EXPERIMENT 04

AIM :-

Implementation of MUX and DEMUX.

LO No :- LO2

LO : Analyse and design combinational circuits.

SOFTWARE :- Logisim Software.

Theory :-

Multiplexer is a combinational circuit that has maximum of 2^n data inputs, 'n' selection lines and single output line. One of these data inputs will be connected to the output based on the values of selection lines.

Since there are 'n' selection lines, there will be 2^n possible combinations of zeros and ones. So, each combination will select only one data input. Multiplexer is also called as **Mux**.

Multiplexer and Demultiplexer
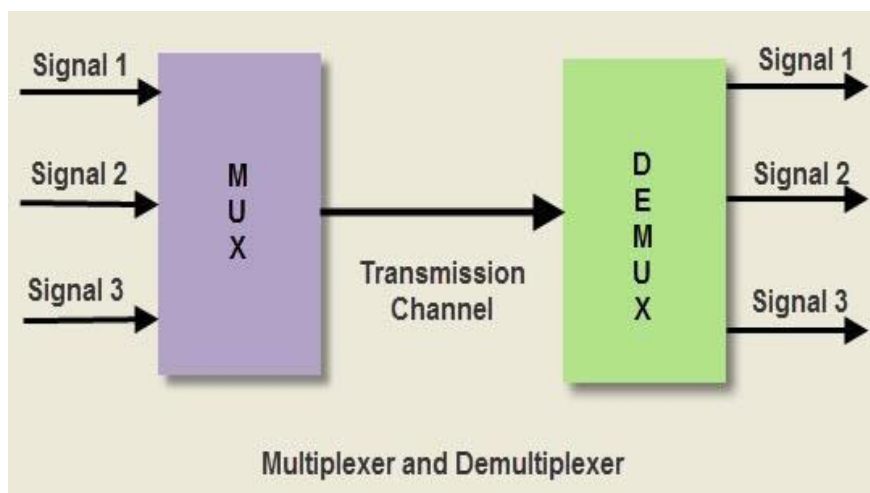
De-Multiplexer is a combinational circuit that performs the reverse operation of Multiplexer. It has single input, 'n' selection lines and maximum of 2^n outputs. The input will be connected to one of these outputs based on the values of selection lines.

Since there are 'n' selection lines, there will be 2^n possible combinations of zeros and ones. So, each combination can select only one output. De-Multiplexer is also called as **De-Mux**.
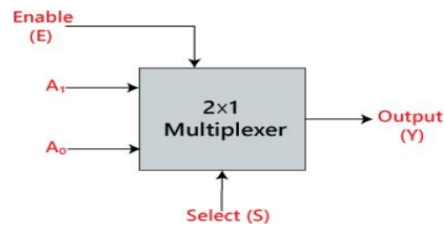
2:1 Multiplexer : In 2×1 multiplexer, there are only two inputs, i.e., A_0 and A_1, 1 selection line, i.e., S_0 and single outputs, i.e., Y.
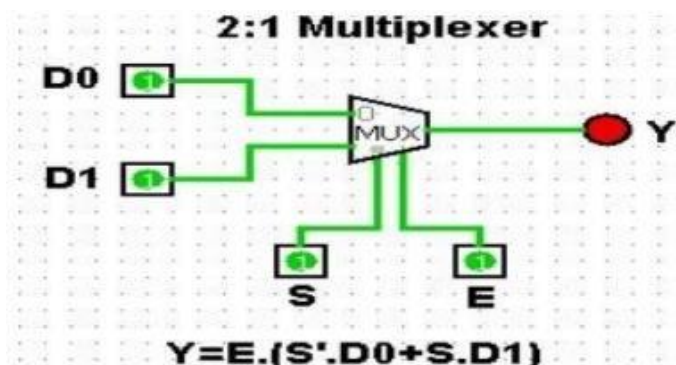
Symbol :

Boolean expression :

$$Y = D0S' + \dot{D}1S$$

Truth Table :

Select	Inputs		Output
0	0	0	0
0	0	1	1
1	1	0	1
1	1	1	1

Diagram :
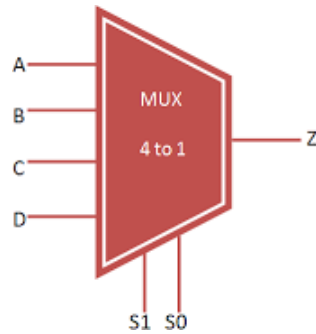
4:1 Multiplexer : A 4-to-1 multiplexer consists four data input lines as D0 to D3, two select lines as S0 and S1 and a single output line Y.
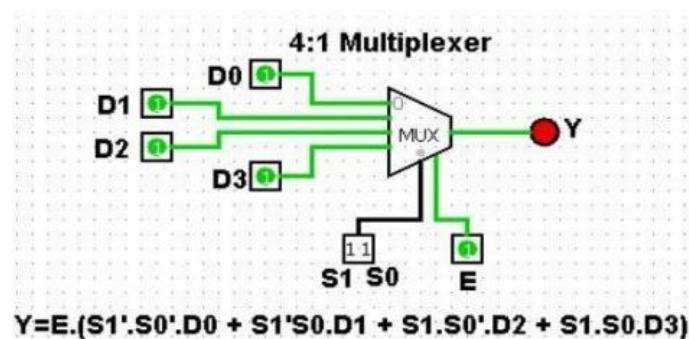
Symbol :

Boolean expression :

$$Y=E.(S1'.S0'.D0 + S1'S0.D1 + S1.S0'.D2 + S1.S0.D3)$$

Truth Table :

Select Data Inputs		Output
S_1	S_0	Y
0	0	D_0
0	1	D_1
1	0	D_2
1	1	D_3

Diagram :

$$Y=E.(S1'.S0'.D0 + S1'S0.D1 + S1.S0'.D2 + S1.S0.D3)$$

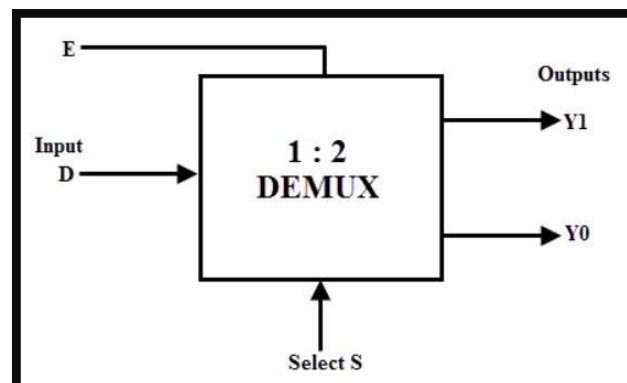**1:2 De-Multiplexer :** A 1-to-2 demultiplexer consists of one input line, two output lines and one select line. The signal on the select line helps to switch the input to one of the two outputs. The figure below shows the block diagram of a 1-to-2 demultiplexer with additional enable input.
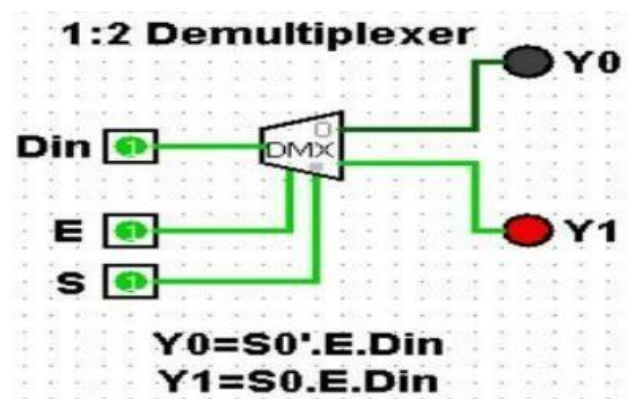
Symbol :

Boolean expression :

$Y0=S0'.E.\overline{D}in \quad Y1=S0.E.Din$

Truth Table :

Select	Input	Outputs	
S	D	Y_1	Y_0
0	0	0	0
0	1	0	1
1	0	0	0
1	1	1	0

Diagram :
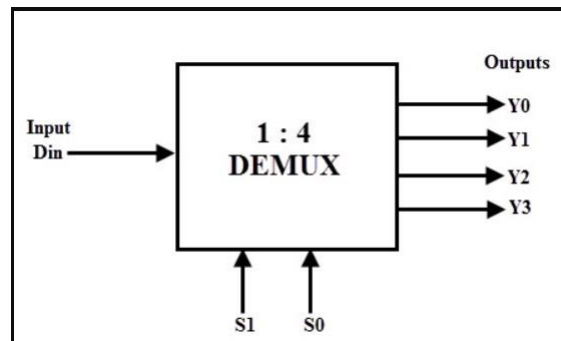
1:4 De-Multiplexer : A 1-to-4 demultiplexer has a single input (D), two selection lines (S1 and S0) and four outputs (Y0 to Y3). The input data goes to any one of the four outputs at a given time for a particular combination of select lines.

Symbol :

Boolean expression :

Y0=S1'.S0'.E.Din
Y1=S1'.S0.E.Din
Y2=S1.S0'.E.Din `
Y3=S1.S0.E.Din

Truth Table :

Data Input	Select Inputs		Outputs			
D	S_1	S_0	Y_3	Y_2	Y_1	Y_0
D	0	0	0	0	0	D
D	0	1	0	0	D	0
D	1	0	0	D	0	0
D	1	1	D	0	0	0

Diagram :
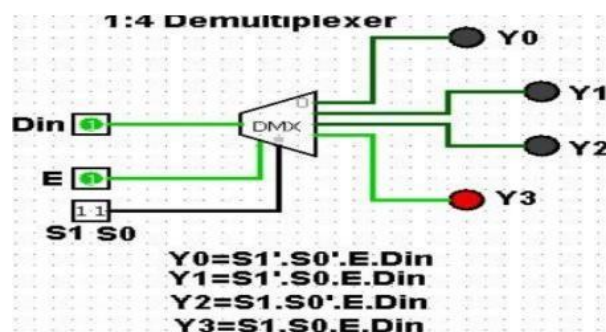
Conclusion : Understood the basic of multiplexer's and de-multiplexer's with their types along with the help of symbols, expressions, truth table and switch diagram.