Digital Electronics and System

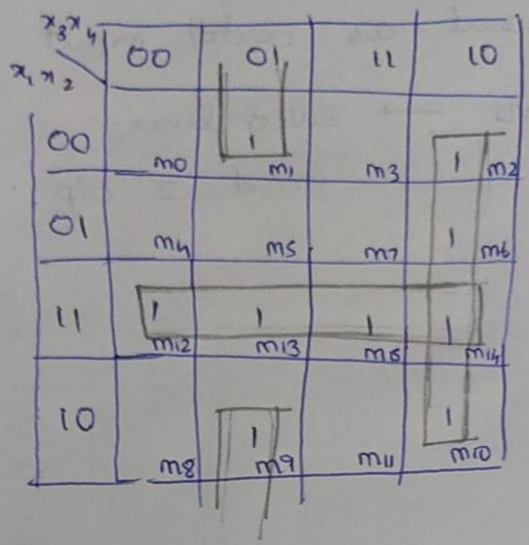
19ECE204

Name : Rithika Sri J

Roll no : CB.EN.U4CSE19025

Home assignment - 2

(1) $f(x_1, x_2, x_3, x_4) = \Sigma m(1,2,6,9,10,12,13,14,15)$



$f(x_1, x_2, x_3, x_4) = \bar{x_2}\bar{x_3}x_4 + x_3\bar{x_4} + x_1x_2$

By Shanon expansion Theorem,

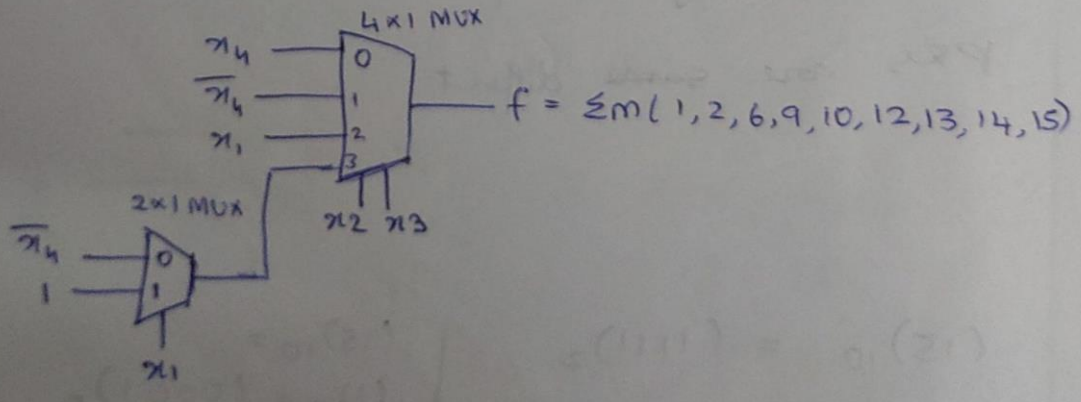
$f = \bar{x_2}\bar{x_3}(1.1.x_4 + 0.\bar{x_4} + x_1.0) + \bar{x_2}x_3(1.0.x_4 + 1.\bar{x_4} + x_1.0) + x_2\bar{x_3}(0.1.x_4 + 0.\bar{x_4} + x_1.1) + x_2x_3(0.0.x_4 + 1.\bar{x_4} + x_1.1)$

$= \bar{x_2}\bar{x_3}(x_4) + \bar{x_2}x_3(\bar{x_4}) + x_2\bar{x_3}(x_1) + x_2x_3(\bar{x_4} + x_1)$

Let $g = \bar{x_4} + x_1$

$= \bar{x_1}(\bar{x_4} + 0) + x_1(\bar{x_4} + 1)$

$= \bar{x_1}(\bar{x_4}) + x_1(1)$

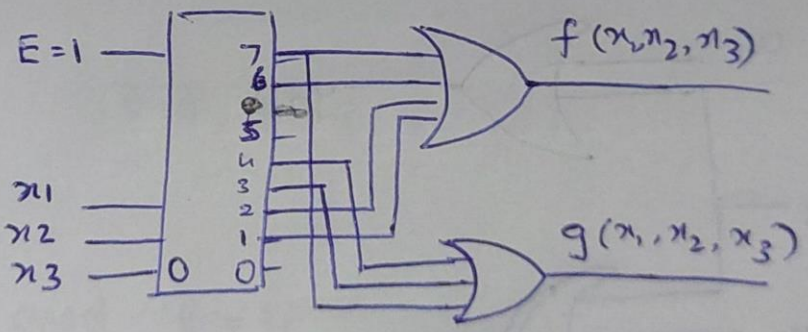


(2) $F(x_1, x_2, x_3) = \Sigma m(1, 2, 6, 7)$

$G(x_1, x_2, x_3) = \Pi M(0, 1, 2, 5, 6)$

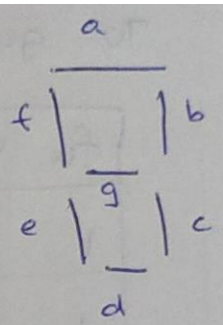
$= \Sigma m(3, 4, 7)$

In active high decoder,



(3)

$\omega_0 \rightarrow$ coffee $\rightarrow$ C (a, f, e, d)
$\omega_1 \rightarrow$ tea $\rightarrow$ t (f, g, e, d)
$\omega_2 \rightarrow$ milk $\rightarrow$ L (f, e, d)
$\omega_3 \rightarrow$ cocoa $\rightarrow$ H (e, f, a, b, c, g)

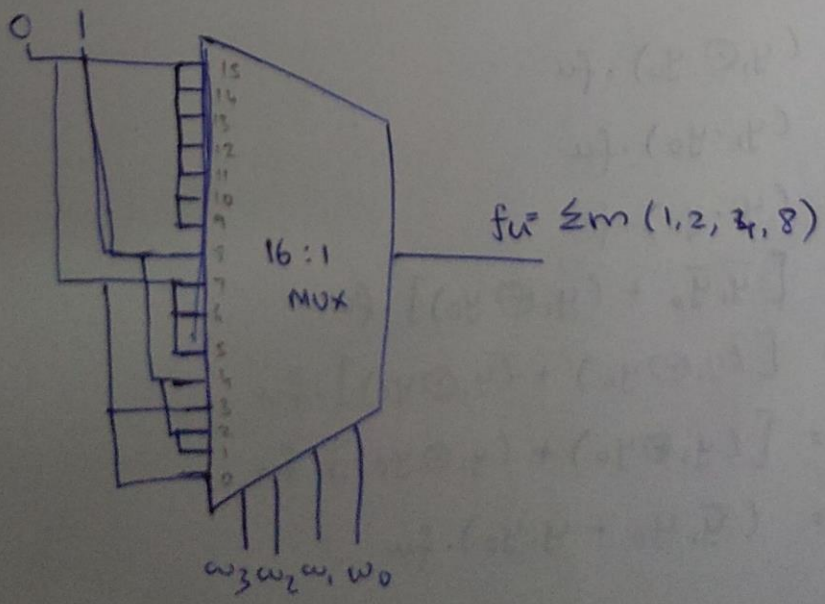


ω_3	ω_2	ω_1	ω_0	y_1	y_0	fu
0	0	0	0	X	X	0
0	0	0	1	0	0	1
0	0	1	0	0	1	1
0	1	0	0	1	0	1
1	0	0	0	1	1	1

To ensure that exactly only one switch is selected : $fu = \overline{\omega_3}\,\overline{\omega_2}\,\overline{\omega_1}\,\omega_0 + \overline{\omega_3}\,\overline{\omega_2}\,\omega_1\,\overline{\omega_0} + \overline{\omega_3}\,\omega_2\,\overline{\omega_1}\,\overline{\omega_0} + \omega_3\,\overline{\omega_2}\,\overline{\omega_1}\,\overline{\omega_0}$

$fu = \Sigma m(1, 2, 4, 8)$

In 16×1 MUX:

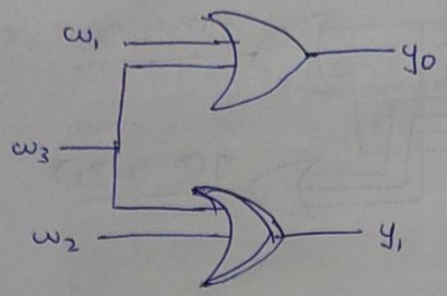


From the table,

$y_0 = w_1 + w_3$

$y_1 = w_2 + w_3$

Encoder using gates:



To generate seven segment display:

fu	y_1	y_0	a	b	c	d	e	f	g
1	0	0	1	0	0	1	1	1	0
1	0	1	0	0	0	1	1	1	1
1	1	0	0	0	0	1	1	1	0
1	1	1	1	1	1	0	1	1	1

From the table,

$a = y_1' y_0' + y_1 y_0 = [y_1 \odot y_0] \cdot fu$

$b = c = [y_1 \cdot y_0] \cdot fu$

$d = [\bar{y_1}\bar{y_0} + (\bar{y_1} y_0 + \bar{y_1} \bar{y_0})] \cdot fu$

$= [\bar{y_1}\bar{y_0} + (y_1 \oplus y_0)] \cdot fu$

$e = f = (\bar{y_1}\bar{y_0} + \bar{y_1} y_0 + y_1 \bar{y_0} + y_1 y_0) \cdot fu$

$= [(y_1 \oplus y_0) + (y_1 \odot y_0)] \cdot fu$

$g = (\bar{y_1} y_0 + y_1 y_0) \cdot fu$

$a = (y_1 \odot y_0) \cdot fu$

$b = (y_1 \cdot y_0) \cdot fu$

$c = (y_1 \cdot y_0) \cdot fu$

$d = [\bar{y_1}\bar{y_0} + (y_1 \oplus y_0)] \cdot fu$

$e = [(y_1 \oplus y_0) + (y_1 \odot y_0)] \cdot fu$

$f = [(y_1 \oplus y_0) + (y_1 \odot y_0)] \cdot fu$

$g = (\bar{y_1} y_0 + y_1 y_0) \cdot fu$

(4) $A = a_3a_2a_1a_0$ $B = b_3b_2b_1b_0$

(i) $A = 4$ and $B = 3$

BCD code for 4 : 0100
BCD code for 3 : 0011 (+)

0111

BCD value : 7

(ii) $A = 7$ and $B = 4$

BCD code for 7 : 0111 (+)
BCD code for 4 : 0100

1011

Adding 0110 (6),

1011 (+)
0110

10001

BCD value : 11

(iii) $A = 9$ and $B = 8$

BCD code for 9 : 1001 (+)
BCD code for 8 : 1000

10001

Adding 0110 (6),

10001 (+)
0110

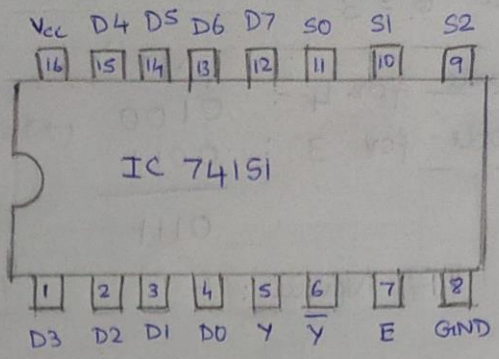
10111

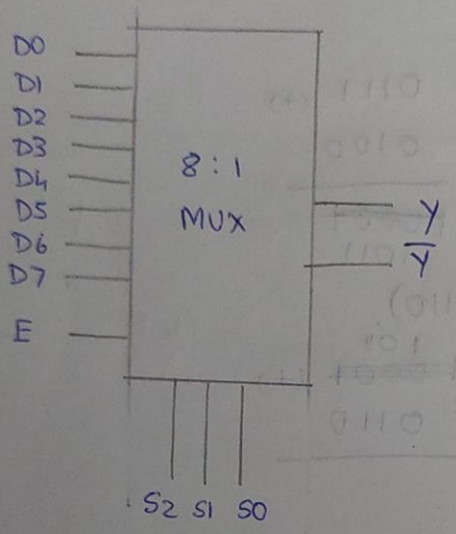
BCD value : 17

(5)

(a) 74151 8:1 MUX

(i)

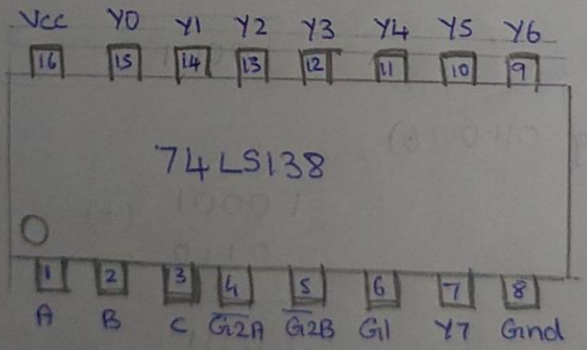


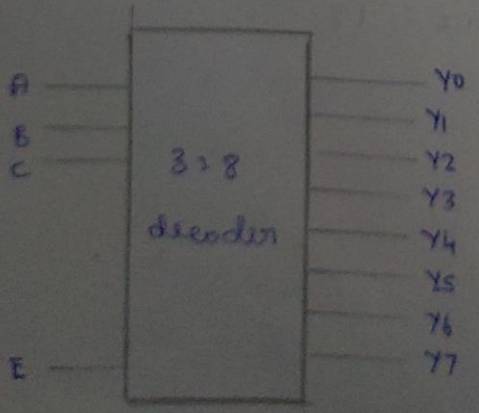


E	S2	S1	S0	Y
0	X	X	X	0
1	0	0	0	D0
1	0	0	1	D1
1	0	1	0	D2
1	0	1	1	D3
1	1	0	0	D4
1	1	0	1	D5
1	1	1	0	D6
1	1	1	1	D7

(b) 74138 3 to 8 decoder

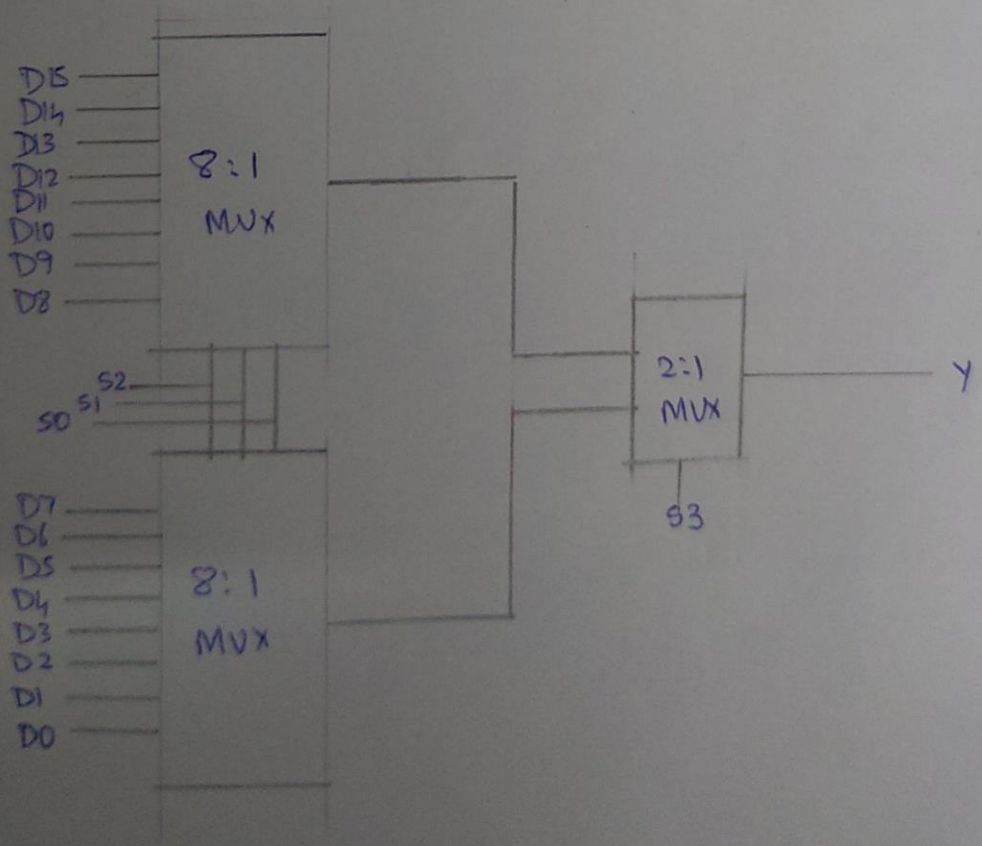
(i)



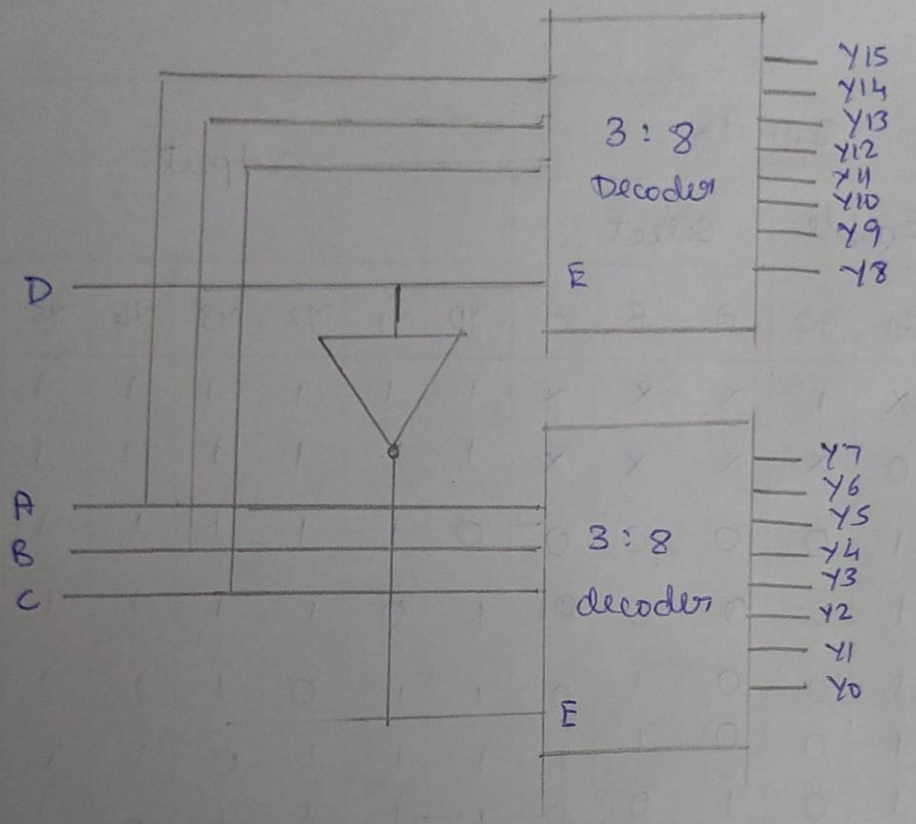


Inputs					Output							
Enable		Select										
G1	G2	A	B	C	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	1	X	X	X	1	1	1	1	1	1	1	1
0	X	X	X	X	1	1	1	1	1	1	1	1
1	0	0	0	0	0	1	1	1	1	1	1	1
1	0	0	0	1	1	0	1	1	1	1	1	1
1	0	0	1	0	1	1	0	1	1	1	1	1
1	0	0	1	1	1	1	1	0	1	1	1	1
1	0	1	0	0	1	1	1	1	0	1	1	1
1	0	1	0	1	1	1	1	1	1	0	1	1
1	0	1	1	0	1	1	1	1	1	1	0	1
1	0	1	1	1	1	1	1	1	1	1	1	0

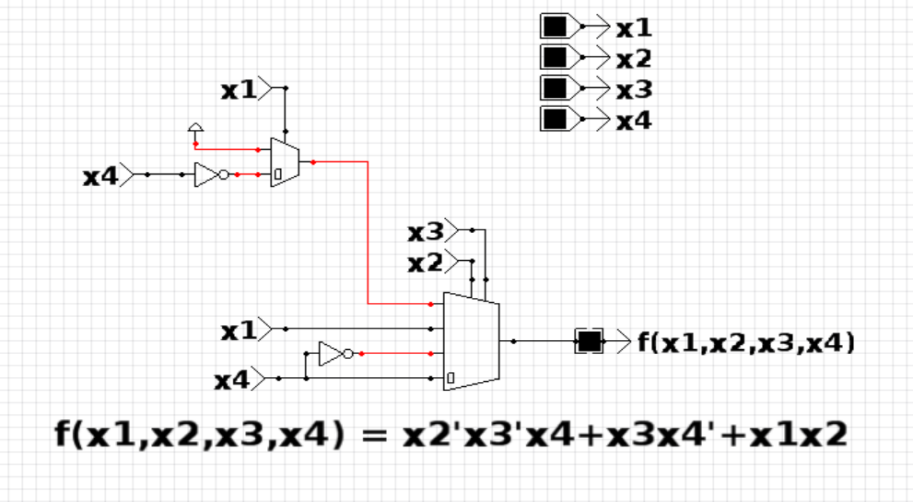
(ii) Two 74151 ICs to realize 16:1 MUX:

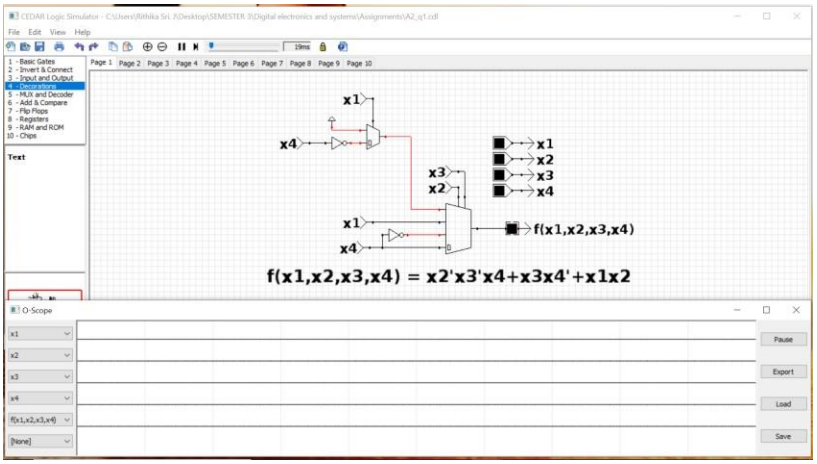


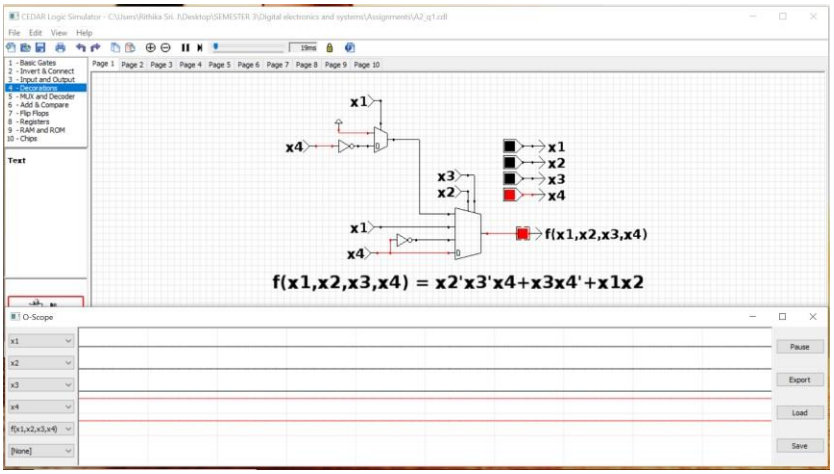
(iii) Two 74138 IC to realize 4 : 16 decoder

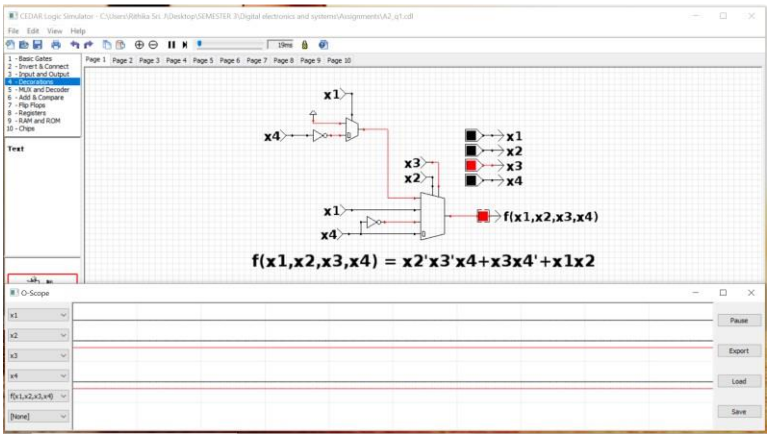


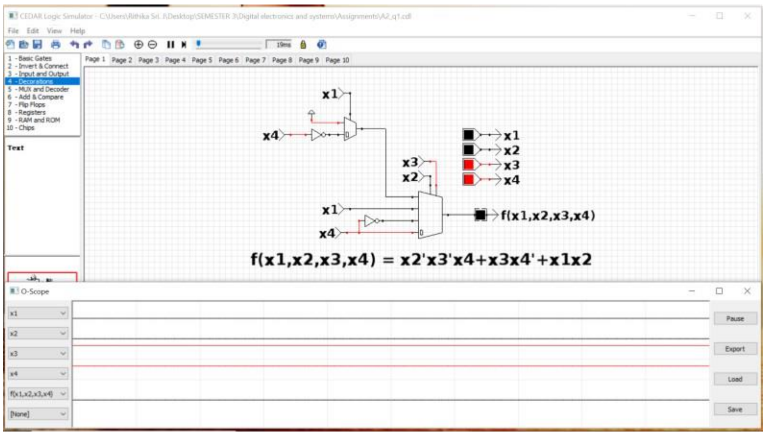
(1) F(x1, x2, x3, x4) = Σm(1,2,6,9,10,12,13,14,15)








x1
x4
x3
x2
x1
x4
x1
x2
x3
x4
f(x1,x2,x3,x4)
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
Export
Load
Save


x1
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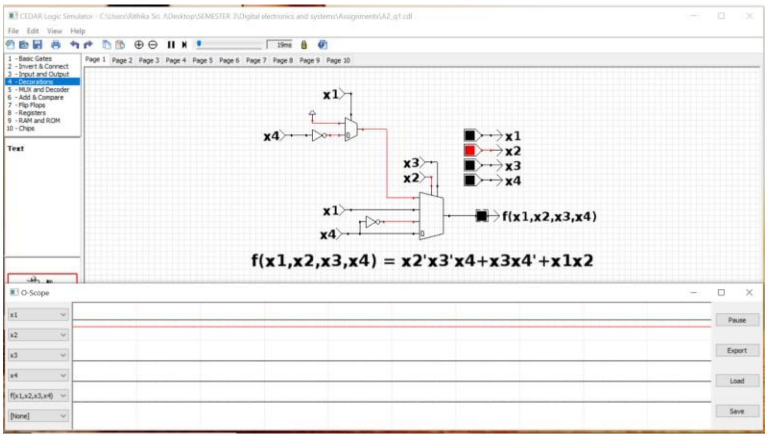
x1
x4
x1
x2
x3
x4
f(x1,x2,x3,x4)
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
Export
Load
Save


x1
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x1
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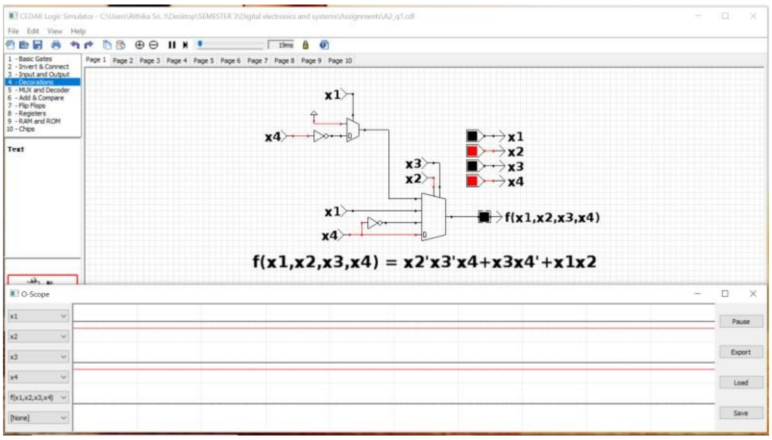
x1
x2
x3
x4
f(x1,x2,x3,x4)
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
Export
Load
Save


x1
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x1
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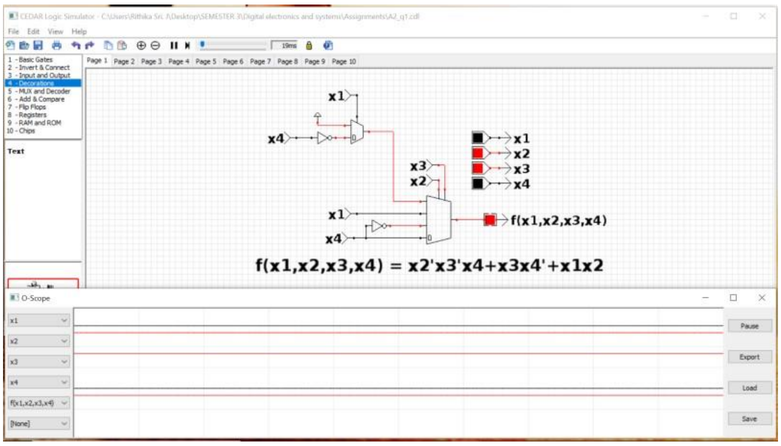
x3
x4
f(x1,x2,x3,x4)
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
Export
Load
Save


x1
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x4
f(x1,x2,x3,x4)
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
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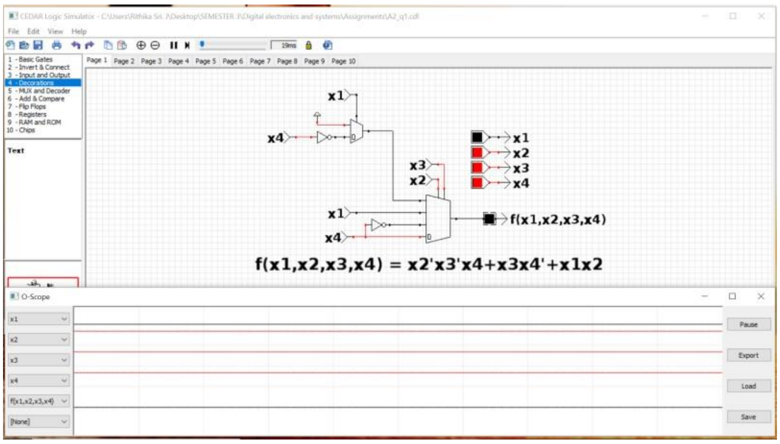
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O-Scope
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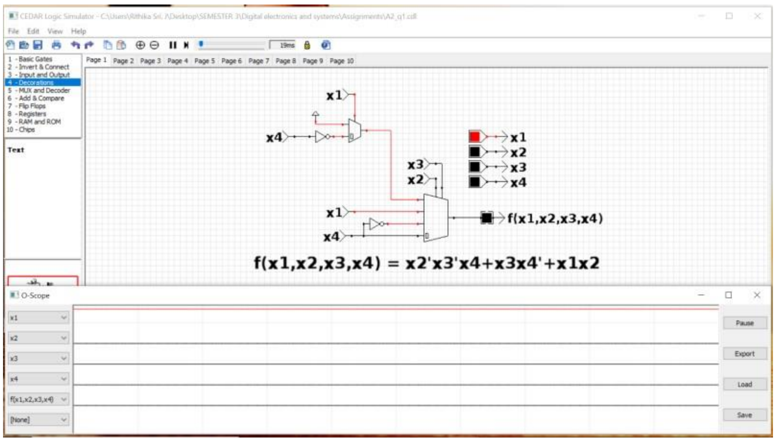
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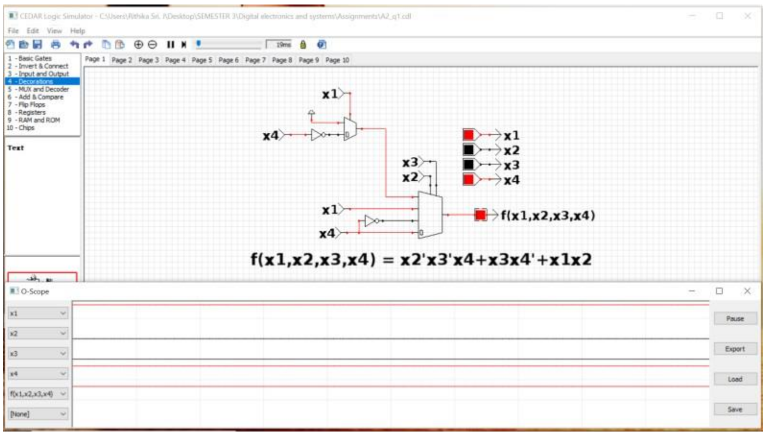
f(x1,x2,x3,x4)
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
Export
Load
Save


x1
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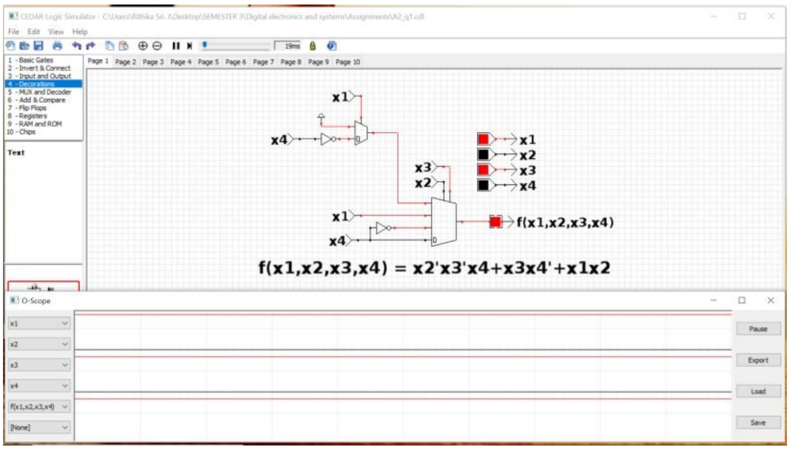
f(x1,x2,x3,x4)
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
Export
Load
Save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f(x1,x2,x3,x4)
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
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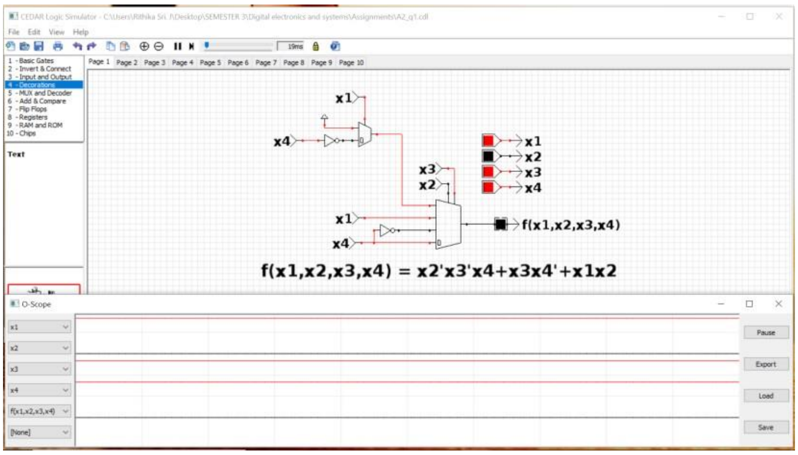
x1
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x4
x1
x2
x3
x4
f(x1,x2,x3,x4)
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
Export
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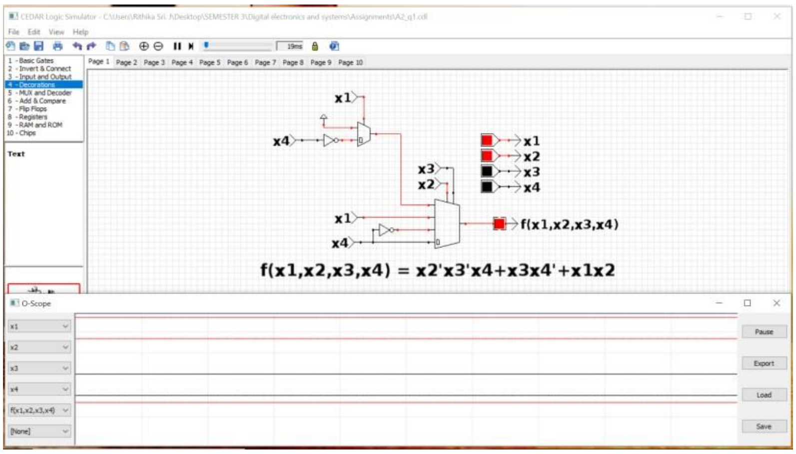
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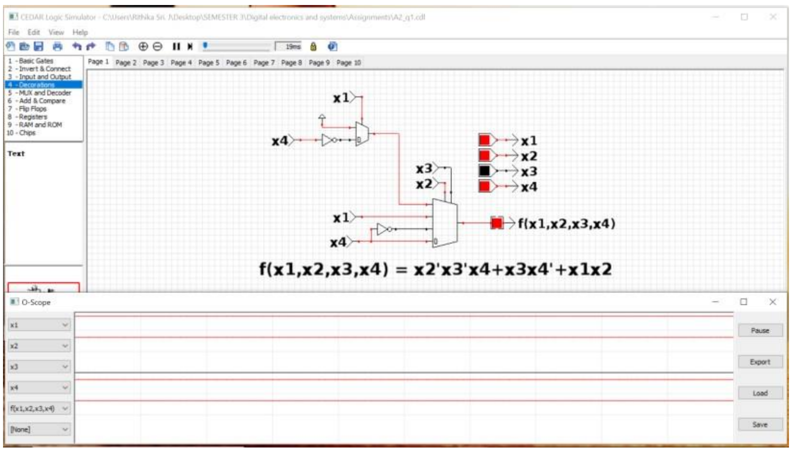
f(x1,x2,x3,x4)
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
Export
Load
Save


x1
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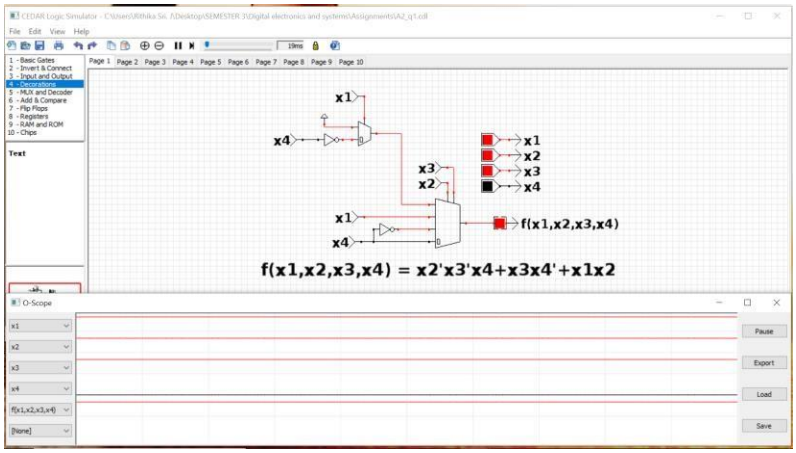
x2
x1
x4
x1
x2
x3
x4
f(x1,x2,x3,x4)
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
Export
Load
Save


x1
x4
x3
x2
x1
x2
x3
x4
x1
x4
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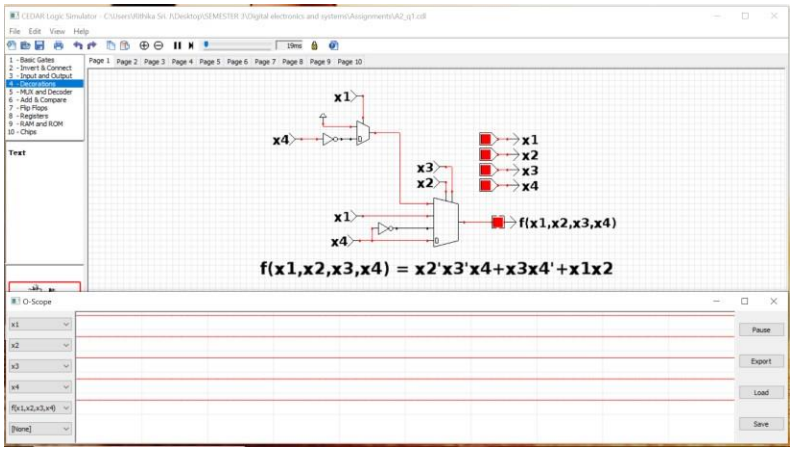
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
Export
Load
Save


x1
x4
x3
x2
x1
x2
x3
x4
x1
x4
f(x1,x2,x3,x4)
f(x1,x2,x3,x4) = x2'x3'x4+x3x4'+x1x2
O-Scope
Pause
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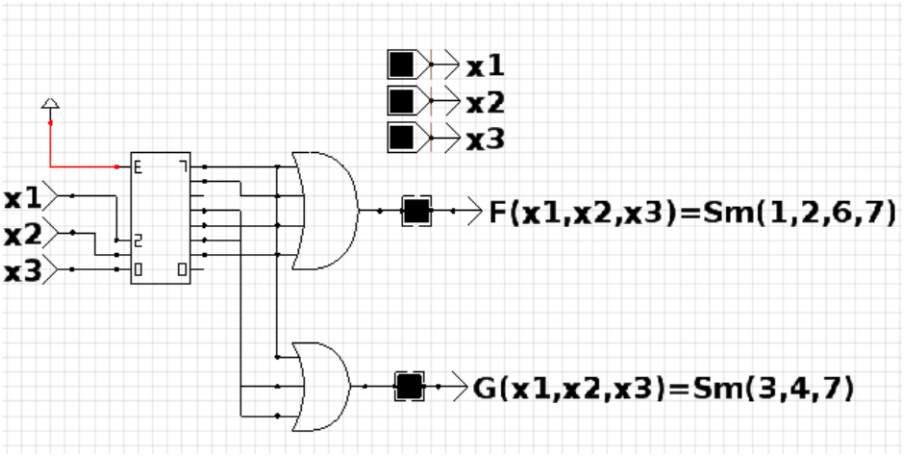
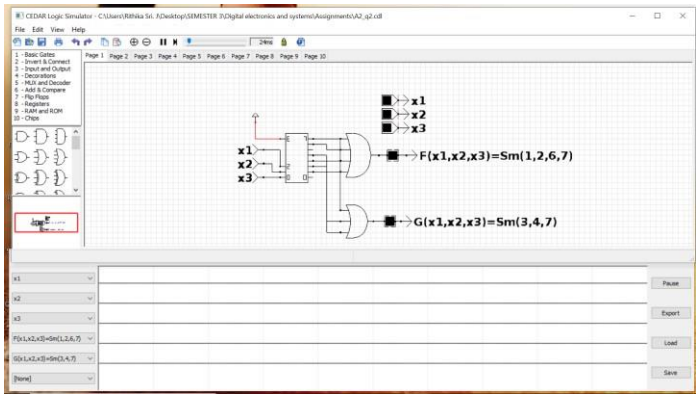
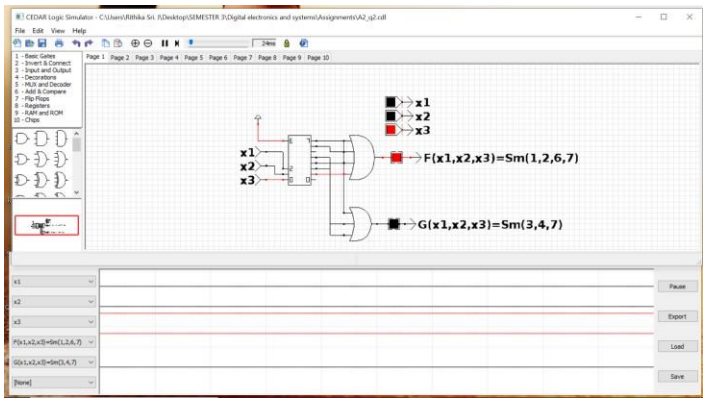
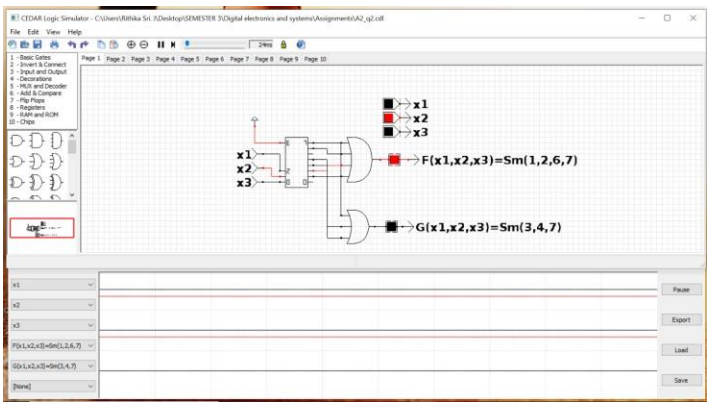
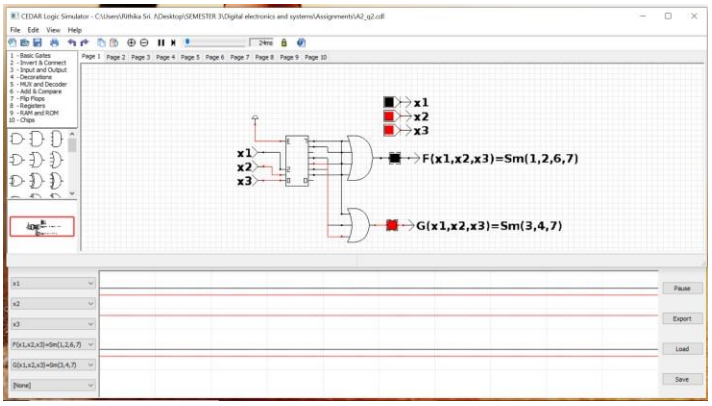
(2) $F(x_1, x_2, x_3) = \Sigma m(1,2,6,7)$
$G(x_1, x_2, x_3) = \Sigma m(3,4,7)$

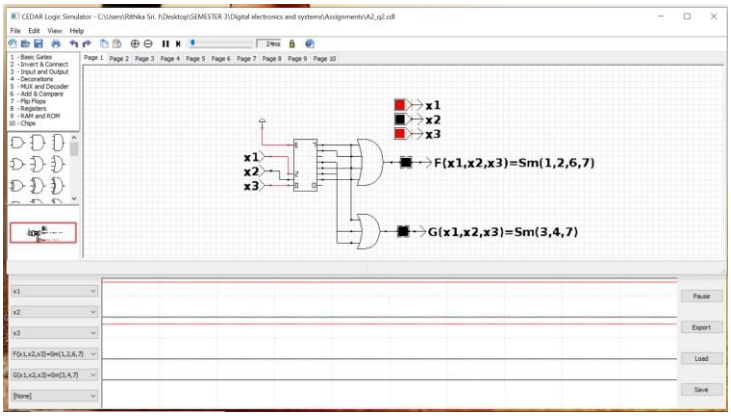


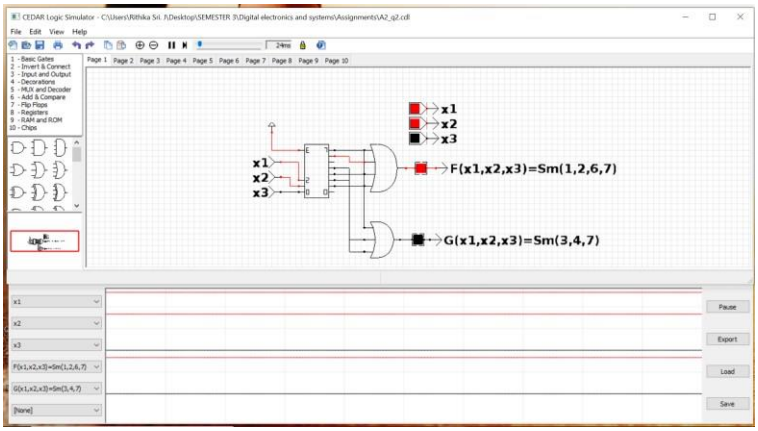


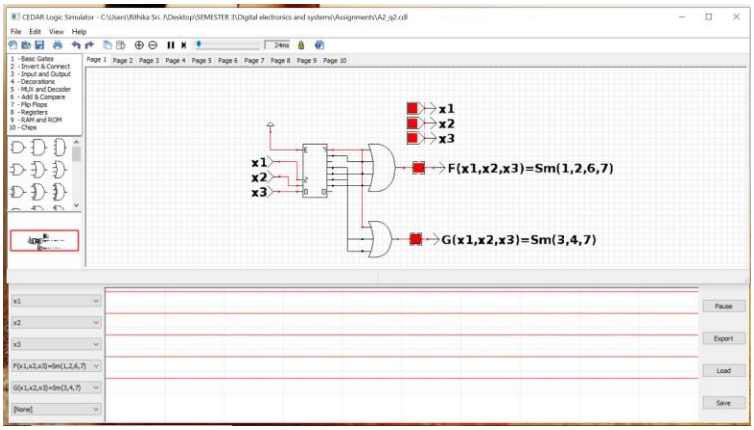




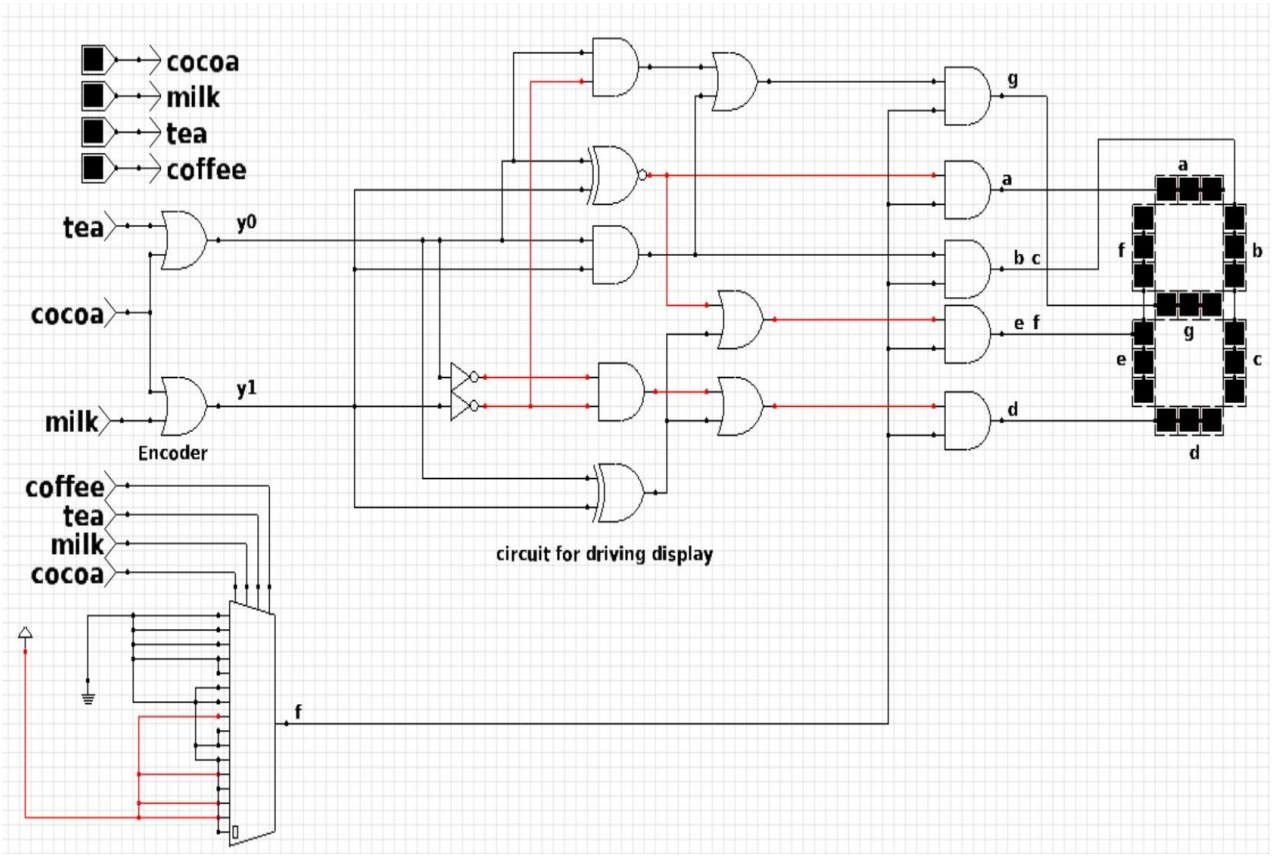

x1
x2
x3
F(x1,x2,x3)=Sm(1,2,6,7)
G(x1,x2,x3)=Sm(3,4,7)

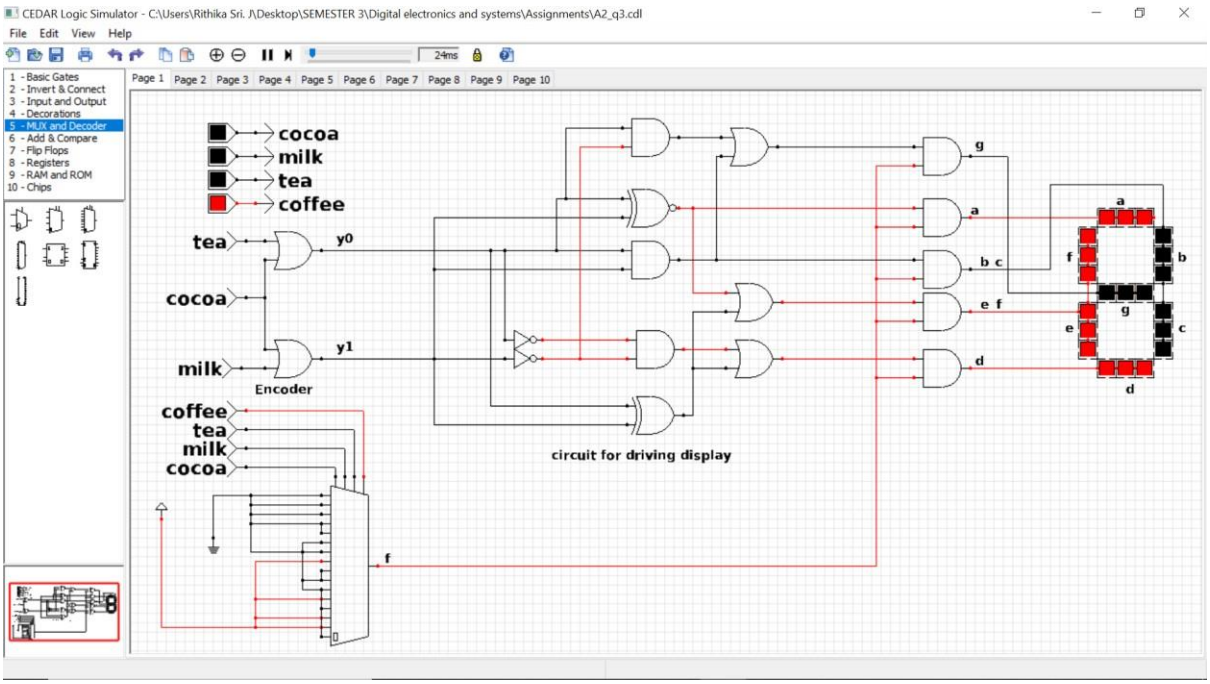

x1
x2
x3
F(x1,x2,x3)=Sm(1,2,6,7)
G(x1,x2,x3)=Sm(3,4,7)

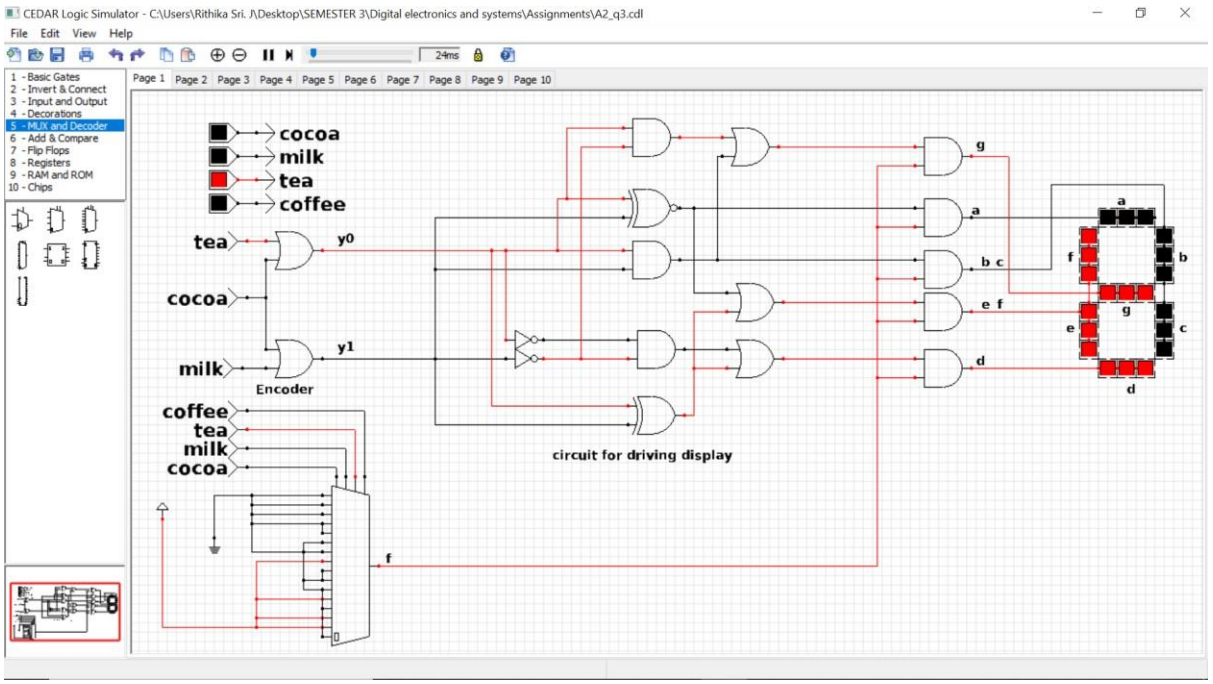

x1
x2
x3
F(x1,x2,x3)=Sm(1,2,6,7)
G(x1,x2,x3)=Sm(3,4,7)


x1
x2
x3
F(x1,x2,x3)=Sm(1,2,6,7)
G(x1,x2,x3)=Sm(3,4,7)

(3)


cocoa
milk
tea
coffee
tea
cocoa
milk
y0
y1
Encoder
coffee
tea
milk
cocoa
f
circuit for driving display
g
a
b c
e f
d
a
f
b
g
e
c
d


CEDAR Logic Simulator - C:\Users\Rithika Sri. J\Desktop\SEMESTER 3\Digital electronics and systems\Assignments\A2_q3.cdl
File Edit View Help
1 - Basic Gates
2 - Invert & Connect
3 - Input and Output
4 - Decorations
5 - MUX and Decoder
6 - Add & Compare
7 - Flip Flops
8 - Registers
9 - RAM and ROM
10 - Chips
Page 1 Page 2 Page 3 Page 4 Page 5 Page 6 Page 7 Page 8 Page 9 Page 10
cocoa
milk
tea
coffee
tea
cocoa
milk
y0
y1
Encoder
coffee
tea
milk
cocoa
f
circuit for driving display
g
a
b c
e f
d
a
f
b
g
e
c
d


CEDAR Logic Simulator - C:\Users\Rithika Sri. J\Desktop\SEMESTER 3\Digital electronics and systems\Assignments\A2_q3.cdl
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cocoa
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cocoa
f
circuit for driving display
g
a
b c
e f
d
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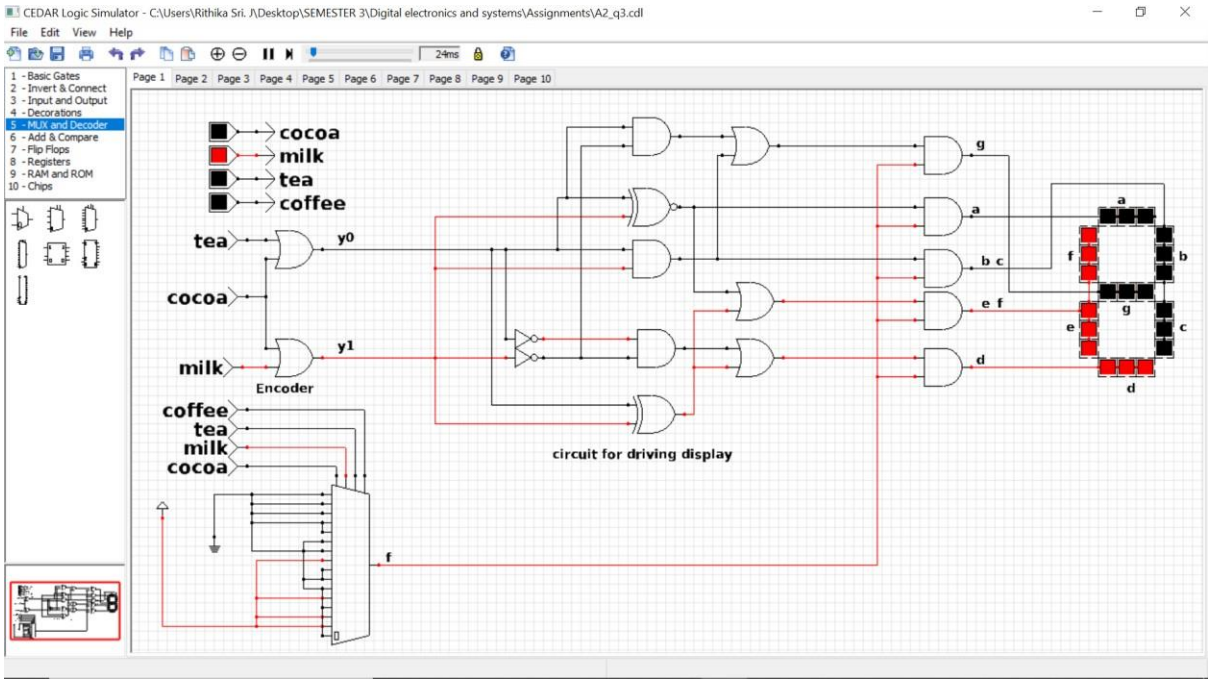
b
g
e
c
d


CEDAR Logic Simulator - C:\Users\Rithika Sri. J\Desktop\SEMESTER 3\Digital electronics and systems\Assignments\A2_q3.cdl
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Page 1 Page 2 Page 3 Page 4 Page 5 Page 6 Page 7 Page 8 Page 9 Page 10
cocoa
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cocoa
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circuit for driving display
g
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b c
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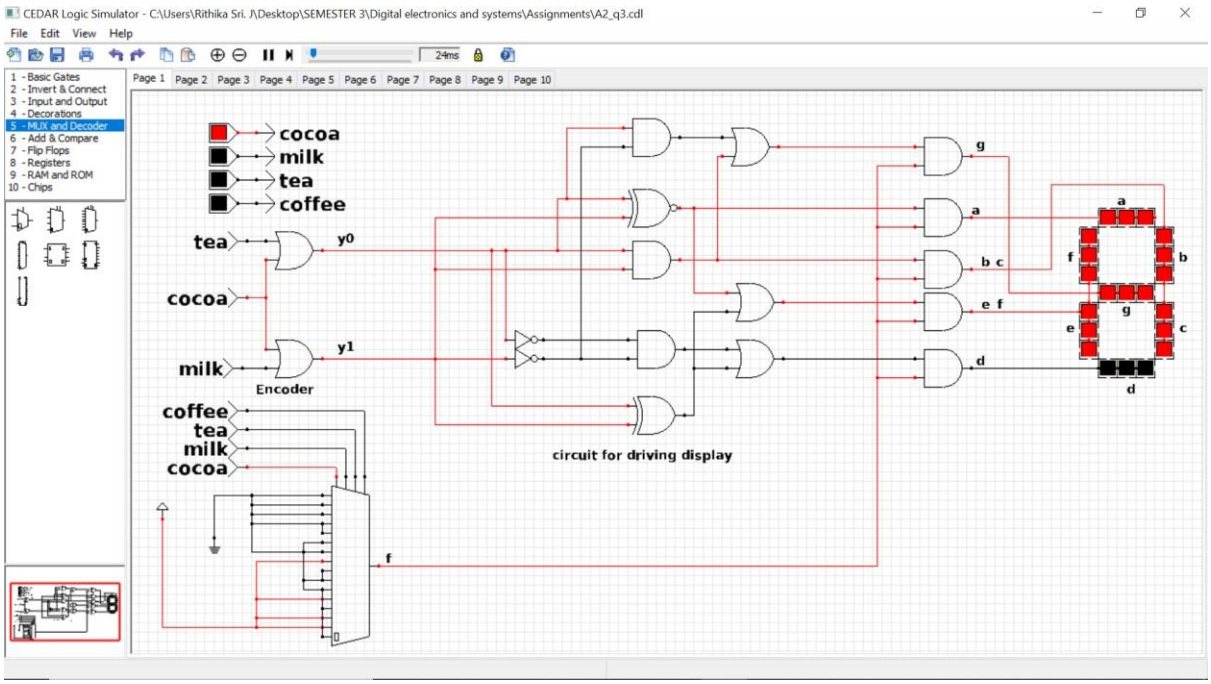
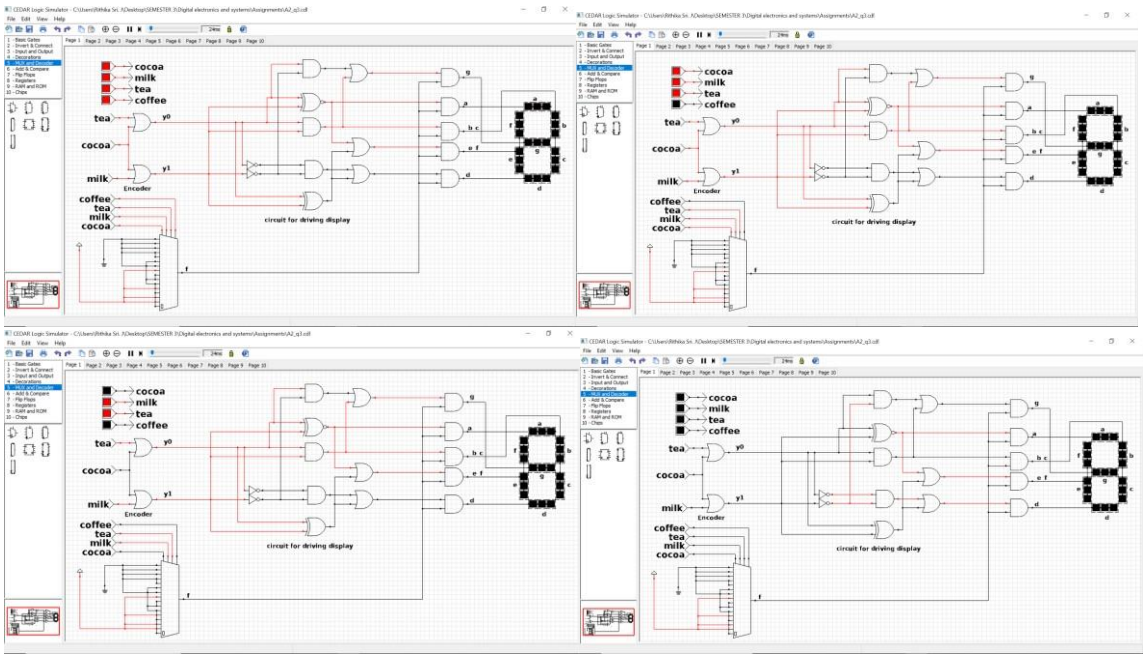
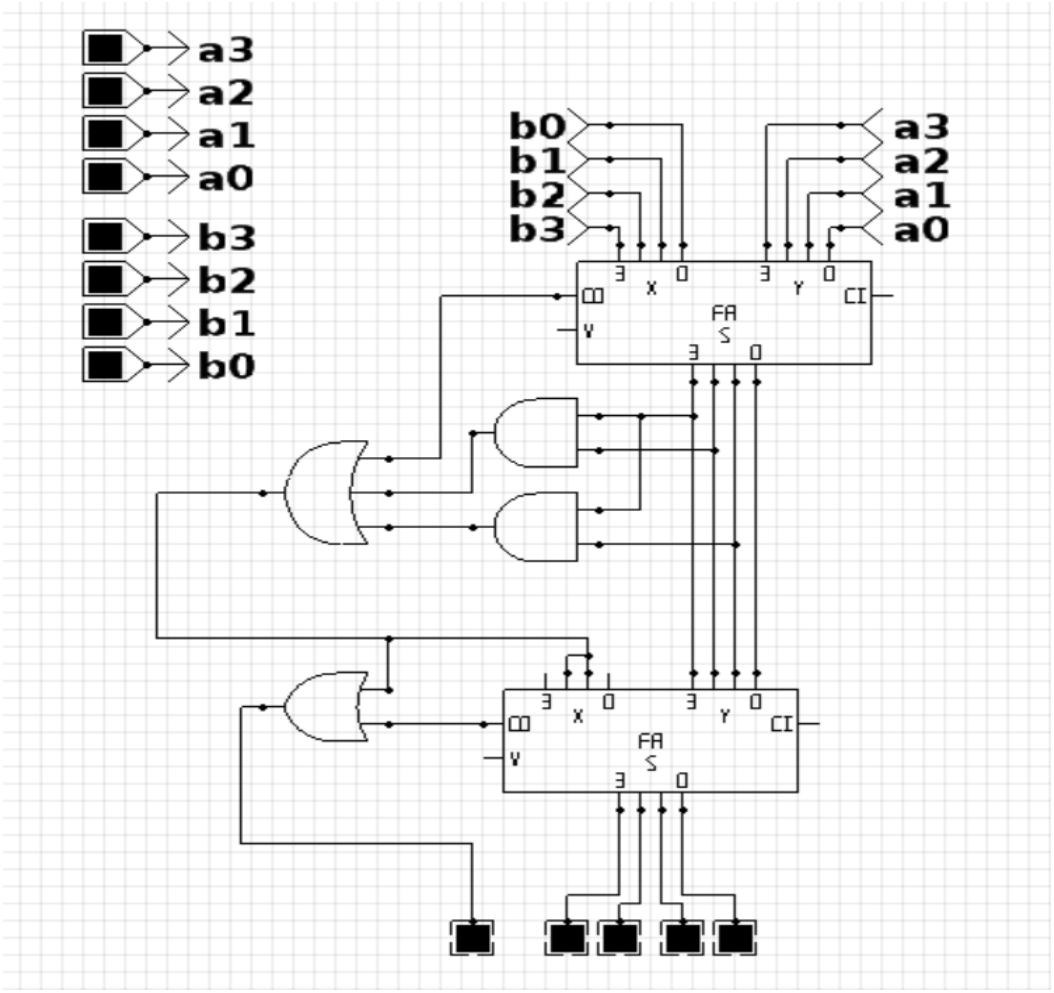


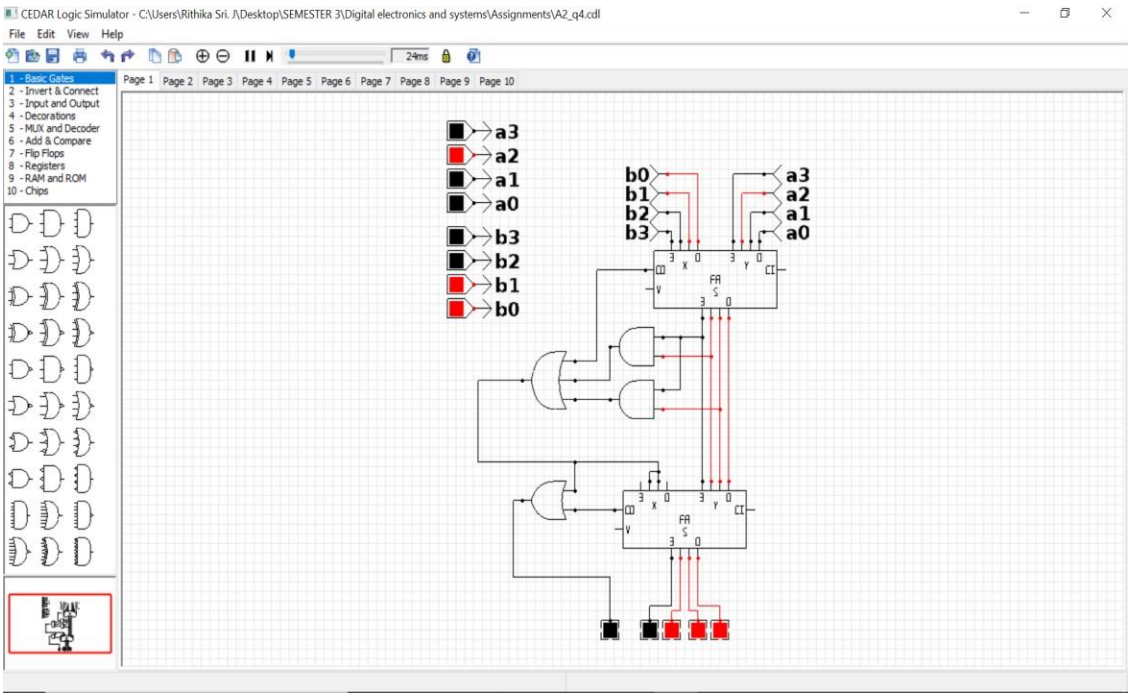
Selecting no switch or more than one switch:



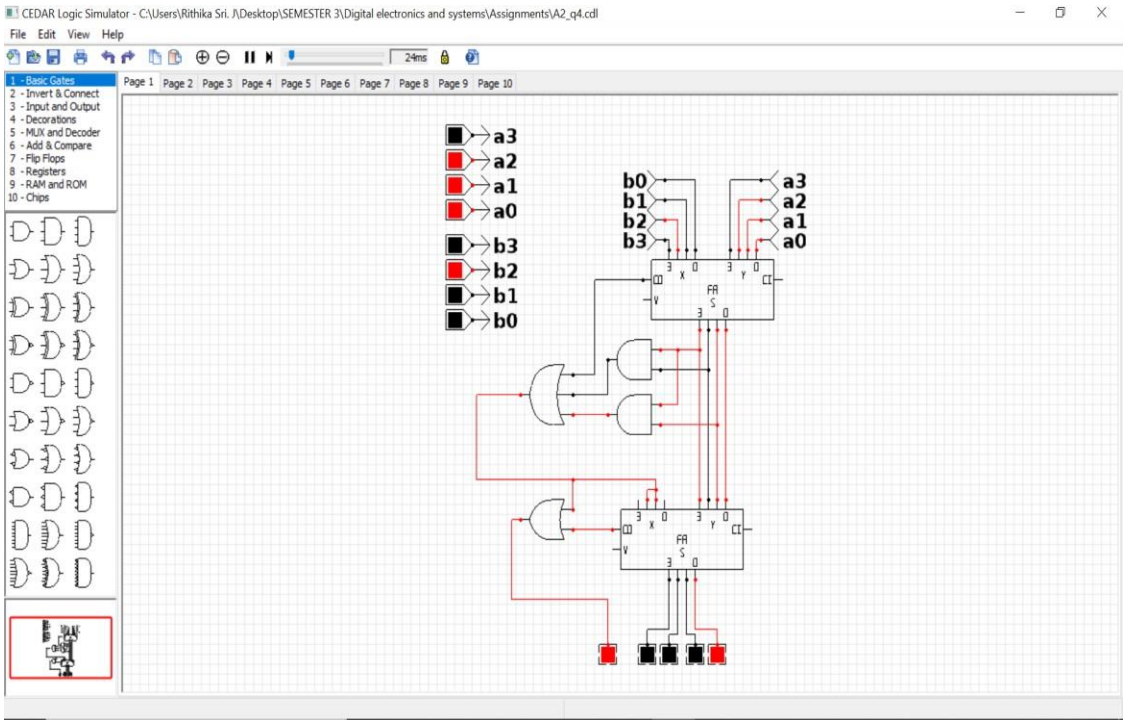
(4) BCD Adder:



a) A=4 and B=3



b) A=7 and B=4



c) A=9 and B=8