Experiment no: 04

Name of the experiment: Designing Multiplexer (Mux) Demultiplexer (DEMUX) ,Encoder, Decoder circuit

Group no: 03

Student Name: Sheikh Muhtasim Nasif

Student ID: 20-42119-1

Course Title: Digital Logic and Circuit Lab

Section: M

Date of experiment: 16.06.2022

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Objective:

(i) Design 4 to 1 multiplexer and verify the truth table

(ii) Design 1 to 4 ~~multi~~demultiplexer and verify the truth table

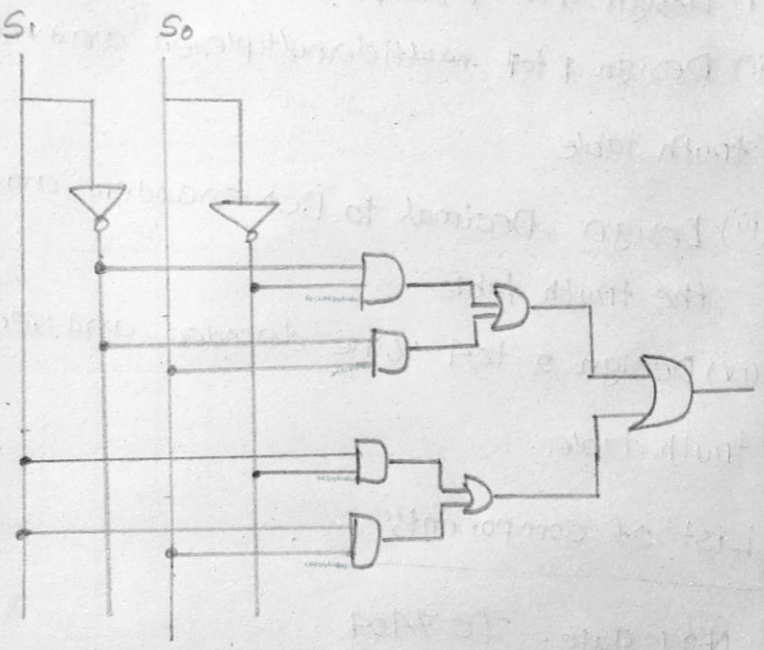
(iii) Design Decimal to BCD encoder and verify the truth table

(iv) Design 2 to 4 line decoder and verify the truth table.

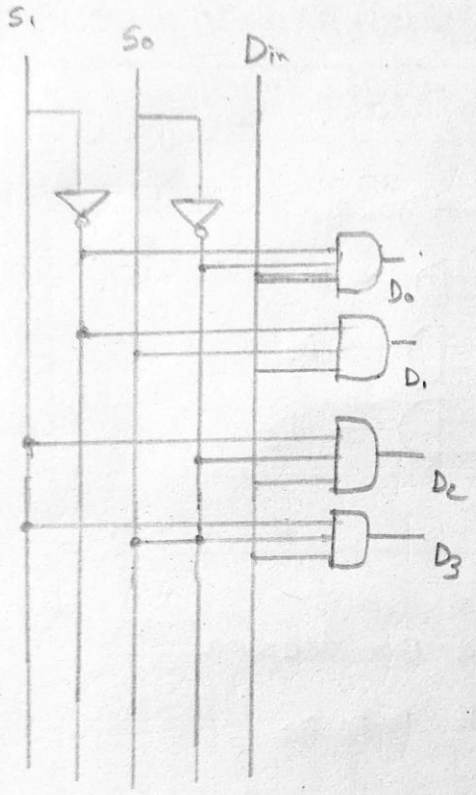
List of components:

NOT gate: IC 7404
AND gate: IC 7408
OR gate: ~~IC 71~~
(i) 3 input OR

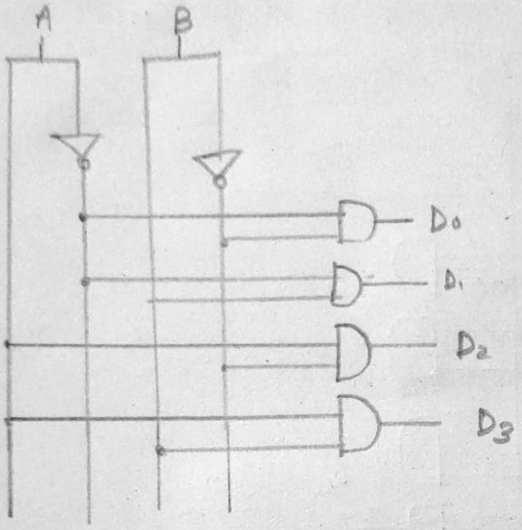
Symbols, Block diagram and Figures:



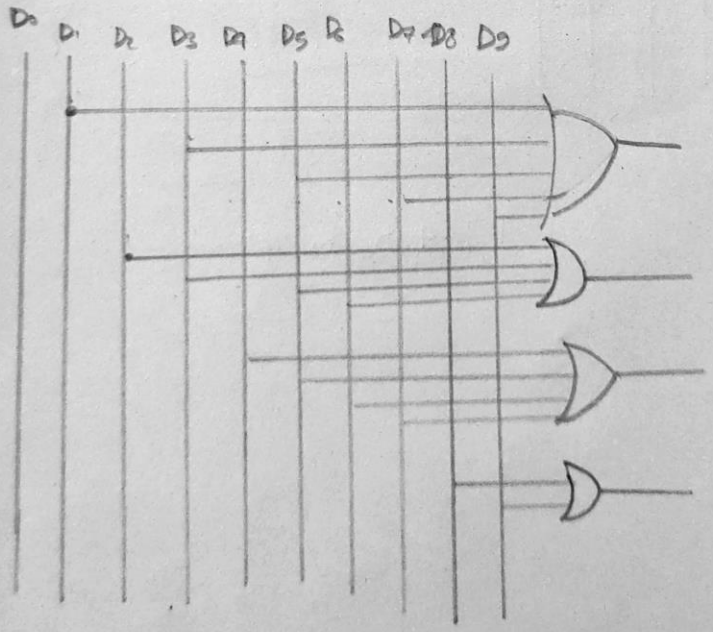
4 to 1 Multiplexer



1 to 4 Demultiplexer



2 to 4 line decoder



Decimal to BCD encoder

Data table and Calculation:

4 to 1 Mux

S_1	S_0	f
0	0	D_0
0	1	D_1
1	0	D_2
1	1	D_3

~~$f = \bar{S}_1\bar{S}_0D_0 + \bar{S}_1S_0D_1 + S_1\bar{S}_0D_2 + S_1S_0D_3$~~

$f = \bar{S}_1\bar{S}_0D_0 + \bar{S}_1S_0D_1 + S_1\bar{S}_0D_2 + S_1S_0D_3$

1 to 4 Demux

S_1	S_0	D_0	D_1	D_2	D_3
0	0	Din	0	0	0
0	1	0	Din	0	0
1	0	0	0	Din	0
1	1	0	0	0	Din

$D_0 = \bar{S}_1\bar{S}_0\,Din$

$D_1 = \bar{S}_1 S_0\,Din$

$D_2 = \bar{S}_1 S_0\,Din$

$D_3 = \bar{S}_1\bar{S}_0\,Din$

Decimal to BCD Encoder

Dec	Y_3	Y_2	Y_1	Y_0
D_0	0	0	0	0
D_1	0	0	0	1
D_2	0	0	1	0
D_3	0	0	1	0
D_4	0	1	0	0
D_5	0	1	0	1
D_6	0	1	1	0
D_7	0	1	1	1
D_8	1	0	0	0
D_9	1	0	0	1

$Y_0 = D_1 + D_3 + D_5 + D_7 + D_9$

$Y_1 = D_2 + D_3 + D_6 + D_7$

$Y_2 = D_4 + D_5 + D_6 + D_7$

$Y_3 = D_8 + D_9$

2 to 4 line decoder

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

$D_0 = \bar{A}\bar{B}$

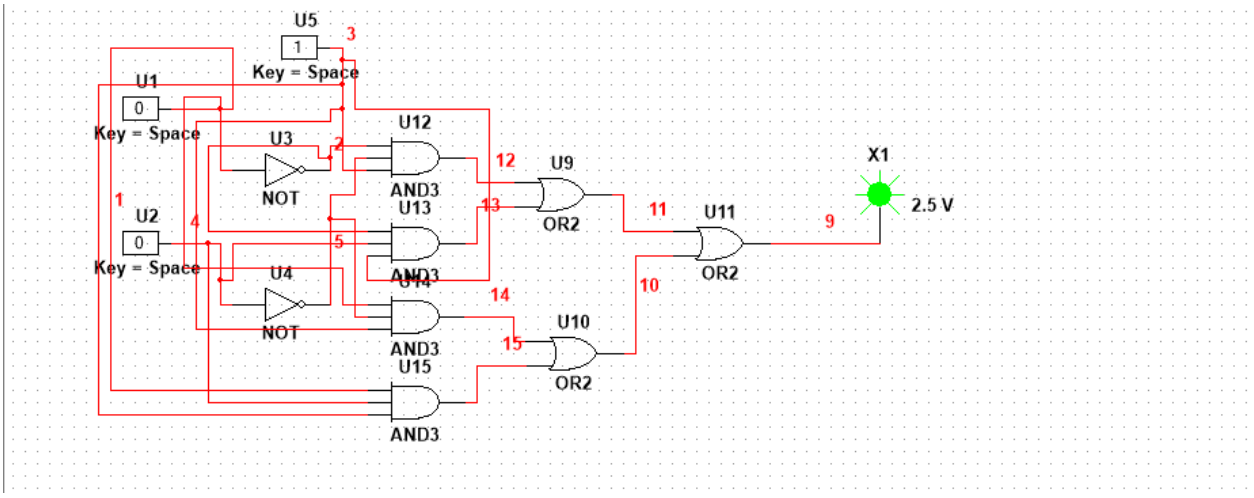
$D_1 = \bar{A}B$

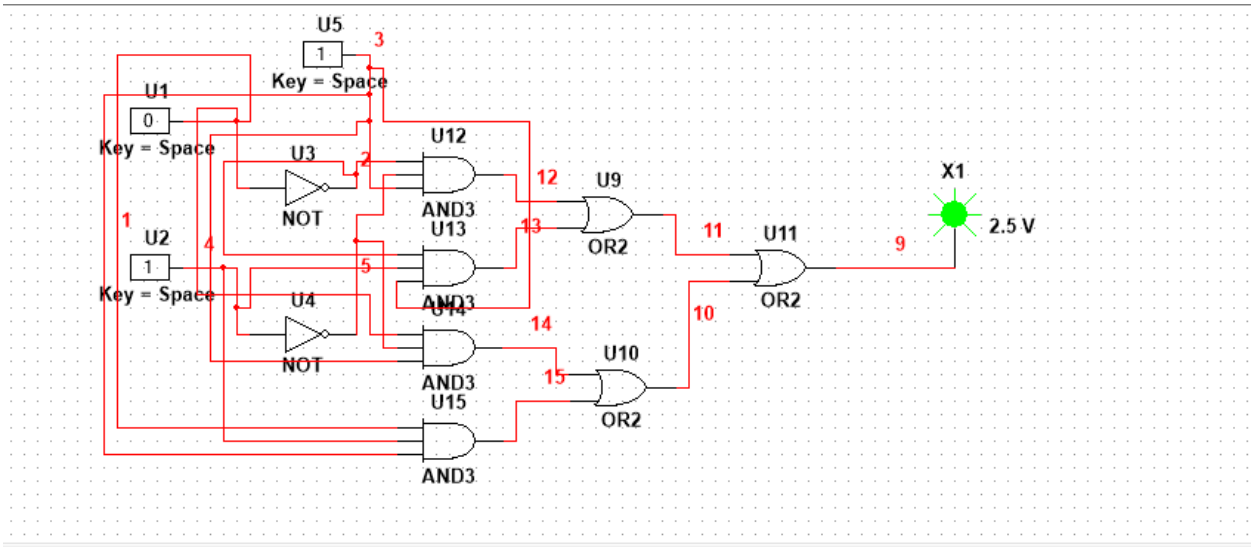
$D_2 = A\bar{B}$

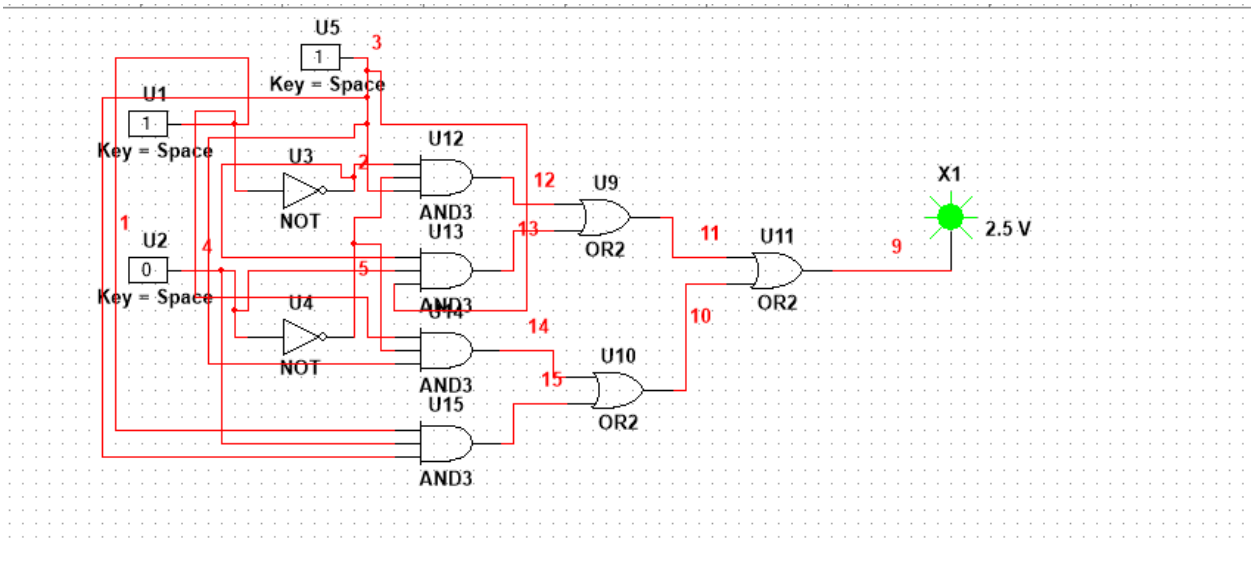
$D_3 = AB$

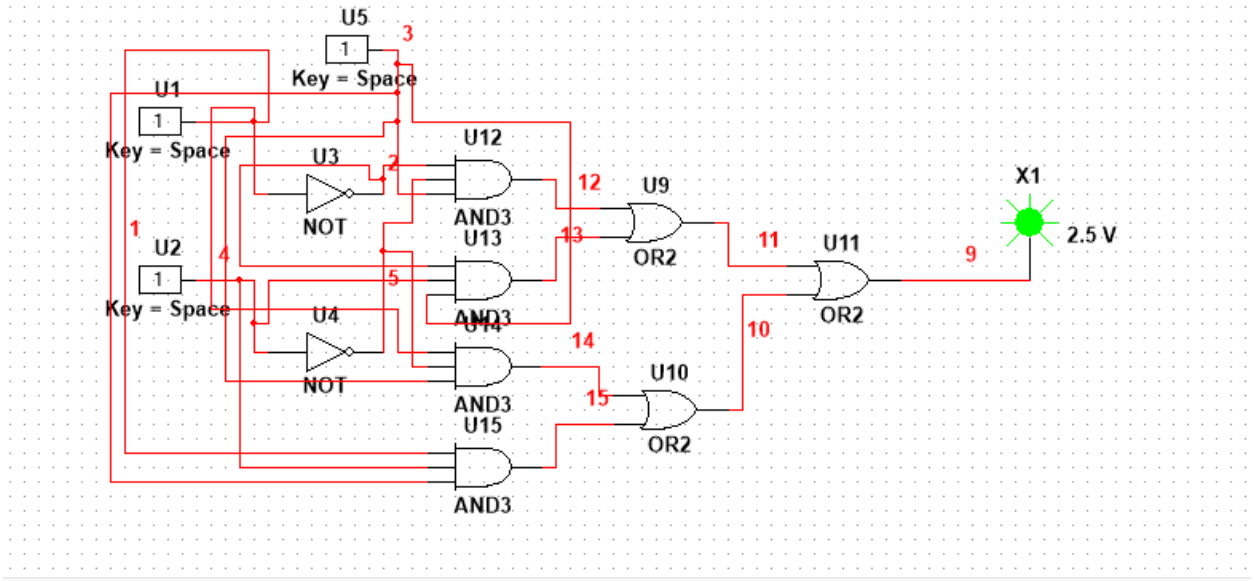
Simulation

4 to 1 MUX

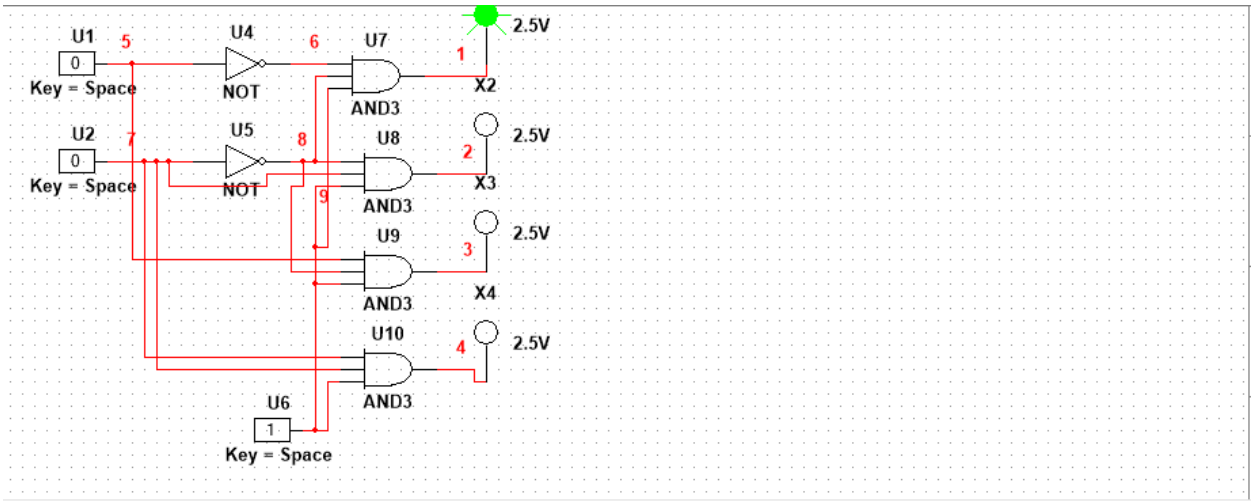


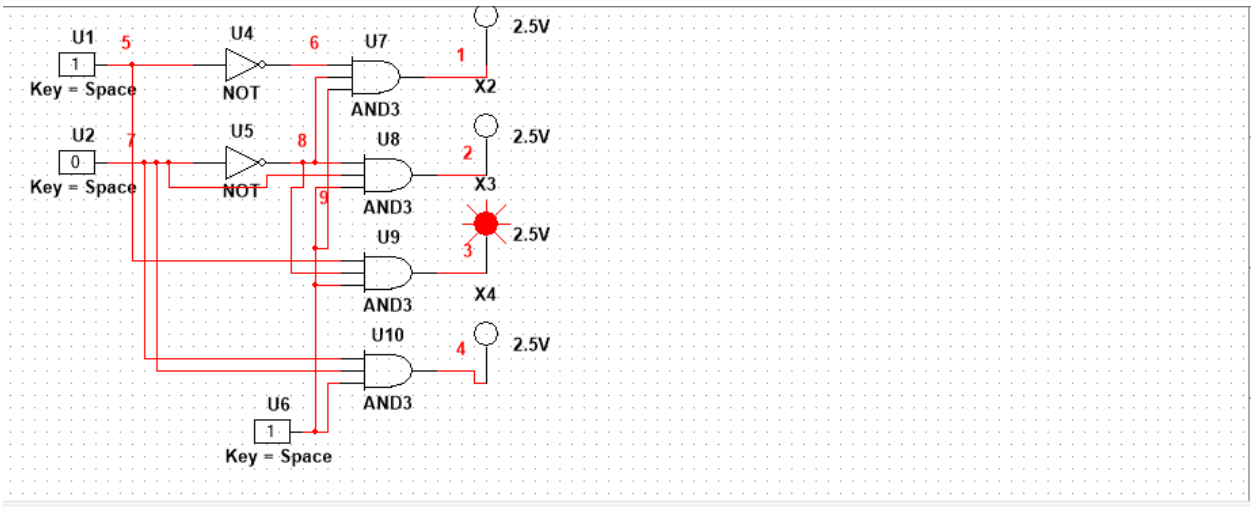


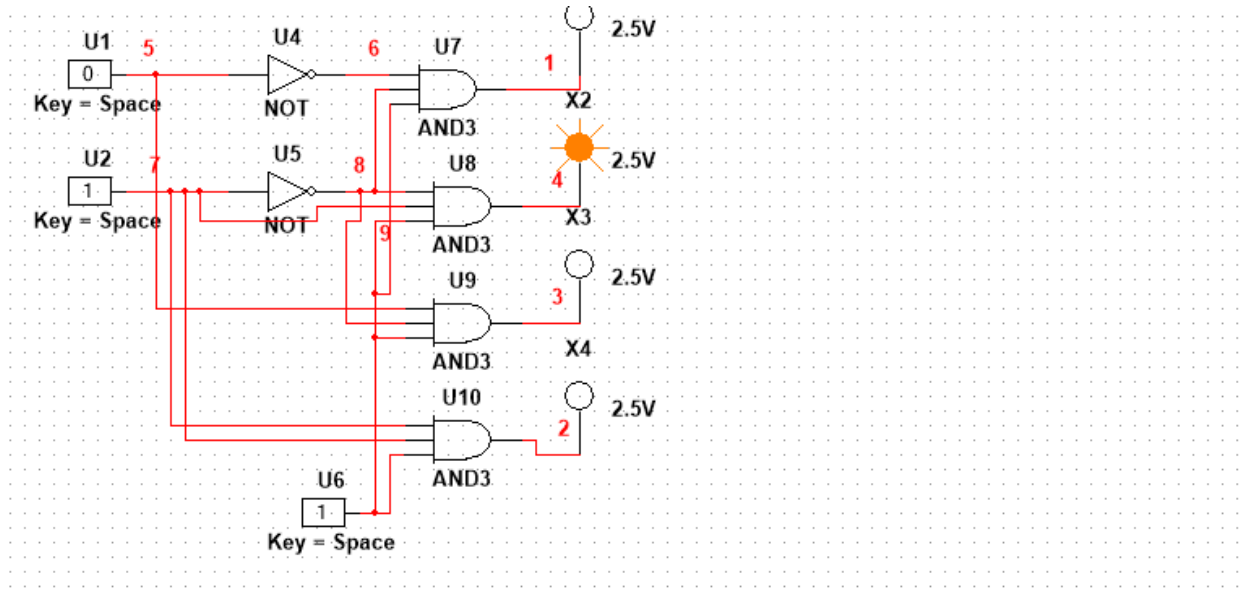

U5
1
Key = Space
3
U1
1
Key = Space
U3
NOT
2
U12
AND3
12
U9
OR2
X1
2.5 V
1
U2
0
Key = Space
4
5
U13
AND3
13
11
U11
OR2
9
U4
NOT
14
10
U10
OR2
15
U15
AND3
AND3

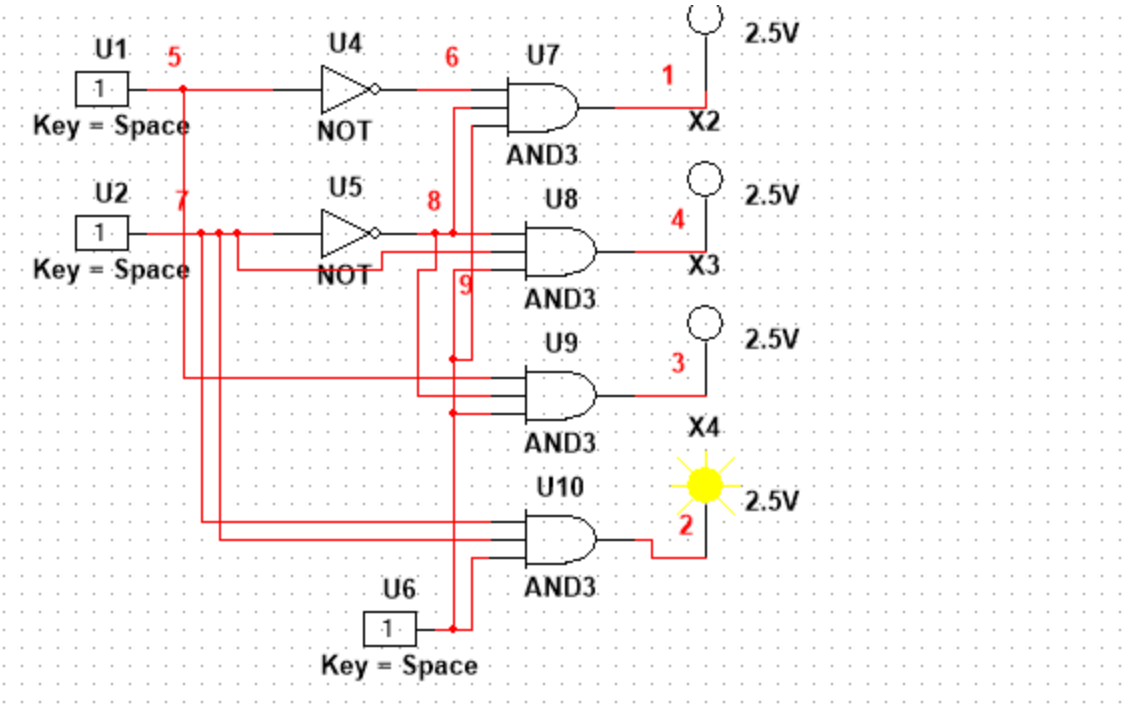

U5
1
Key = Space
3
U1
1
Key = Space
U3
NOT
2
U12
AND3
12
U9
OR2
X1
2.5 V
1
U2
1
Key = Space
4
5
U13
AND3
13
11
U11
OR2
9
U4
NOT
14
10
U10
OR2
15
U15
AND3
AND3

1 to 4 DEMUX

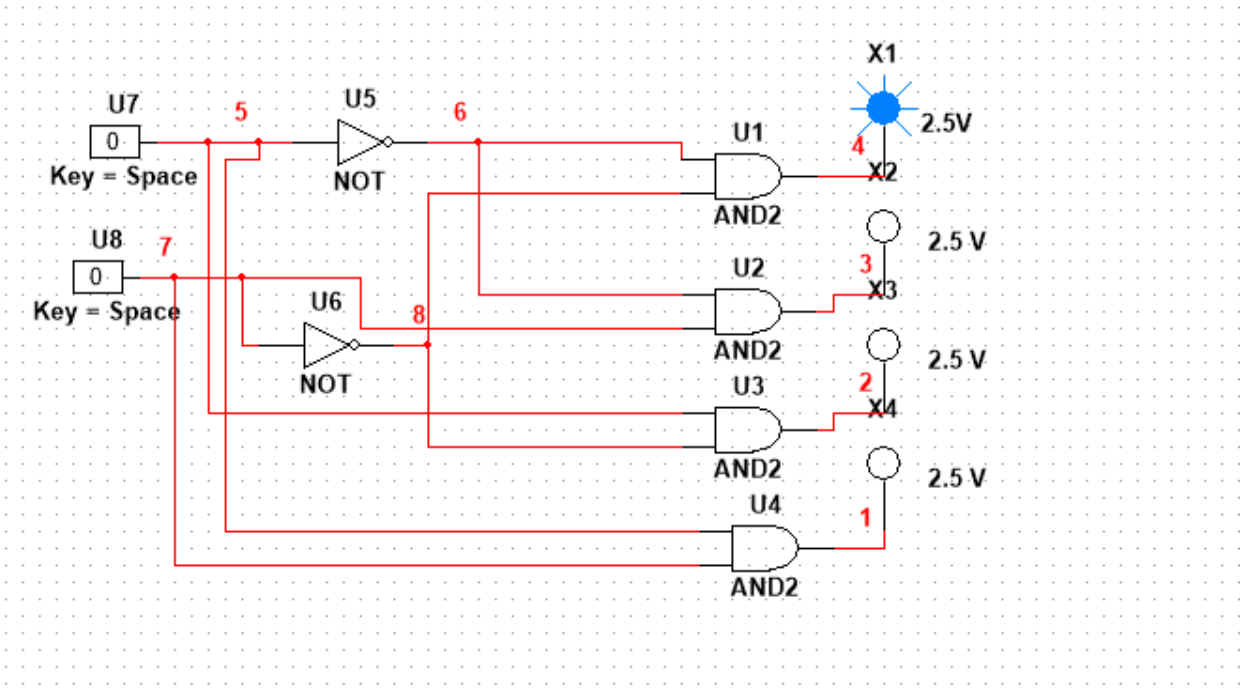

U1
0
Key = Space
U2
0
Key = Space
U4
NOT
U5
NOT
U6
1
Key = Space
U7
AND3
U8
AND3
U9
AND3
U10
AND3
2.5V
X2
X3
X4
5
6
7
8
9
1
2
3
4

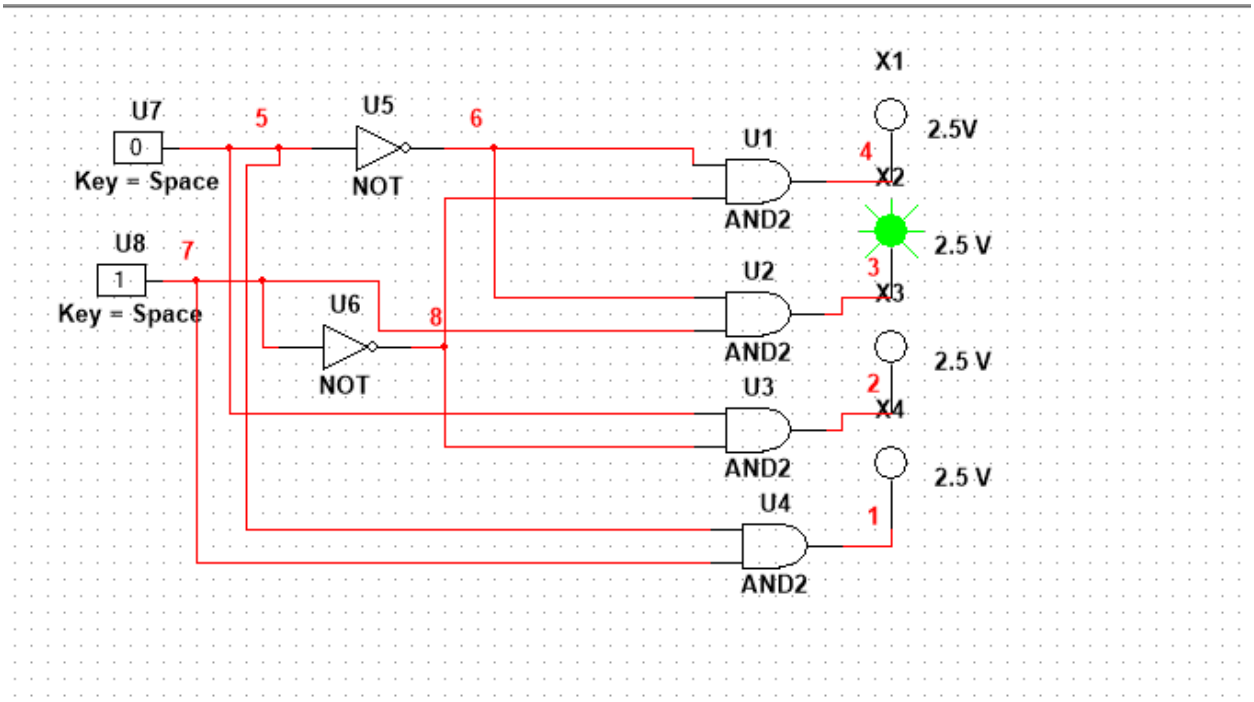

U1
1
Key = Space
U2
0
Key = Space
U4
NOT
U5
NOT
U6
1
Key = Space
U7
AND3
U8
AND3
U9
AND3
U10
AND3
2.5V
X2
X3
X4
5
6
7
8
9
1
2
3
4

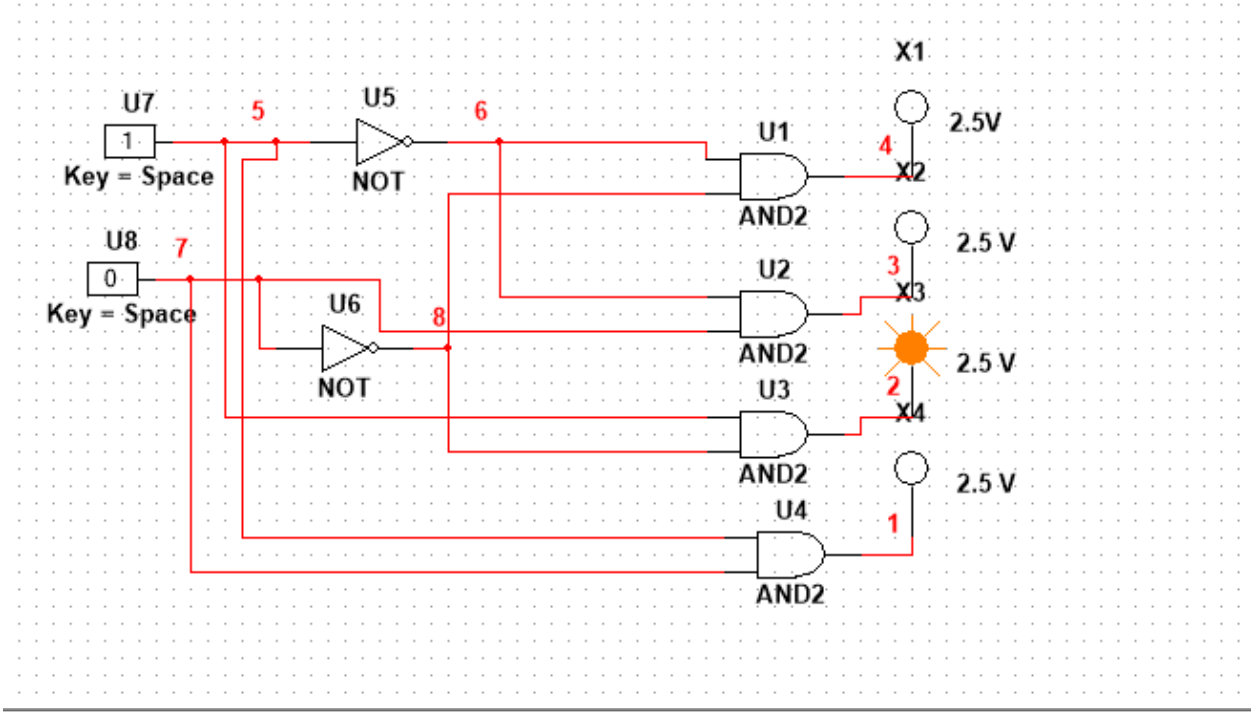

U1
0
Key = Space
U2
1
Key = Space
U4
NOT
U5
NOT
U6
1
Key = Space
U7
AND3
U8
AND3
U9
AND3
U10
AND3
2.5V
X2
X3
X4
5
6
7
8
9
1
4
3
2

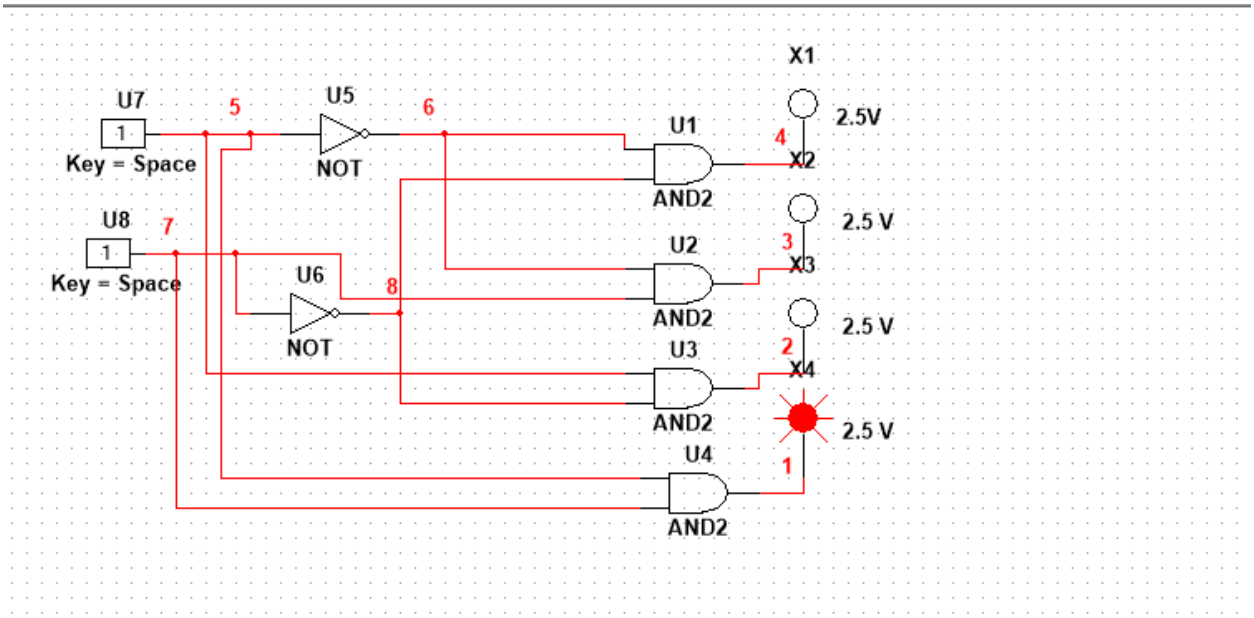


2 to 4 line decoder

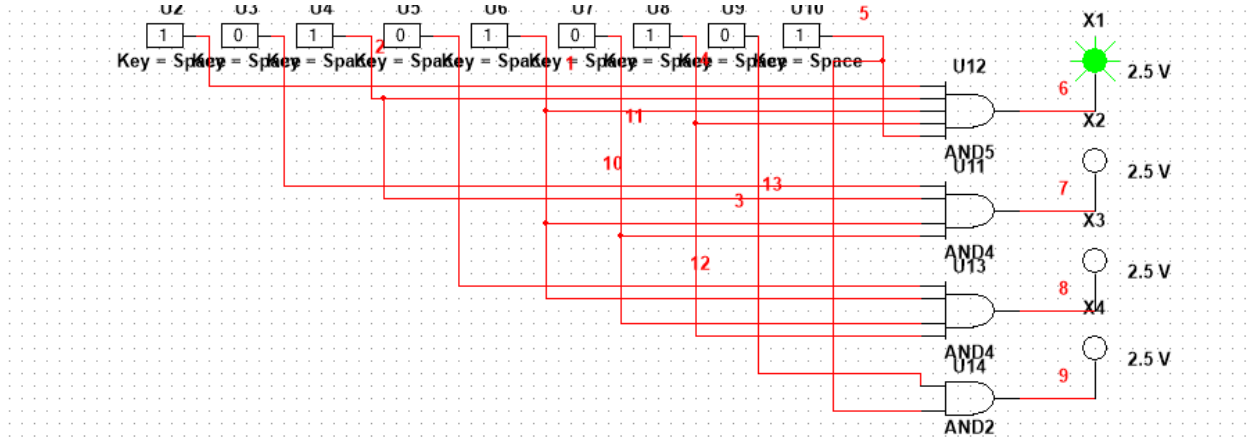


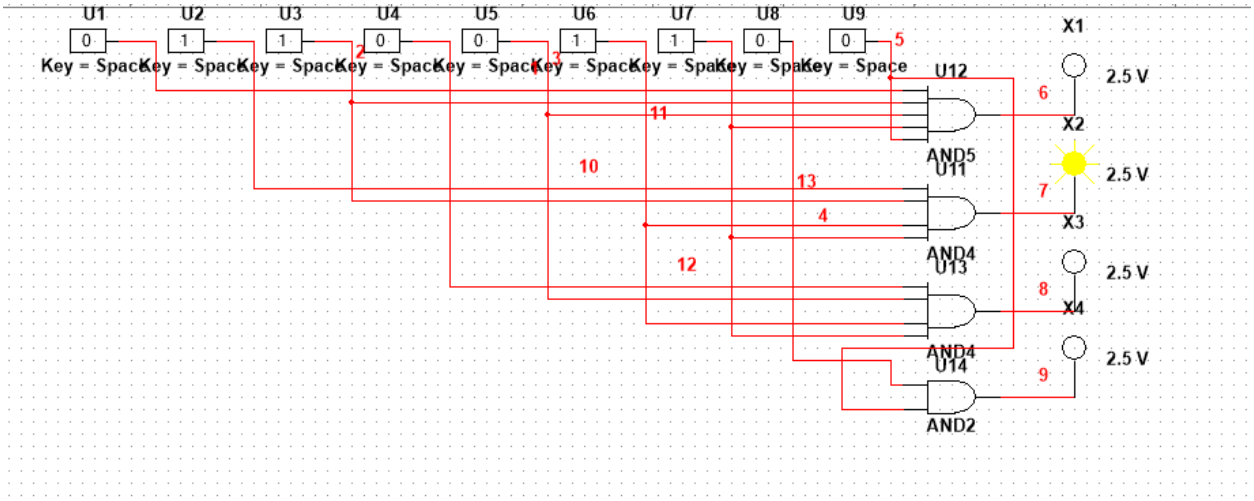

X1
U7
0
Key = Space
5
U5
NOT
6
U1
AND2
4
X2
2.5V
U8
1
Key = Space
7
U6
NOT
8
U2
AND2
3
X3
2.5 V
U3
AND2
2
X4
2.5 V
U4
AND2
1
2.5 V

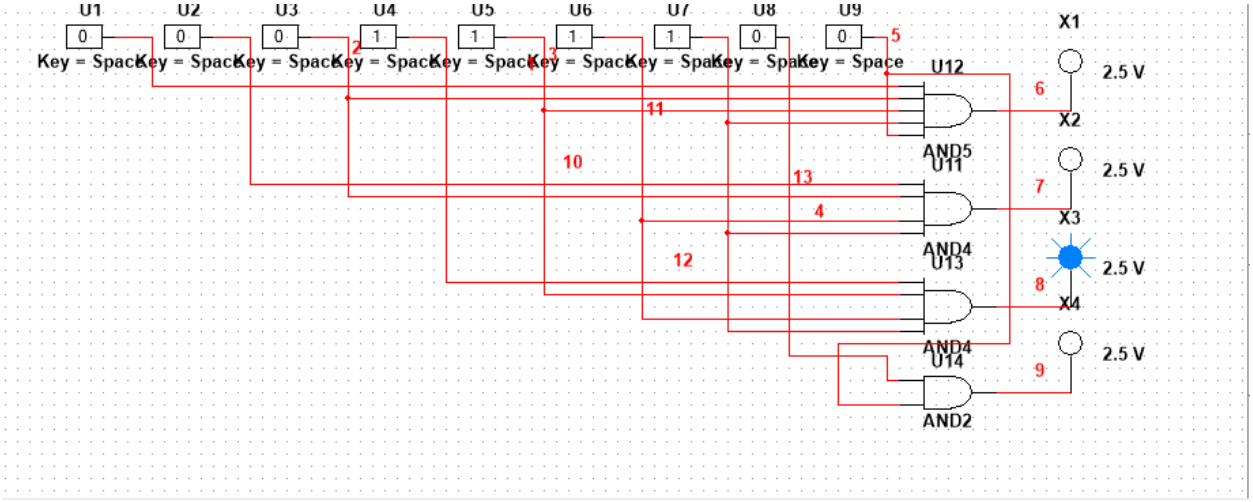


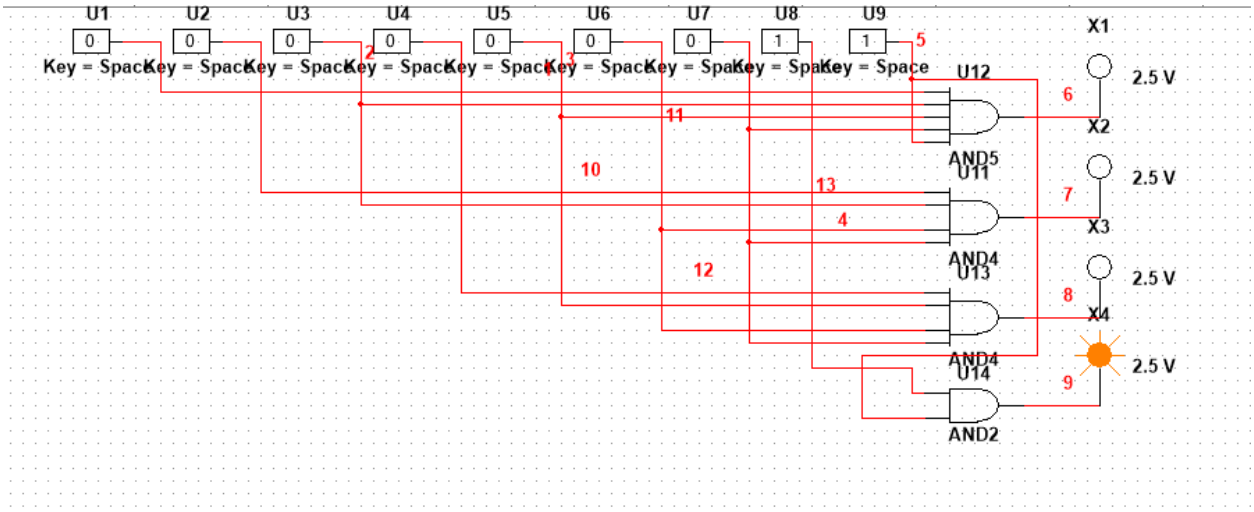


Decimal to BCD encoder


U2 U3 U4 U5 U6 U7 U8 U9 U10
1 0 1 0 1 0 1 0 1
Key = Space
5
2
1
11
10
3
13
12
U12
AND5
U11
AND4
U13
AND4
U14
AND2
6
7
8
9
X1
X2
X3
X4
2.5 V
2.5 V
2.5 V
2.5 V


U1 U2 U3 U4 U5 U6 U7 U8 U9
0 1 1 0 0 1 1 0 0
Key = Space
5
2
1
3
11
10
13
4
12
U12
AND5
U11
AND4
U13
AND4
U14
AND2
6
7
8
9
X1
X2
X3
X4
2.5 V
2.5 V
2.5 V
2.5 V


U1 U2 U3 U4 U5 U6 U7 U8 U9
0 0 0 1 1 1 1 0 0
Key = Space
5
2
1
3
11
10
13
4
12
U12
AND5
U11
AND4
U13
AND4
U14
AND2
6
7
8
9
X1
X2
X3
X4
2.5 V
2.5 V
2.5 V
2.5 V


U1
U2
U3
U4
U5
U6
U7
U8
U9
0
0
0
0
0
0
0
1
1
Key = Space
Key = Space
Key = Space
Key = Space
Key = Space
Key = Space
Key = Space
Key = Space
Key = Space
U12
AND5
U11
AND4
U13
AND4
U14
AND2
X1
X2
X3
X4
2.5 V
2.5 V
2.5 V
2.5 V
1
2
3
4
5
6
7
8
9
10
11
12
13

Discussion:

A mux is a device which selects one of several inputs and forwards the selected input into a single line. A demux is single input taking and provide many output line. Encoder and decoders are mainly used for encode and decode a digital signal.

In the experiment we mainly verify the truth tables using some IC's. There some inputs where for 3 bit, some were for 2 bits. 3 bits input has various pin configuration. By appling the circuit, we have find out the output.

During experiment, there were some errors in Ic pins. Due to excessive use, some pins were not working properly. Despite all of this, the experiment were success as we have matched the output and that's why the experiment success is achived.

Conclusion:

To verify mux, demux, decoder, encoder, we mainly used OR gate, AND gate and Not gate Ic. We solved a boolean function for the truth table. The output was verified.

Remarks:

(i) Mux are mainly used for computer memory telephone networks, etc

(ii) Demuxs are used for mainly carry multiple data signal

(iii) Encoder and decoder are used for data encription, decription

Reference:

[1] Tomas. L. Floyd "Digital Fundamentals" 11th edition