Ex.No.5	**Design and implementation of 8x1 MUX and 1x8 DEMUX using LT spice software**
Date:	

AIM

- To design an 8x1 MUX using two 4x1 MUX and one 2x1 MUX using LT Spice software
- To design an 1x8 DEMUX using two 1x4 DEMUX and one 1x2 DEMUX using LT Spice software
- To test the truth table and functionality of the both MUX and DEMUX

SOFTWARE REQUIRED

LT spice

1. THEORY OF MUX AND DEMUX

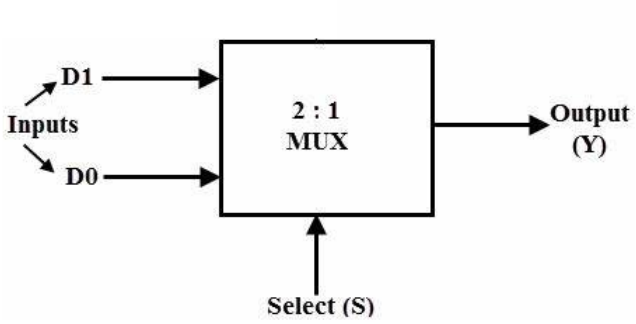
MUX stands for Multiplexer. It is a combinational circuit that selects binary information from one of many input lines and routes it to one output line. As a result, it is based on many-to-one concepts. MUX is a very important circuit and is widely used in Communication circuits, Computer Memory, ALU, Telephone network, etc.

Design and Implementation 8x1 MUX using LT spice

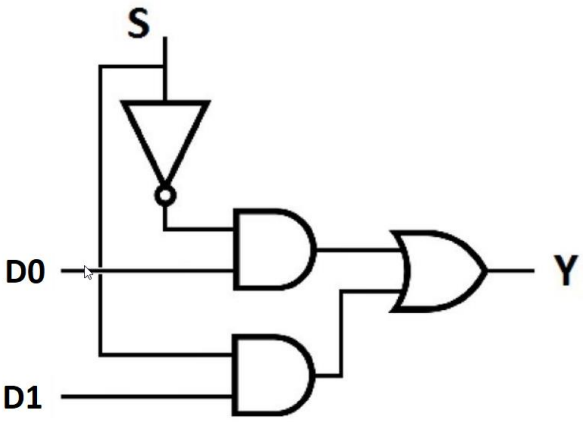
1. Design of 1x2 MUX

   2x1 MUX consists of 2 input lines, one selection line and one output line.

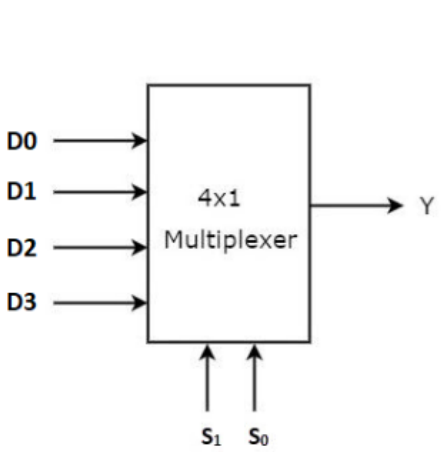
   (a) Create a symbol in LT spice with the following input, output specifications and save the symbol with the name 2x1_mux.



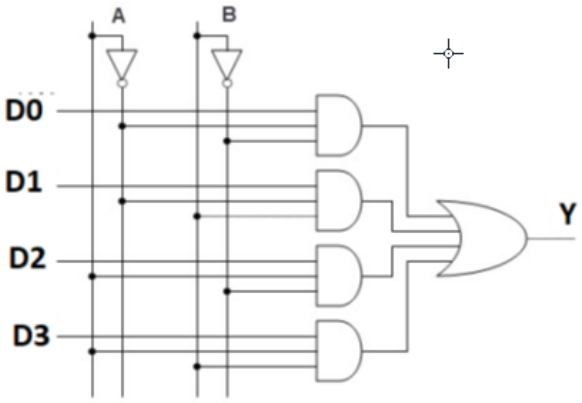
   (b) Create a new schematic file for the gate realization of a 2x1 MUX. Implement the 2x1 combinational logic circuit (as shown below) and save the file with the same name as used during the symbol creation: 2x1_mux.



2. Design of 4x1 MUX
   4x1 MUX consists of 4 input lines, 2 selection lines and one output line.
   Use the same procedure for the implementation of 4x1 MUX. Create a 4x1 MUX symbol and schematic file with the following specifications

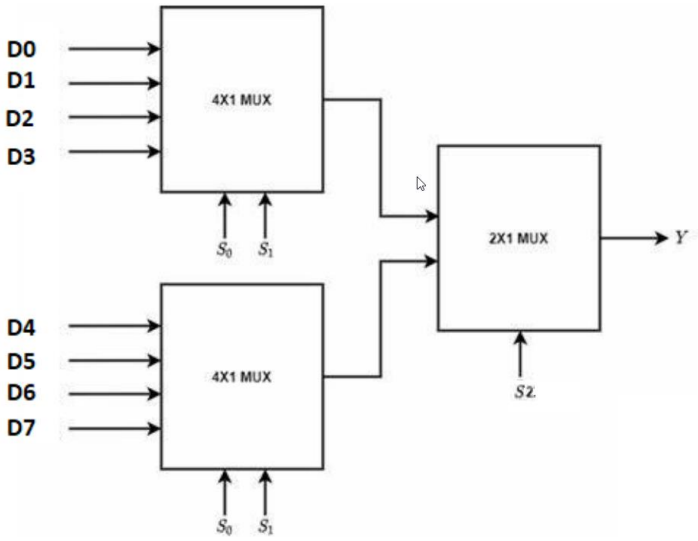


(a) Symbol of 4x1 MUX



(b) Schematic of 4x1 MUX

3. Now construct the required 8x1 mux using two 4x1 MUX and one 2x1 MUX as shown in the schematic diagram below.



4. Verify the truth table of 8x1 MUX

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

PROCEDURE

1. Create a LT spice symbol for 2x1 and 4x1 MUX.
2. Create the corresponding schematic files for 2x1 and 4x1 MUX.
3. Create a new schematic and construct the required 8x1 MUX circuit by instantiating the 4x1 and 2x1 MUX symbols.
4. Apply the inputs and verify the truth table.

Output Waveforms

Paste your results here

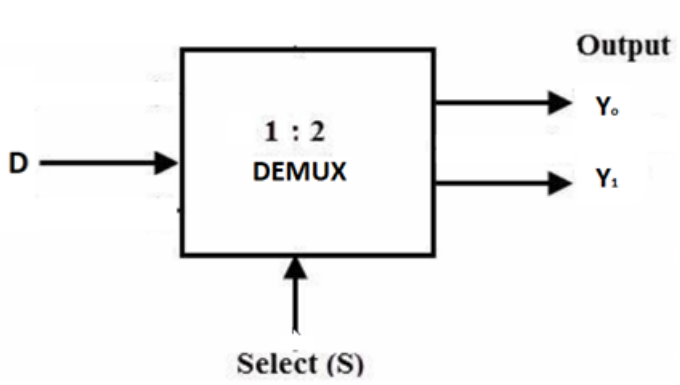
2. THEORY OF DEMUX

It is the reverse of Multiplexer and abbreviated for **DEMUX**. This circuit is capable of forwarding its single input onto any one of the output lines. *A Demultiplexer has a single input and multiple outputs.* It has 2^n output lines where "n" is the number of control signals. Each combination of control signal selects a specific output line through which the input data signal should flow out. These output lines are known as channels. Demultiplexer's operation is exactly opposite of Multiplexer.
1x8 DEMUX can direct one data line onto 8 separate output channels and these 8 channels are controlled by 3 control signals.

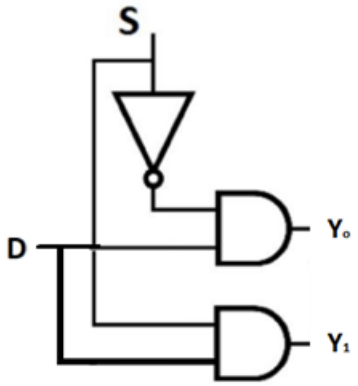
Design and Implementation 8x1 MUX using LT spice

1. Design of 1x2 DEMUX
   1x2 DEMUX consists of 1 input line, one selection line and two output lines.

   (a) Create a symbol in LT spice with the following input, output specifications and save the symbol with the name 1x2_demux

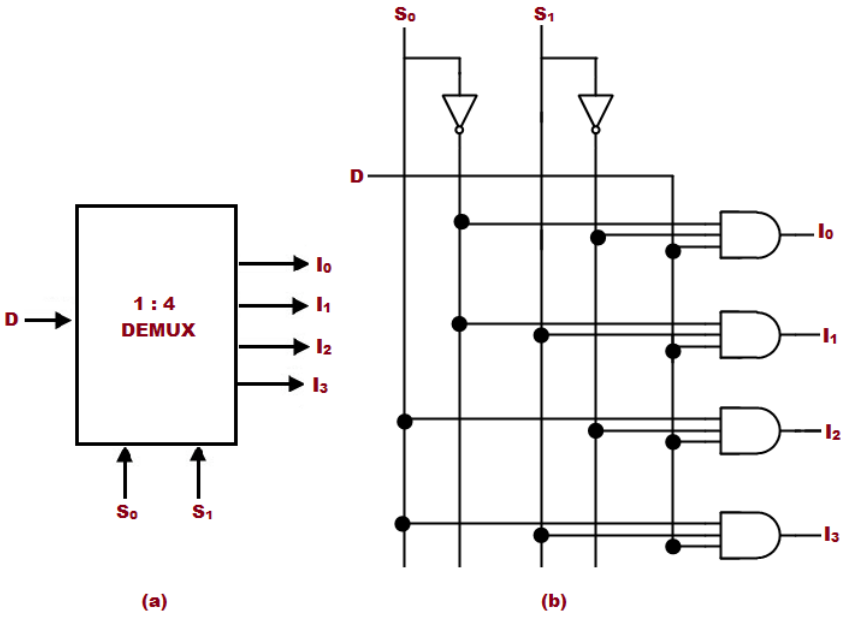


(a) Create a schematic file for gate realization of 1x2 MUX and save it with the same name 1x2_demux



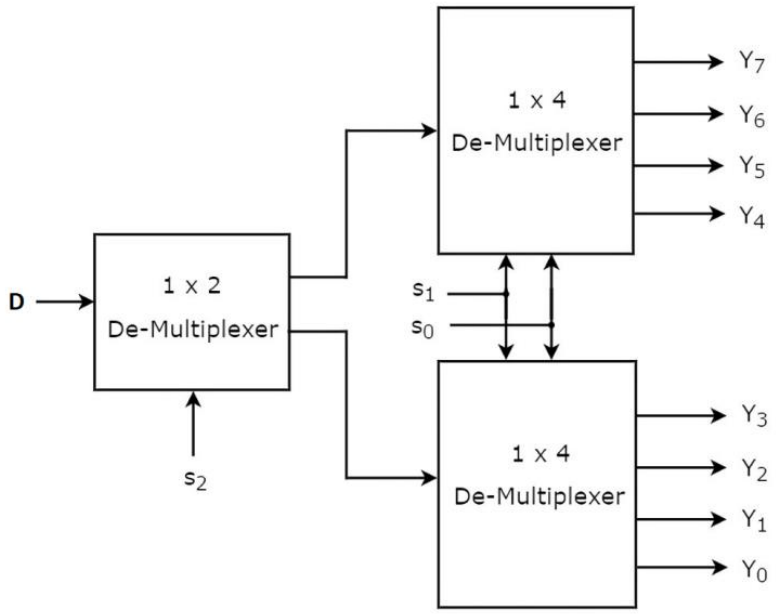
5. Design of 1x4 DEMUX

1x4 DEMUX consists of 1 input line, 2 selection lines and 4 output lines.
Use the same procedure for the implementation of 1x4 DEMUX. Create a 1x4 DEMUX symbol and schematic file with the following specifications



(a) Symbol of 4x1 MUX (b) Schematic of 4x1 MUX

(b) 1x8 DEMUX realization using two 4x1 DEMUX and one 2x1 DEMUX
Now construct the required 1x8 DEMUX using two 1x4 DEMUX and one 1x2 DEMUX as shown in the schematic diagram below.



Truth Table

Consider D as input data and Y_0-Y_7 as the 8 output channels and S_0, S_1, S_2 as control signals. En is the active high Enable input. So the truth table for 1 to 8 DEMUX is:

Data Input	Select Inputs			Outputs							
D	S_2	S_1	S_0	Y_7	Y_6	Y_5	Y_4	Y_3	Y_2	Y_1	Y_0
D	0	0	0	0	0	0	0	0	0	0	D
D	0	0	1	0	0	0	0	0	0	D	0
D	0	1	0	0	0	0	0	0	D	0	0
D	0	1	1	0	0	0	0	D	0	0	0
D	1	0	0	0	0	0	D	0	0	0	0
D	1	0	1	0	0	D	0	0	0	0	0
D	1	1	0	0	D	0	0	0	0	0	0
D	1	1	1	D	0	0	0	0	0	0	0

For the direct implementation of 1x8 DEMUX (to achieve the above truth table), the following output expressions are used:

$Y_0 = \overline{S}_2 \overline{S}_1 \overline{S}_0 D$
$Y_1 = \overline{S}_2 \overline{S}_1 S_0 D$
$Y_2 = \overline{S}_2 S_1 \overline{S}_0 D$
$Y_3 = \overline{S}_2 S_1 S_0 D$
$Y_4 = S_2 \overline{S}_1 \overline{S}_0 D$
$Y_5 = S_2 \overline{S}_1 S_0 D$
$Y_6 = S_2 S_1 \overline{S}_0 D$
$Y_7 = S_2 S_1 S_0 D$

PROCEDURE

3. Create a LT spice symbol for 1x2 and 1x4 DEMUX.
4. Create the corresponding schematic files for 1x2 and 1x4 DEMUX.
5. Create a new schematic and construct the required 1x8 DEMUX circuit by instantiating the 1x4 and 1x2 DEMUX symbols.
6. Apply the inputs and verify the truth table.

Output Waveforms

Paste your results here

RESULTS

Thus, the 8x1 Multiplexer and 1x8 Demultiplexer circuits using LT Spice software were designed, and their respective truth tables were tested.