implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates

Aim:

To analyze the truth table and working of 1x4 De-Multiplexer by using 3-input NAND and 1-input NOT logic gate ICs and 4x1 Multiplexer by using 3-input AND, 3-input OR, and 1-input NOT logic gate ICs.

Introduction:

The function of a multiplexer is to select the input of any 'n' input lines and feed that to one output line. The function of a de-multiplexer is to inverse the function of the multiplexer and the shortcut forms of the multiplexer. The de-multiplexers are mux and de-mux. Some multiplexers perform both multiplexing and de-multiplexing operations.
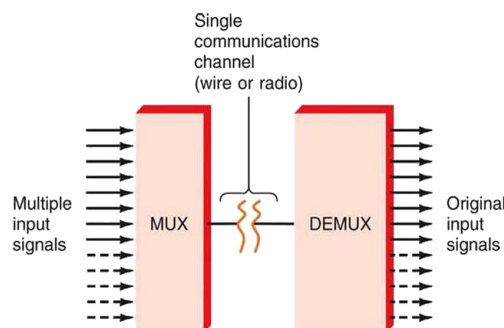

Figure-1: Block diagram of Multiplexer and De-multiplexer

1) Multiplexer: Multiplexer is a device that has multiple inputs and a single line output. The select lines determine which input is connected to the output and increase the amount of data that can be sent over a network within a certain time. It is also called a data selector.

Multiplexers are classified into four types:

a)	2-1	multiplexer	(1	select	line)
b)	4-1	multiplexer	(2	select	lines)
c)	8-1	multiplexer	(3	select	lines)

d) 16-1 multiplexer (4 select lines)

1.1) 4X1 Multiplexer

4x1 Multiplexer has four data inputs D0, D1, D2 & D3, two selection lines S0 & S1 and one output Y. The block diagram of 4x1 Multiplexer is shown in the following figure. One of these 4 inputs will be connected to the output based on the combination of inputs present at these two selection lines. Truth table of 4x1 Multiplexer is shown below.
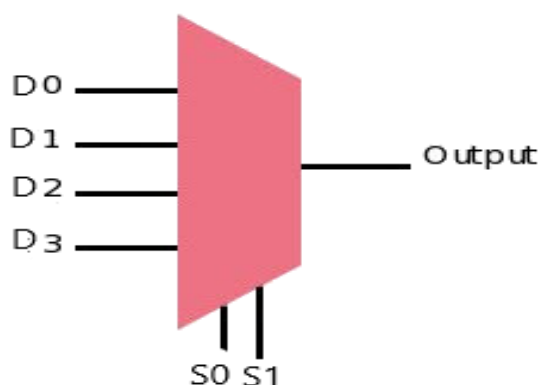

Figure-2: Block diagram of 4x1 Multiplexer

Selection Lines		Output
S0	S1	Y
0	0	D_0
0	1	D_1
1	0	D_2
1	1	D_3

Figure-3: Truth table of 4x1 Multiplexer

2) **De-multiplexer:** De-multiplexer is also a device with one input and multiple output lines. It is used to send a signal to one of the many devices. The main difference between a multiplexer and a de-multiplexer is that a multiplexer takes two or more signals and encodes them on a wire, whereas a de-multiplexer does reverse to what the multiplexer does.

De-multiplexers are classified into four types:

a)1-2 demultiplexer (1 select line)
b)1-4 demultiplexer (2 select lines)
c)1-8 demultiplexer (3 select lines)
d)1-16 demultiplexer (4 select lines)

2.2) 1x4 De-multiplexer

1x4 De-Multiplexer has one input Data(D), two selection lines, S0 & S1 and four outputs Y0, Y1, Y2 & Y3. The block diagram of 1x4 De-Multiplexer is shown in the following figure.
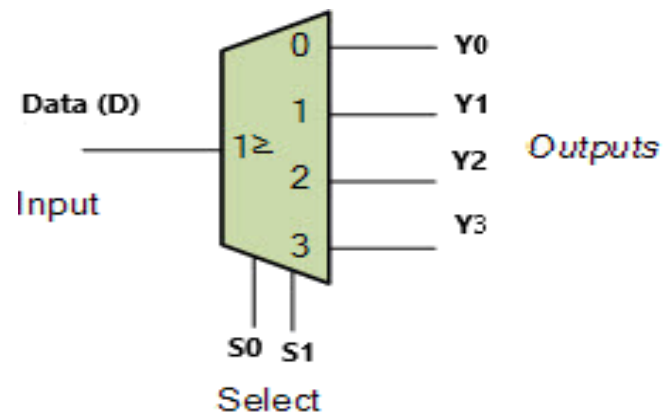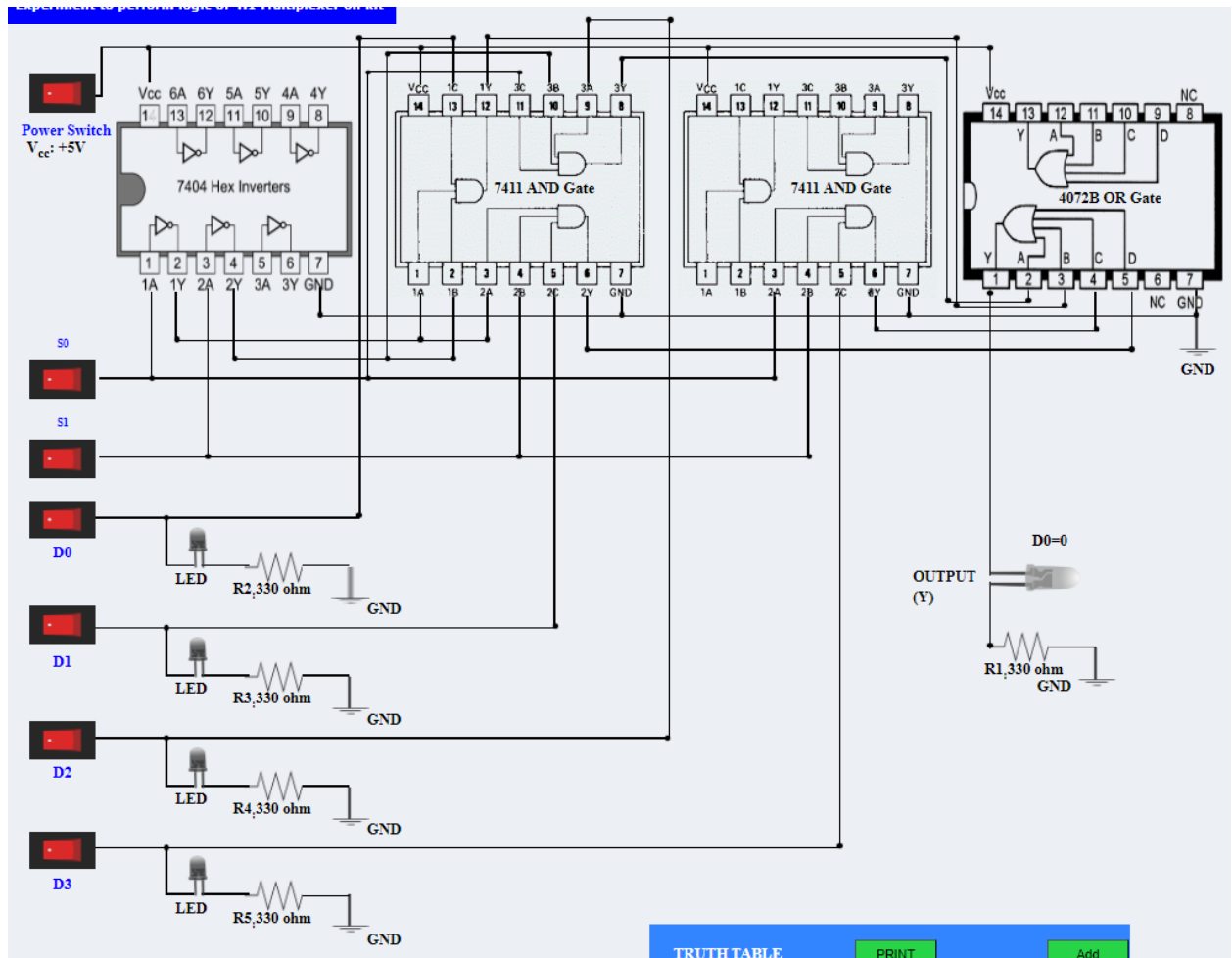
Figure-4: Block diagram of 1x4 De-Multiplexer

Selection Inputs		Outputs			
S0	S1	Y_3	Y_2	Y_1	Y_0
0	0	0	0	0	D
0	1	0	0	D	0
1	0	0	D	0	0
1	1	D	0	0	0

Figure-5: Truth table of 1x4 De-Multiplexer

Experiment to perform 4:1 Multiplexer:

TRUTH TABLE FOR 4:1 MULTIPLEXER:

Serial No.	S0	S1	OUTPUT (Y)	OUTPUT VALUE
1	0	0	D0	1
2	0	1	D1	1
3	1	0	D2	1
4	1	1	D3	1

Experiment to perform 1:4 De-Multiplexer:
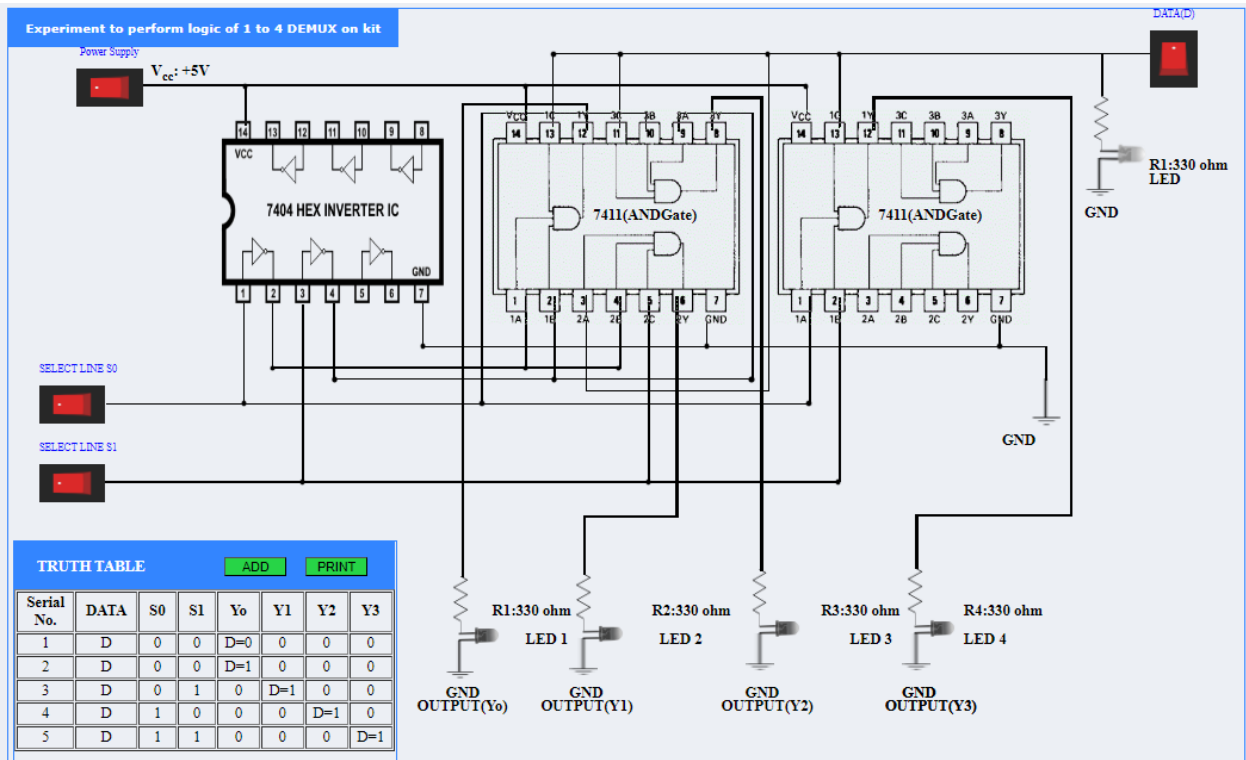
TRUTH TABLE FOR 1:4 De-MULTIPLEXER:

Serial No.	DATA	S0	S1	Yo	Y1	Y2	Y3
1	D	0	0	D=0	0	0	0
2	D	0	0	D=1	0	0	0
3	D	0	1	0	D=1	0	0
4	D	1	0	0	0	D=1	0
5	D	1	1	0	0	0	D=1