D.Y. PATIL INTERNATIONAL UNIVERSITY
B.TECH CSE FY SEM-2
A.Y. 2022-2023

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SUBJECT: DIGITAL LOGIC AND DESIGN
BATCH: A1

EXPERIMENT-4 (A)

Aim:
Implementation of 4x1 multiplexer.

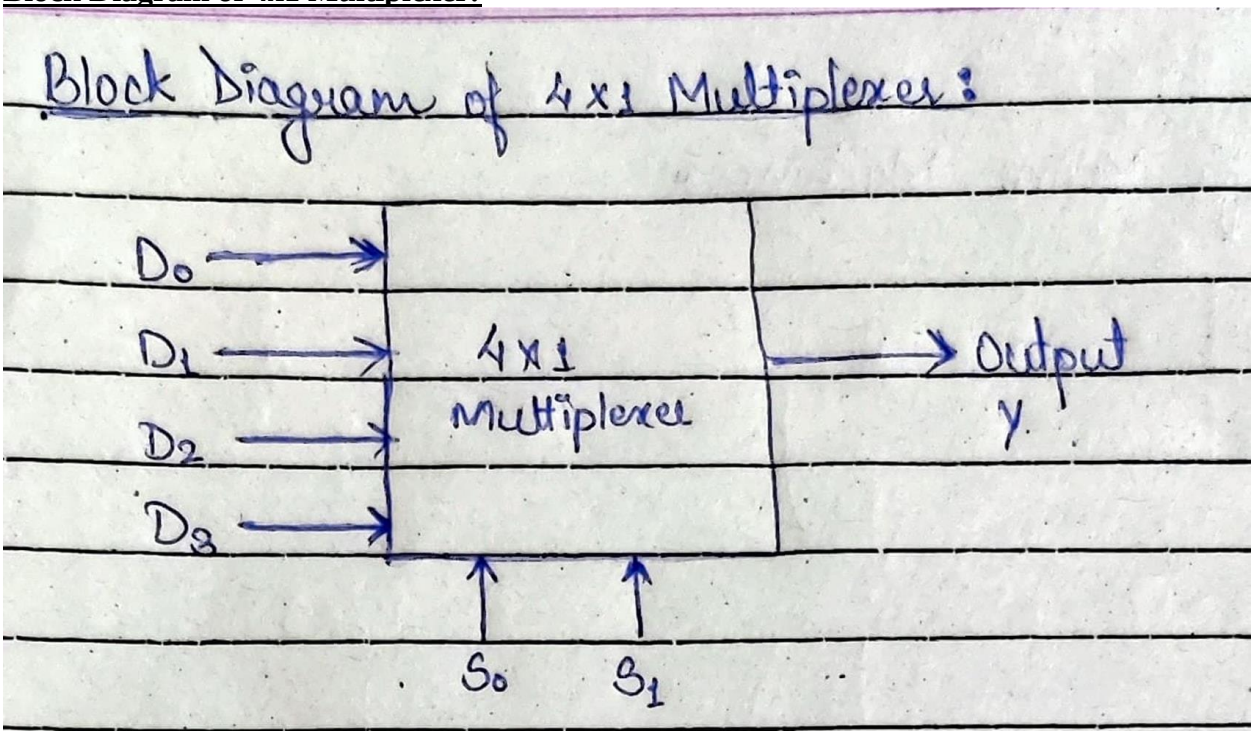
Requirements:
- AND gate
- OR gate
- NOT gate
- MyDaQ

Theory:
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 also to increase the amount of data that can be sent over a network within certain time. It is also called a data selector.
Multiplexers are classified into four types:

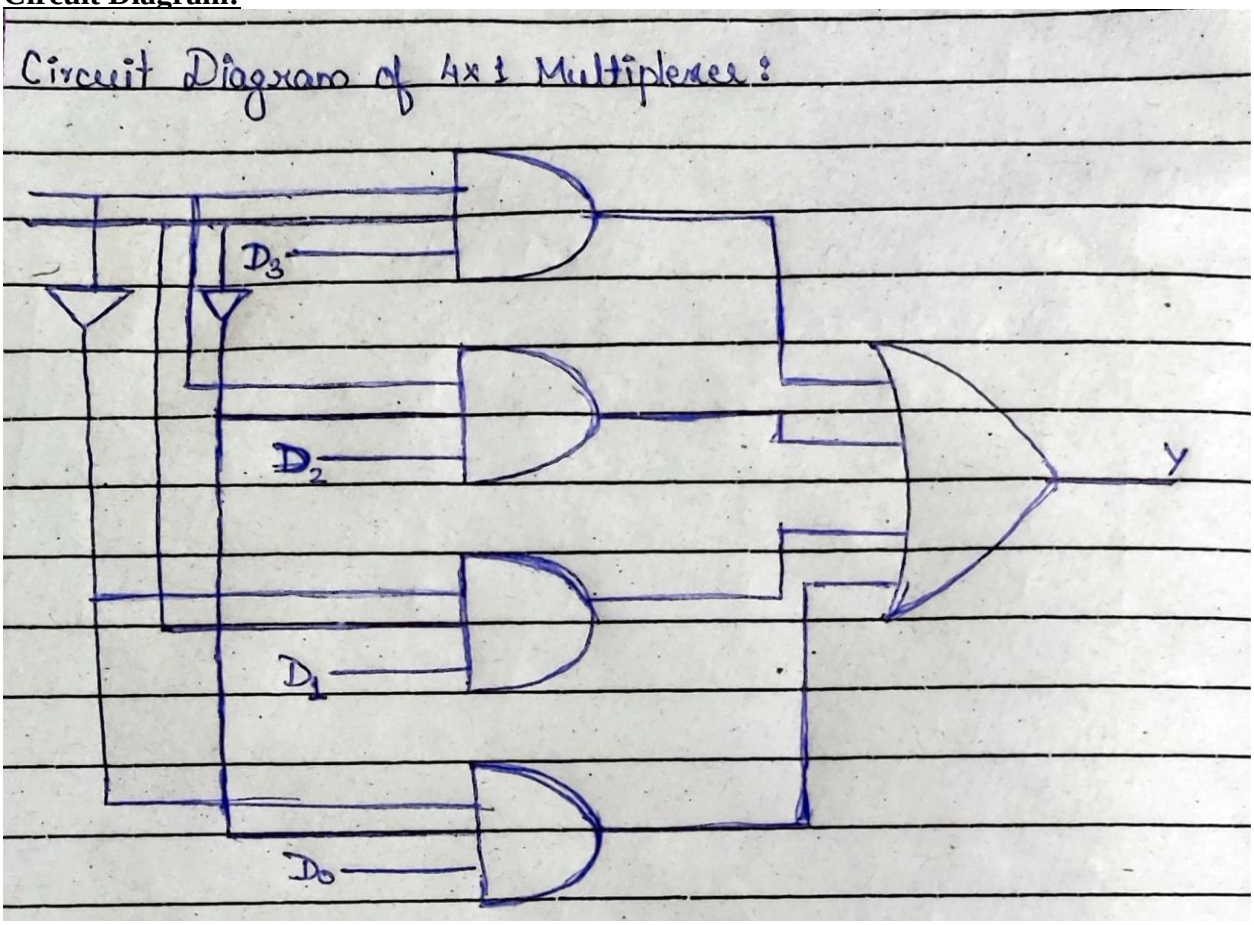
1. 2-1 Multiplexer (1 select line)
2. 4-1 Multiplexer (2 select lines)
3. 8-1 Multiplexer (3 select lines)
4. 16-1 multiplexer (4 select lines)

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.

Block Diagram of 4x1 Multiplexer:



Circuit Diagram:



Truth Table:

Selection lines		output
S_0	S_1	Y
0	0	D_0
0	1	D_1
1	0	D_2
1	1	D_3

Mathematical Expression for 4x1 Multiplexer:

$$Y = S_1' S_0' D_0 + S_1' S_0 D_1 + S_1 S_0' D_2 + S_1 S_0 D_3$$

Observation Table:

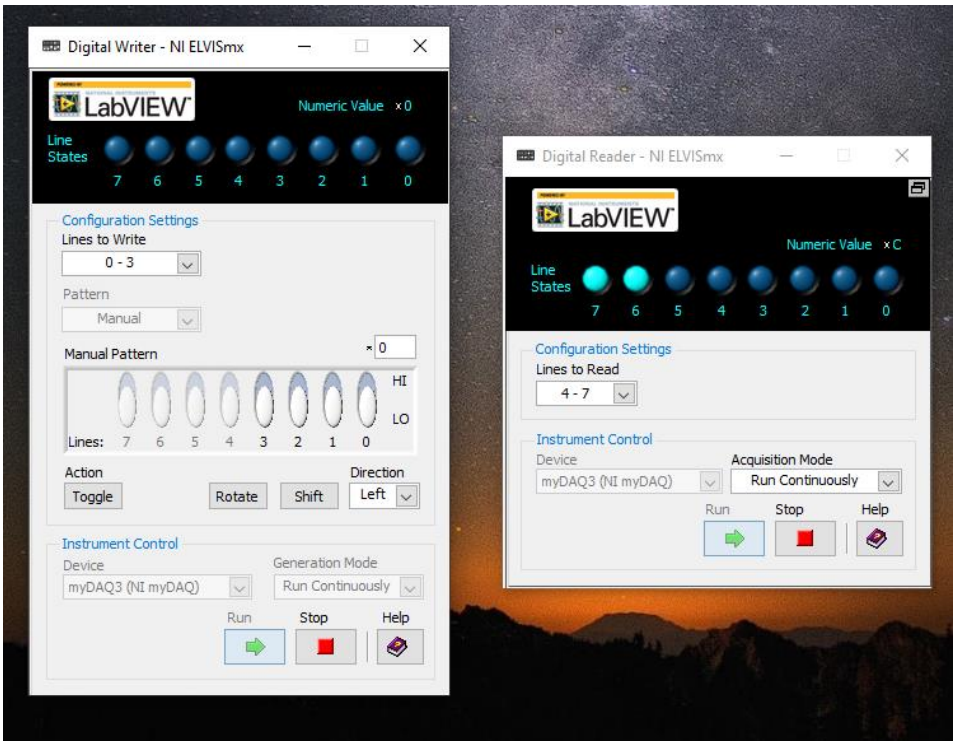
Input Variables- E_a, S_1, S_0

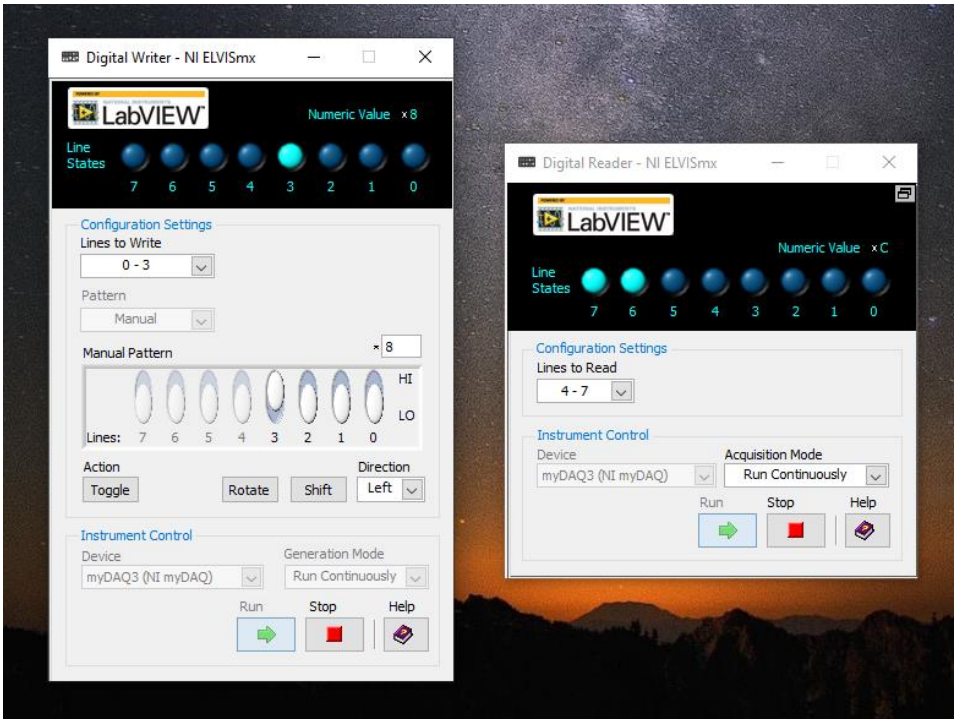
Output Variables- Y_a.

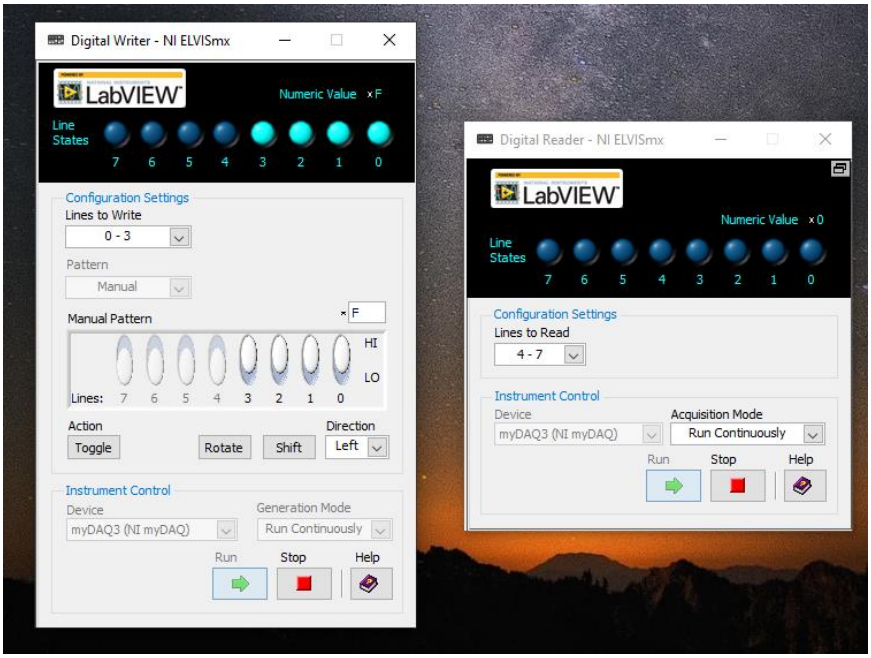
where, E_a, E_b represents the enable bits for the respective multiplexers and S_1, S_0 are the select lines. Y_a, Y_b represents the output bits for the respective multiplexers.

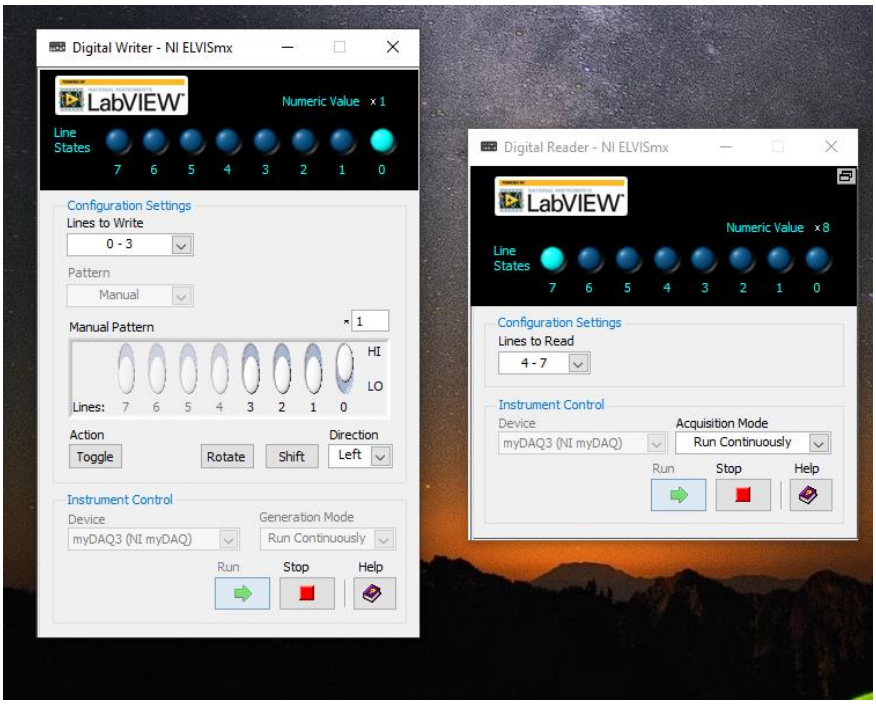
Input			Output
$\overline{E_a}$	S_1	S_0	Y_a
D0	0	0	D0
D1	1	0	D1
D2	0	1	D2
D3	1	1	D3

Output:


Digital Writer - NI ELVISmx
LabVIEW
Numeric Value x 0
Line States
7 6 5 4 3 2 1 0
Configuration Settings
Lines to Write
0 - 3
Pattern
Manual
Manual Pattern
x 0
HI
LO
Lines: 7 6 5 4 3 2 1 0
Action
Toggle
Rotate
Shift
Direction
Left
Instrument Control
Device
myDAQ3 (NI myDAQ)
Generation Mode
Run Continuously
Run
Stop
Help
Digital Reader - NI ELVISmx
LabVIEW
Numeric Value x C
Line States
7 6 5 4 3 2 1 0
Configuration Settings
Lines to Read
4 - 7
Instrument Control
Device
myDAQ3 (NI myDAQ)
Acquisition Mode
Run Continuously
Run
Stop
Help


Digital Writer - NI ELVISmx
LabVIEW
Numeric Value x 8
Line States
7 6 5 4 3 2 1 0
Configuration Settings
Lines to Write
0 - 3
Pattern
Manual
Manual Pattern
x 8
HI
LO
Lines: 7 6 5 4 3 2 1 0
Action
Toggle
Rotate
Shift
Direction
Left
Instrument Control
Device
myDAQ3 (NI myDAQ)
Generation Mode
Run Continuously
Run
Stop
Help
Digital Reader - NI ELVISmx
LabVIEW
Numeric Value x C
Line States
7 6 5 4 3 2 1 0
Configuration Settings
Lines to Read
4 - 7
Instrument Control
Device
myDAQ3 (NI myDAQ)
Acquisition Mode
Run Continuously
Run
Stop
Help





Result: The implementation of 4x1 multiplexer is done.

EXPERIMENT-4 (B)

Aim:

Implementation of 1x4 demultiplexer.

Requirements:

- NAND Gate
- NOT Gate

Theory:

Describe the demultiplexers in brief and enlist the different demultiplexers. And also explain the 1x4 demultiplexer along with its block diagram.

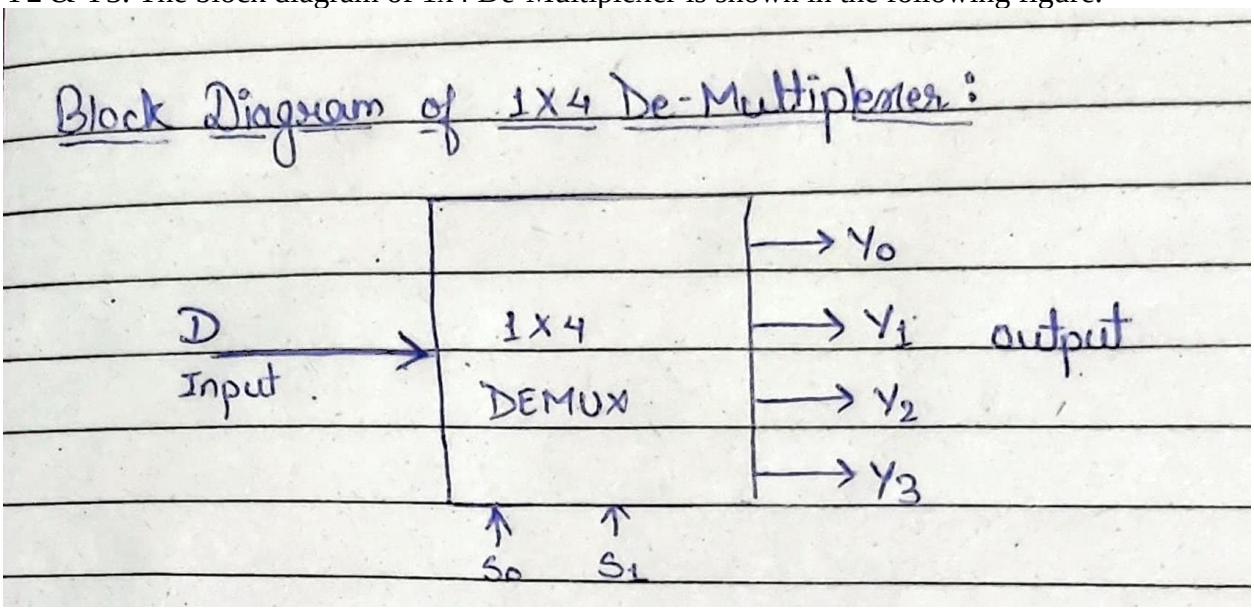
De-multiplexer De-multiplexer is also a device with one input and multiple output lines. It is used to send a signal to one of the many devices. The main difference between a multiplexer and a de-multiplexer is that a multiplexer takes two or more signals and encodes them on a wire, whereas a de-multiplexer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

De-Multiplexer are classified into four types:

1) 1-2 demultiplexer (1 select line)
2) 1-4 demultiplexer (2 select lines)
3) 1-8 demultiplexer (3 select lines)
4) 1-16 demultiplexer (4 select lines)

1x4 De-multiplexer:

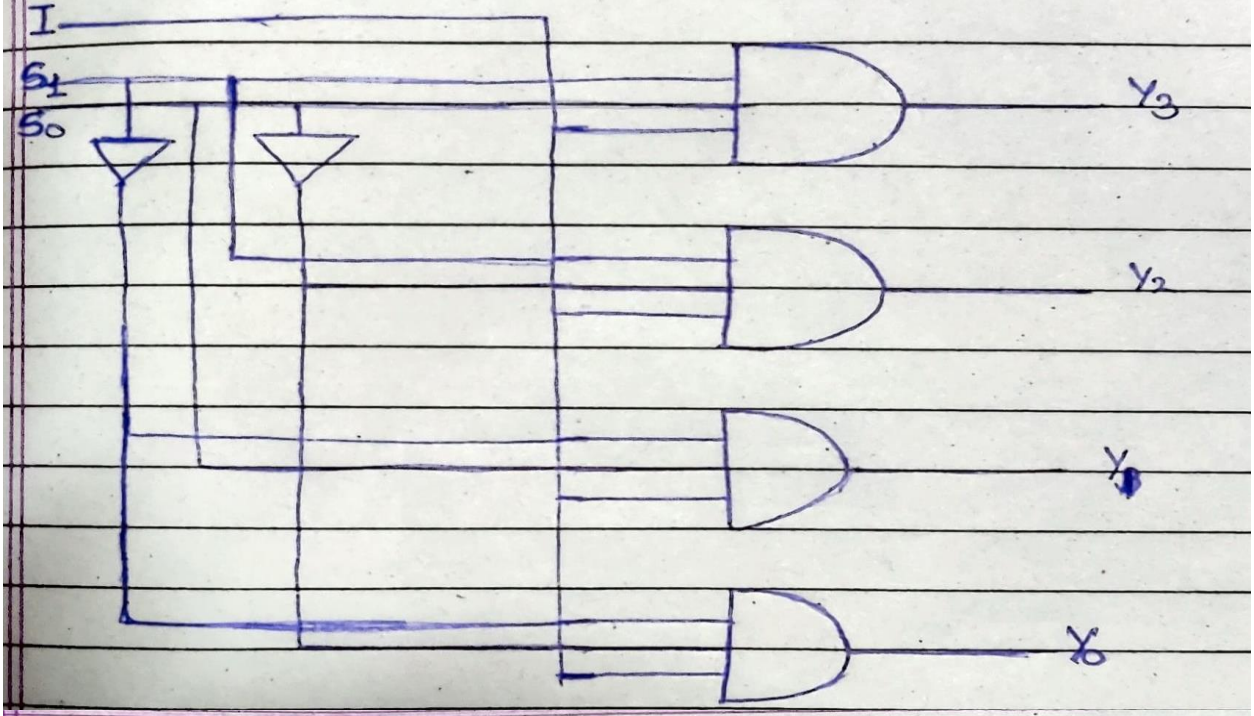
1x4 De-Multiplexer has one input Data(D), two selection lines, S0 & S1 and four outputs Y0, Y1, Y2 & Y3. The block diagram of 1x4 De-Multiplexer is shown in the following figure.



Circuit Diagram:

Mention the mathematical equations used for the realization part along with its truth table and logic diagram.

Circuit Diagram 1x4 Demultiplexer:



Truth Table:

Selection Inputs		outputs			
S_0	S_1	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

Mathematical Expression:

$Y_3 = S_1 S_0 D$

$Y_2 = S_1 S_0' D$

$Y_1 = S_1' S_0 D$

$Y_0 = S_1' S_0' D$

Observation Table:

Input Variables- G, B, A

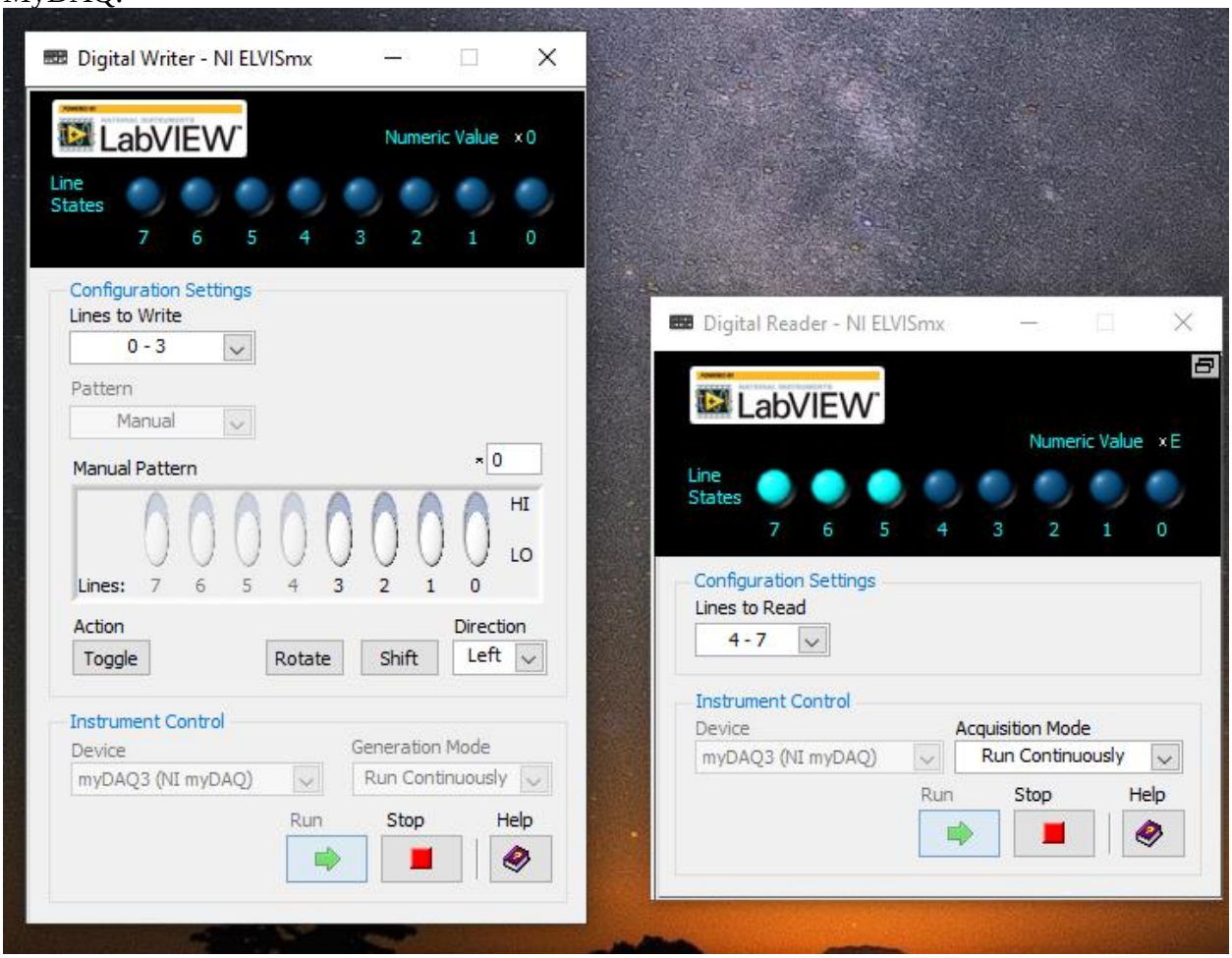
Output Variables- Y_0, Y_1, Y_2, Y_3

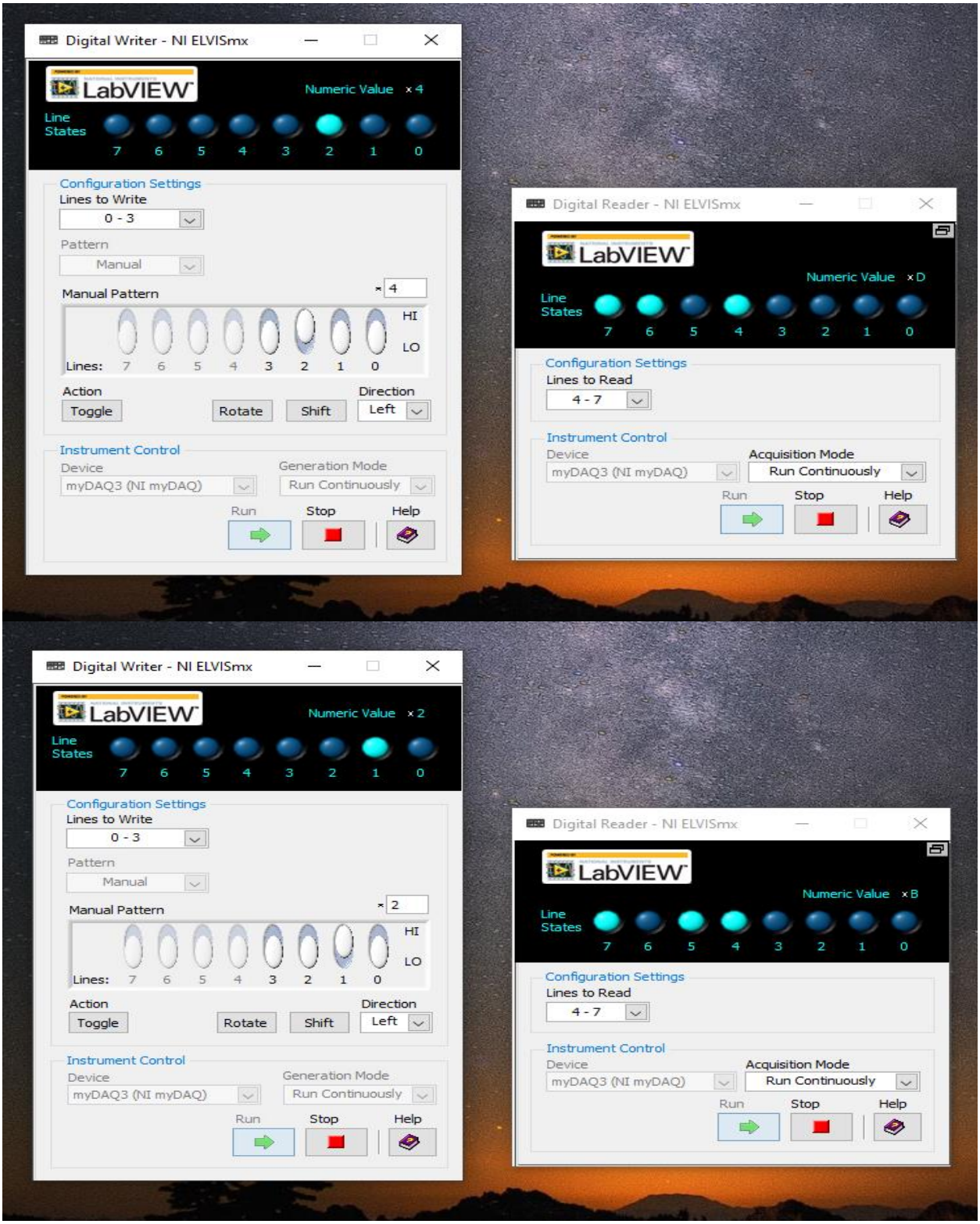
where G, B, A represents the input bits for 1x4 demultiplexer,

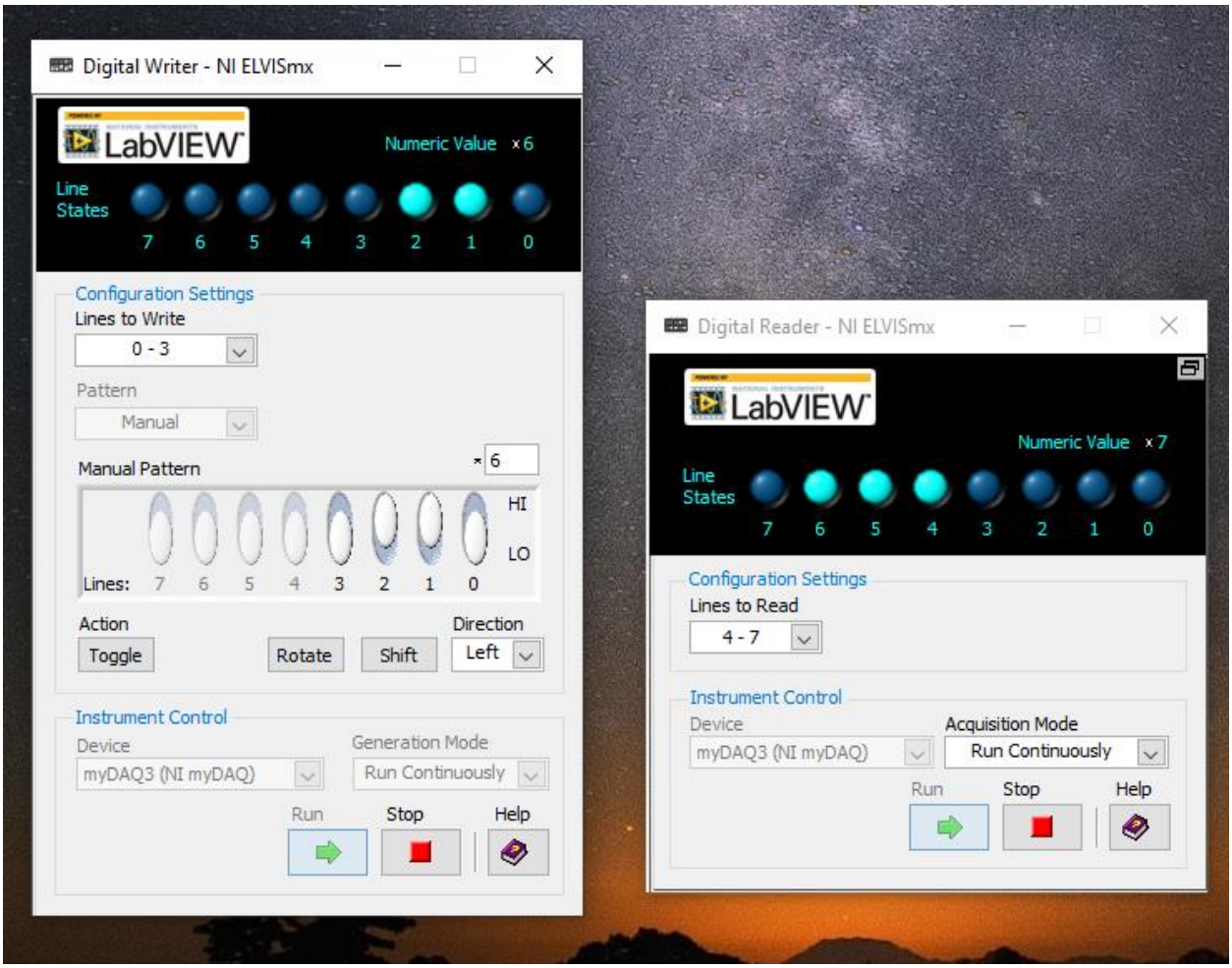
Y_0, Y_1, Y_2, Y_3 represents the output bits for 1x4 demultiplexer

Input			Output			
G	B	A	Y_0	Y_1	Y_2	Y_3
D	0	0	D	0	0	0
D	1	0	0	D	0	0
D	0	1	0	0	D	0
D	1	1	0	0	0	D

Output: Attach the screenshots of the simulation of 1x4 demultiplexer which is performed on MyDAQ.




Digital Writer - NI ELVISmx
LabVIEW
Numeric Value x 4
Line States
7 6 5 4 3 2 1 0
Configuration Settings
Lines to Write
0 - 3
Pattern
Manual
Manual Pattern
x 4
HI
LO
Lines: 7 6 5 4 3 2 1 0
Action
Toggle
Rotate
Shift
Direction
Left
Instrument Control
Device
myDAQ3 (NI myDAQ)
Generation Mode
Run Continuously
Run
Stop
Help
Digital Reader - NI ELVISmx
LabVIEW
Numeric Value x D
Line States
7 6 5 4 3 2 1 0
Configuration Settings
Lines to Read
4 - 7
Instrument Control
Device
myDAQ3 (NI myDAQ)
Acquisition Mode
Run Continuously
Run
Stop
Help
Digital Writer - NI ELVISmx
LabVIEW
Numeric Value x 2
Line States
7 6 5 4 3 2 1 0
Configuration Settings
Lines to Write
0 - 3
Pattern
Manual
Manual Pattern
x 2
HI
LO
Lines: 7 6 5 4 3 2 1 0
Action
Toggle
Rotate
Shift
Direction
Left
Instrument Control
Device
myDAQ3 (NI myDAQ)
Generation Mode
Run Continuously
Run
Stop
Help
Digital Reader - NI ELVISmx
LabVIEW
Numeric Value x B
Line States
7 6 5 4 3 2 1 0
Configuration Settings
Lines to Read
4 - 7
Instrument Control
Device
myDAQ3 (NI myDAQ)
Acquisition Mode
Run Continuously
Run
Stop
Help



Result:

The implementation of 1x4 demultiplexer is done.