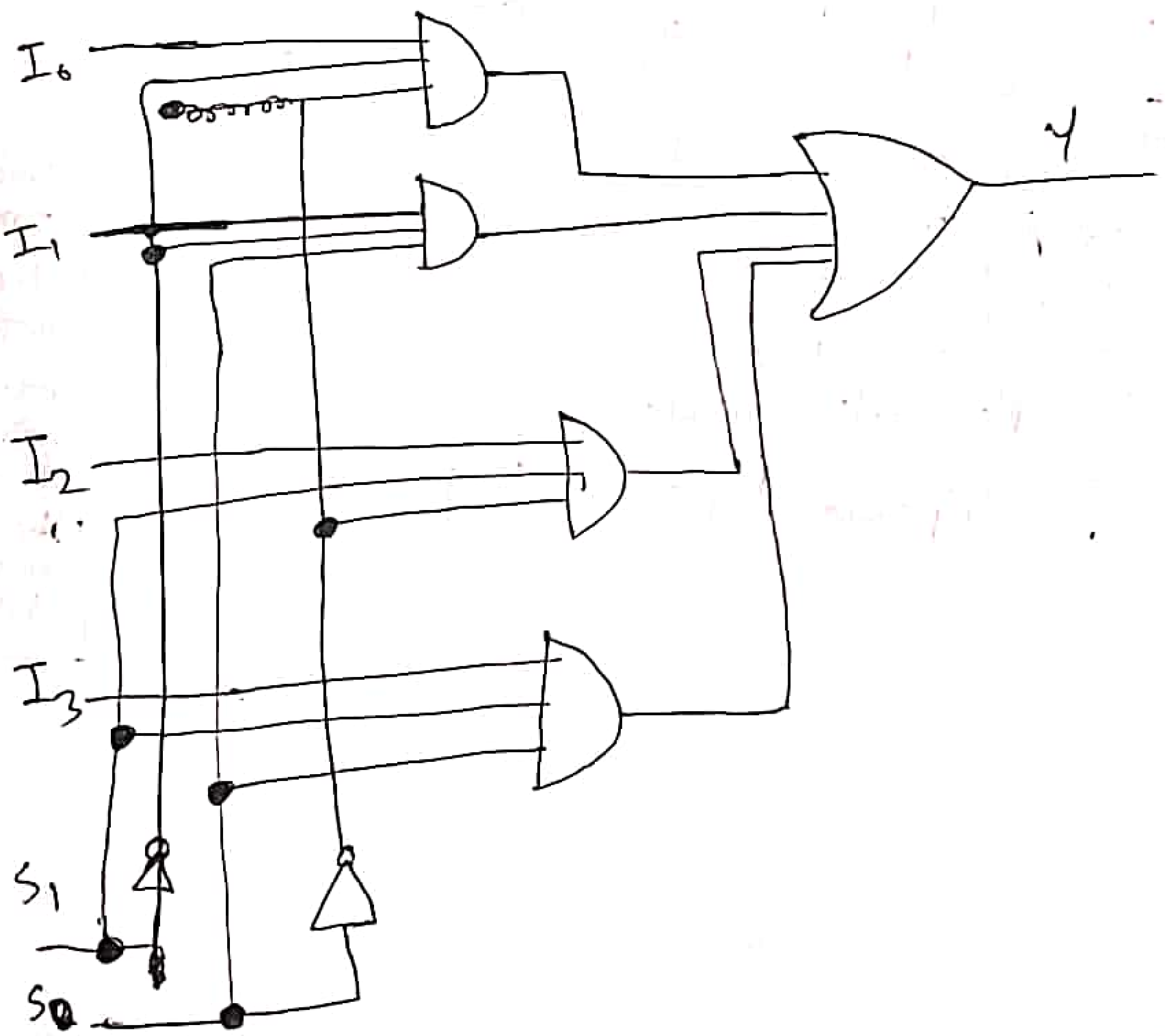
A multiplexers is a combinational circuit that selects binary information from one of many input lines and directs it to a single output line.

(60)



S_1	S_0	Y
0	0	I_0
0	1	I_1
1	0	I_2
1	1	I_3

Selection lines.



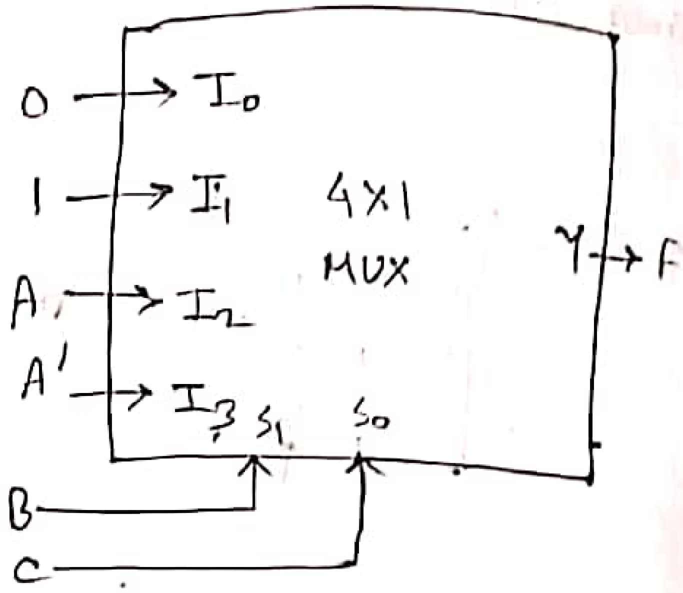
Multiplexers

$F(A,B,C) = \Sigma(1,3,5,6)$

(61)

Truth table:

A	B	C	Y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0



Now,

		I_0	I_1	I_2	I_3
(0)	A'	0	1	2	3
(1)	A	4	5	6	7
		0	1	A	A'

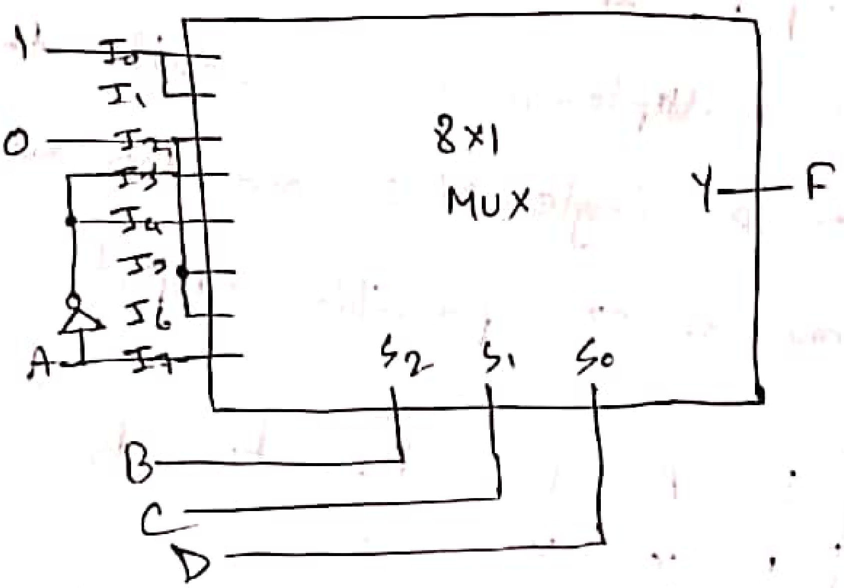
Implementation table

Multiplexers Implementation

circle না থাকলে 0, 2টার circle থাকলে 1, 1টার circle থা: যেটায় circle হয় সেটি যে line এ থাকে সে আউট হবে like → A or A'

$F(A,B,C,D) = \Sigma(0,1,3,4,8,9,15)$

A	B	C	D	Y
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1



multiplexer implementation

	I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
A'	0	1	2	3	4	5	6	7
A	8	9	10	11	12	13	14	15
	1	1	0	A'	A'	0	0	A

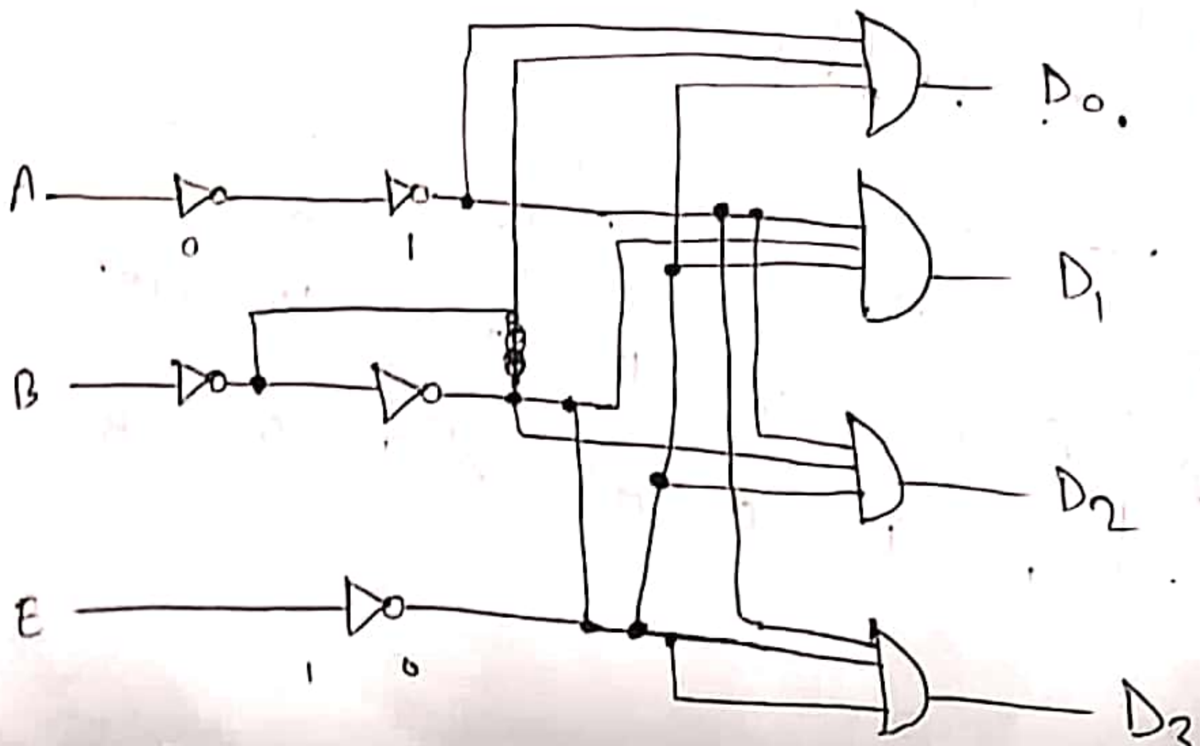
B. Demultiplexer: A decoder with an enable input can function as a demultiplexer.

A multiplexer is a circuit that receive information on a single line and transmit this information on one of 2^n possible output lines. (63)

E	A	B	D_0	D_1	D_2	D_3
1	x	x	1	1	1	1
0	0	0	0	1	1	1
0	0	1	1	0	1	1
0	1	0	1	1	0	1
0	1	1	1	1	1	0

যেগুলো আছে সেগুলো 0 হয় বাকীগুলো 1 হবে

E = 1 [illegible]
E = 0 [illegible]

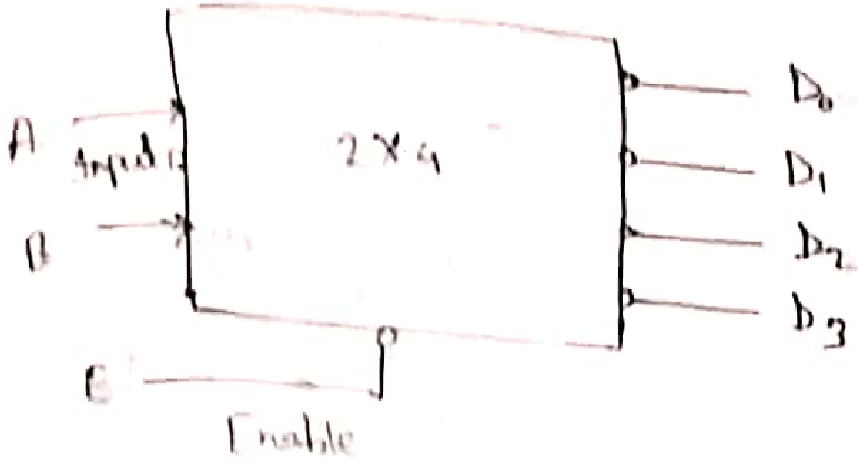


Page 172

E [illegible]

0 1

02/05/19



64

$F(A,B,C) = \Sigma(1,3,5,6)$

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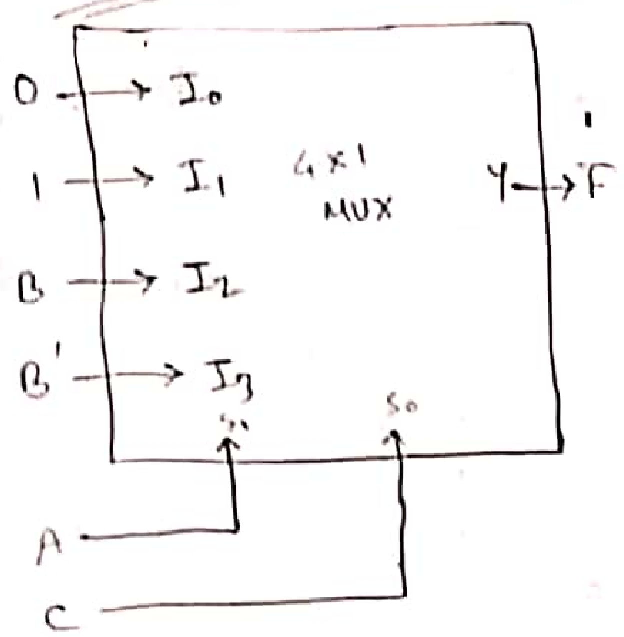
A	B	C	Y
0	0	0	0
0	0	1	1
0	1	0	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

Form B1



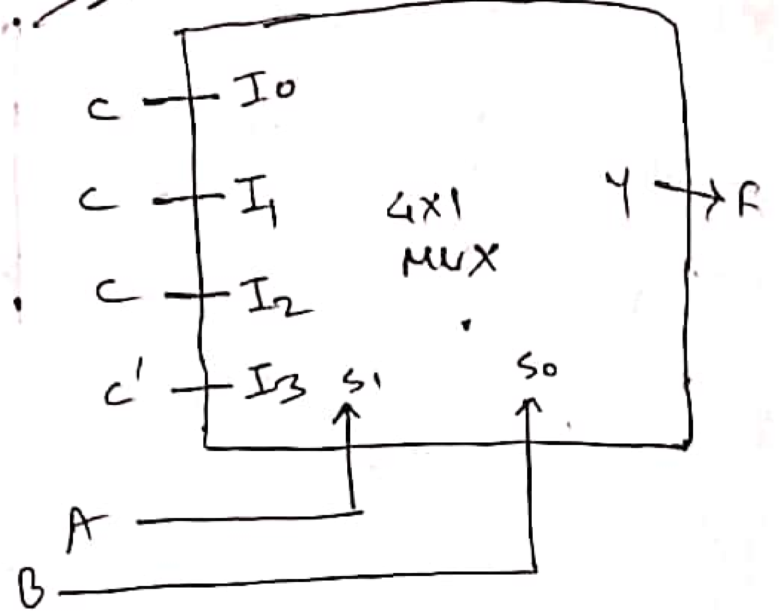
↑
multiplexers

Implementation table

	I_0	I_1	I_2	I_3
B'	0	1	4	5
B	2	3	6	7
	0	1	B	B'

	I_0	I_1	I_2	I_3
C'	0	2	4	6
C	1	3	5	7
	C	C	C	C'

For C



$$F(A,B,C,D) = \Sigma(0,1,3,4,8,9,15)$$

[A, B, C, D বের কর Table + implementation]

A	B	C	D	Y
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

A

	I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
A'	0	1	2	3	4	5	6	7
A	8	9	10	11	12	13	14	15
	1	1	0	A'	A'	0	0	A

C

	I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
C'	0	1	4	5	8	9	12	13
C	2	3	6	7	10	11	14	15
	C'	1	C'	0	C'	C'	0	C

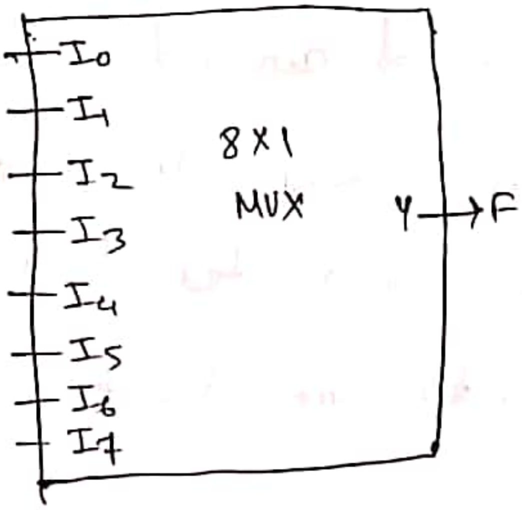
D

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

B

	I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
B'	0	1	2	3	8	9	10	11
B	4	5	6	7	12	13	14	15
	B'	B'	0	B'	B'	B'	0	B

A



State Reduction & Assignment

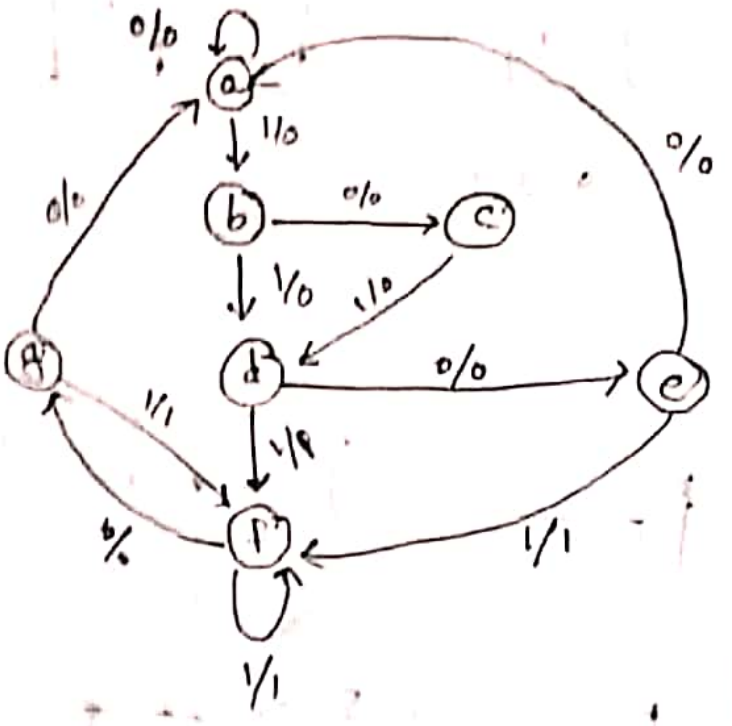
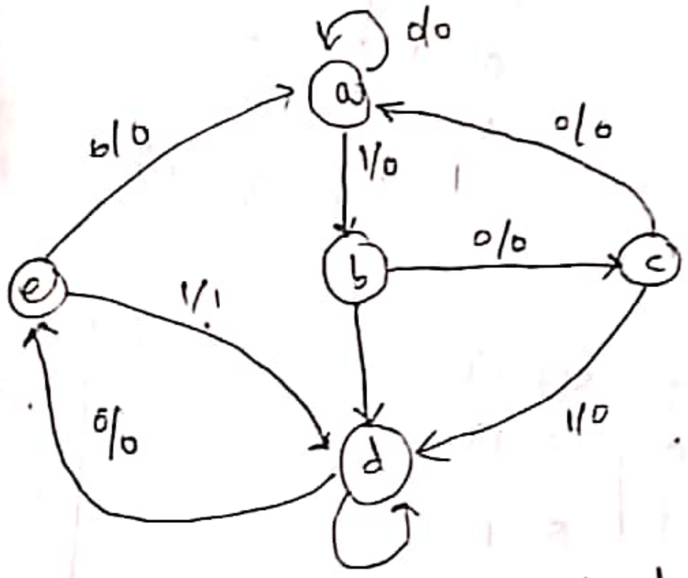


fig : state diagram

Present state	Next State x=0	Next State x=1	Output x=0	Output x=1
a	a	b	0	0
b	c	d	0	0
c	a	d	0	0
d	e	f	0	0
e	a	f	0	1
f	g	f	0	1
g	a	f	0	1

State	a	a	b	c	d	e	f	f	g	f	g a
input	0	1	0	1	0	1	1	0	1	0	0
Output	0	0	0	0	0	1	1	0	1	0	0

Present state	$x=0$	$x=1$	$x=0$	$x=1$
a	a	b	0	0
b	c	d	0	0
c	a	d	0	0
d	e	~~f~~ d	0	0
e	a	~~f~~ d	0	1
~~f~~	~~g~~ e	f	0	1
~~g~~	a	f	0	1



Reduced state diagram

2 টার output সমান
g $\boxed{\begin{matrix} a & f \\ a & f \end{matrix}}$
e
তাই g কে বাদ দিয়ে e বসিয়ে দিব
f এর output d এর output এর সাথে মিলে যাচ্ছে তাই f কে reduced করে d বসাবো।

Present state	$x=0$	$x=1$	$x=0$	$x=1$
a	a	b	0	0
b	c	d	0	0
c	a	d	0	6
d	e	d	0	1
e	a	d	0	1

State	a	a	b	c	d	e	d	d	e	d	e	a
input	0	1	0	1	0	1	1	0	1	0	0	
output	0	0	0	0	0	1	1	0	1	0	0	

19/05/19