Circuit Simulation

Project

https://esim.fossee.in/circuit-simulation-project

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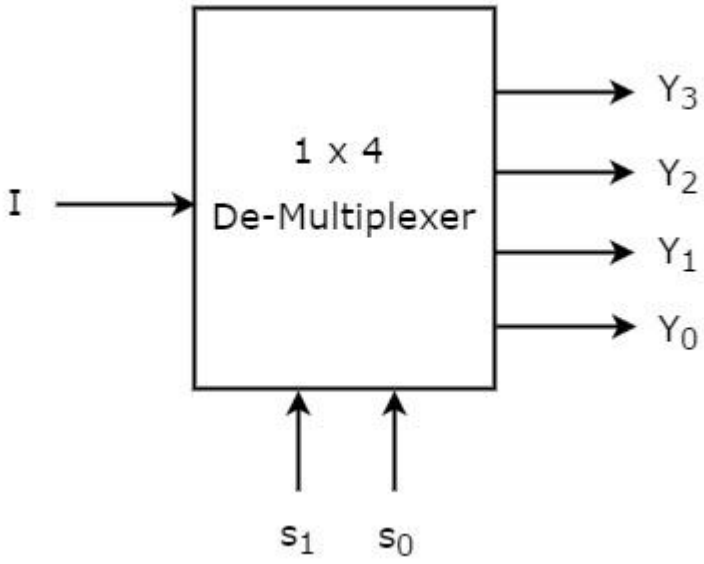
Topic :- 1X4 DEMULTIPLEXER

Theory :- **De-Multiplexer** is a combinational circuit that performs the reverse operation of Multiplexer. It has single input, 'n' selection lines and maximum of 2n 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 2n possible combinations of zeros and ones. So, each combination can select only one output. De-Multiplexer is also called as **De-Mux**.

1x4 De-Multiplexer has one input I, two selection lines, s1 & s0 and four outputs Y3, Y2, Y1 &Y0. The **block diagram** of 1x4 De-Multiplexer is shown in the following figure.



The single input 'I' will be connected to one of the four outputs, Y3 to Y0 based on the values of selection lines s1 & s0. The **Truth table** of 1x4 De-Multiplexer is shown below.

Selection Inputs		Outputs			
S_1	S_0	Y_3	Y_2	Y_1	Y_0
0	0	0	0	0	I
0	1	0	0	I	0
1	0	0	I	0	0
1	1	I	0	0	0

From the above Truth table, we can directly write the **Boolean functions** for each output as

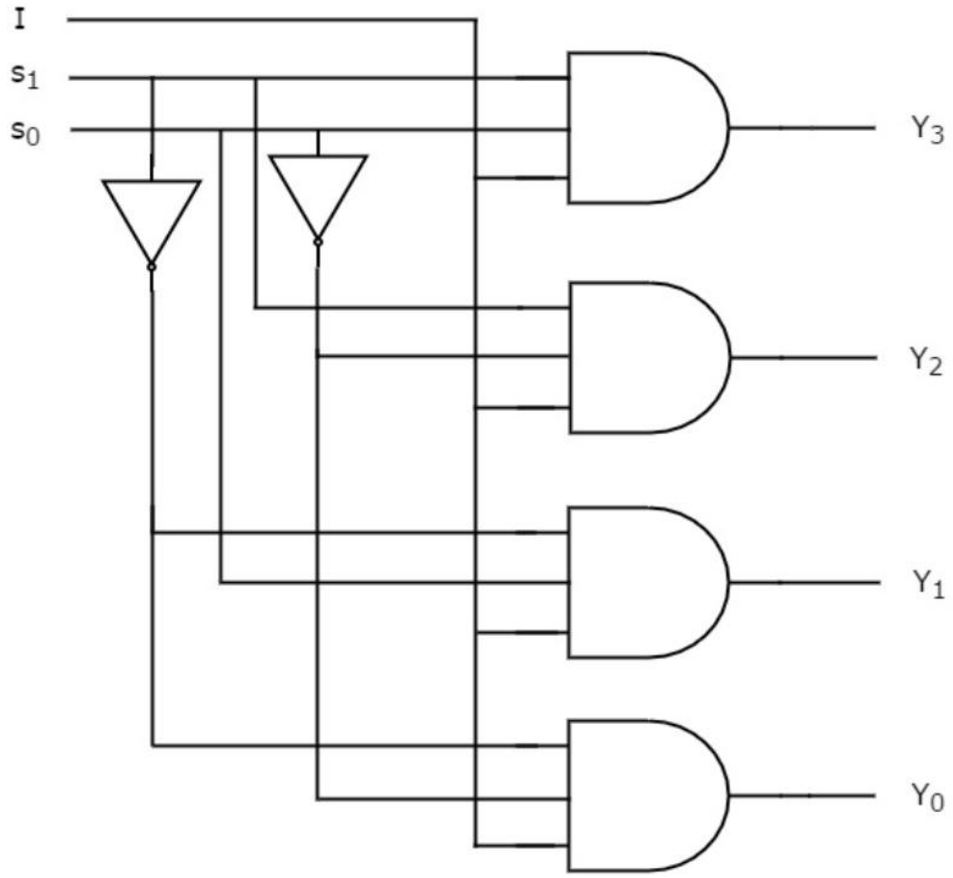
$$Y_3 = s_1 s_0 I$$

$$Y_2 = s_1 s_0' I$$

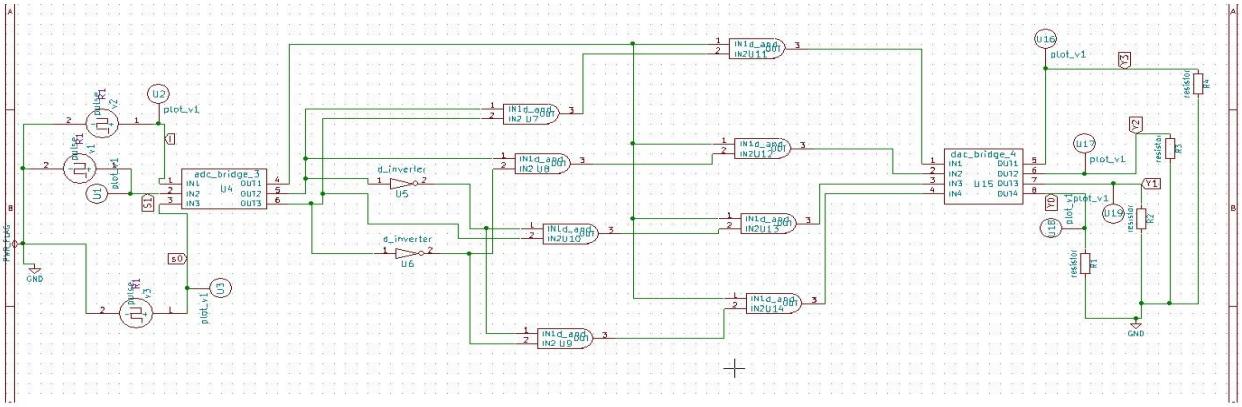
$$Y_1 = s_1' s_0 I$$

$$Y_0 = s_1' s_0' I$$

Circuit Diagram

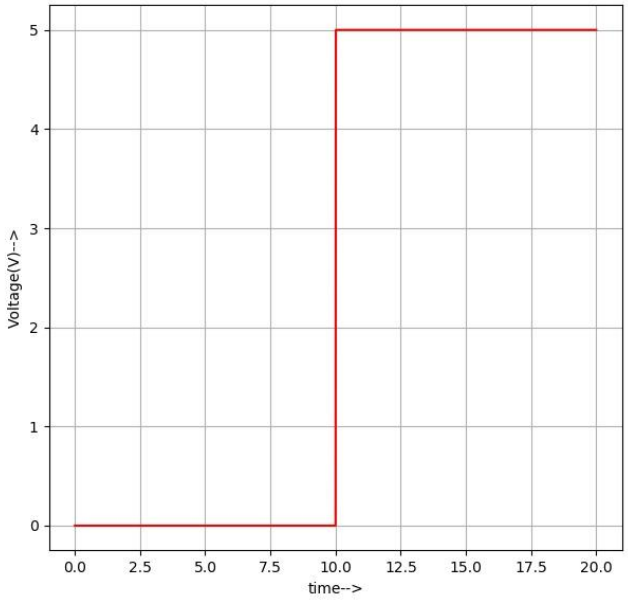


Schematic Diagram (ESim Implementation)

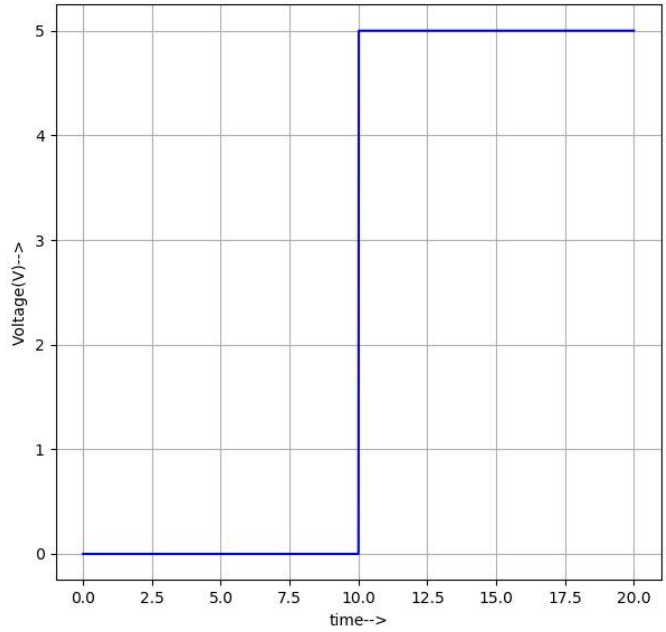


Simulation Plots :-

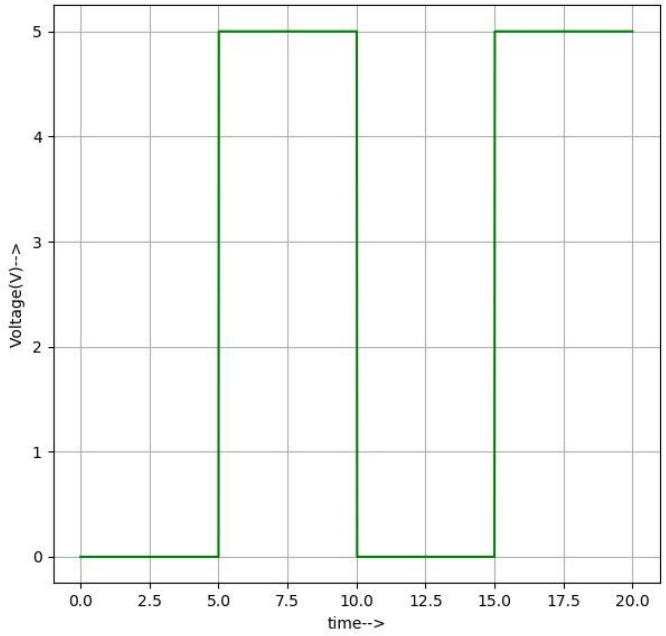
1) I



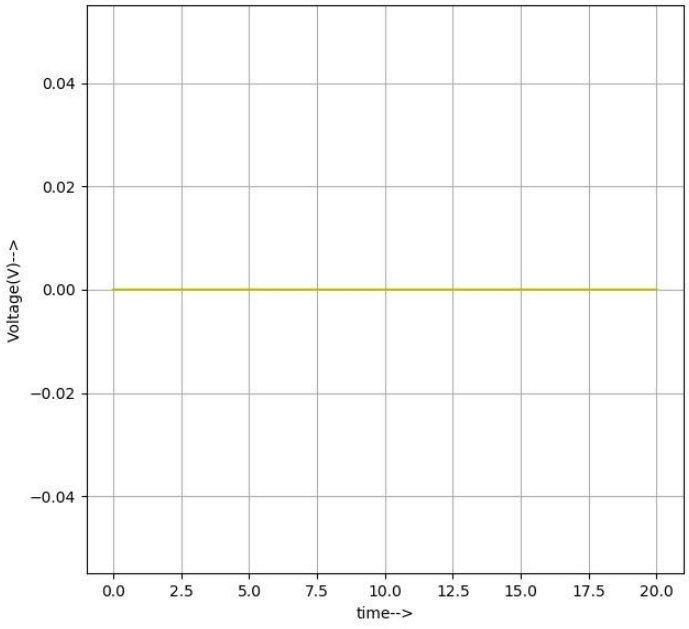
2) S0



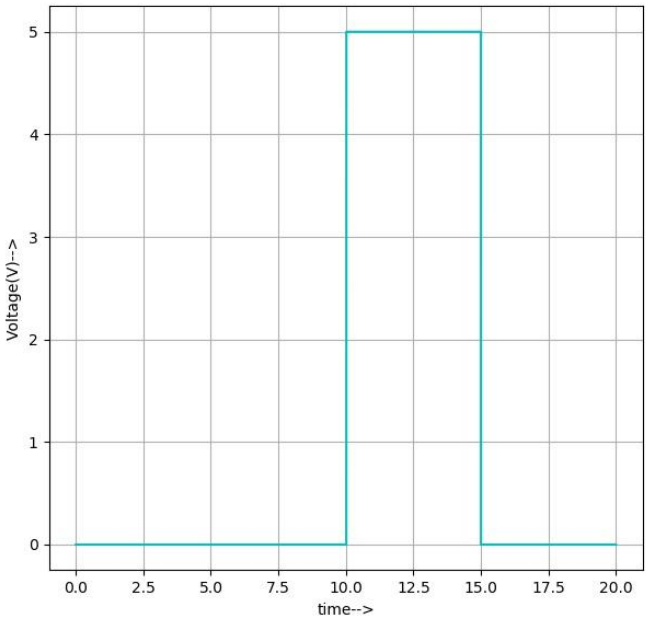
3) S1


Voltage(V)-->
time-->
0
1
2
3
4
5
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0

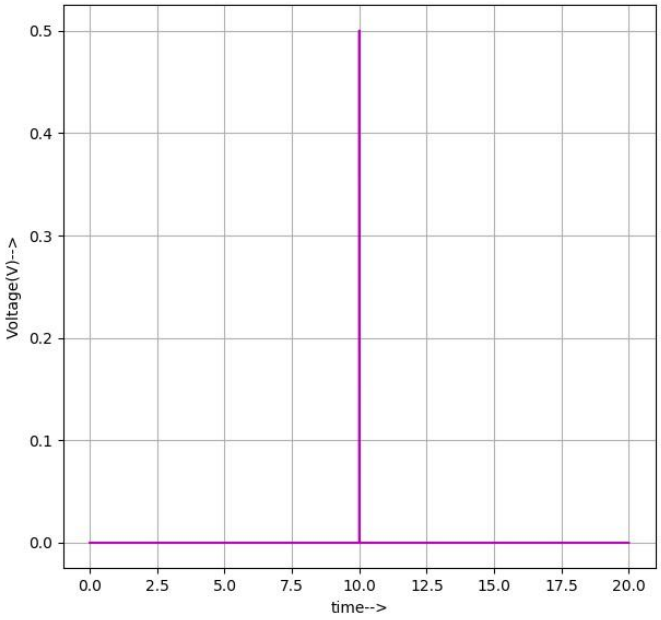
4) Y0


Voltage(V)-->
time-->
0.04
0.02
0.00
−0.02
−0.04
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0

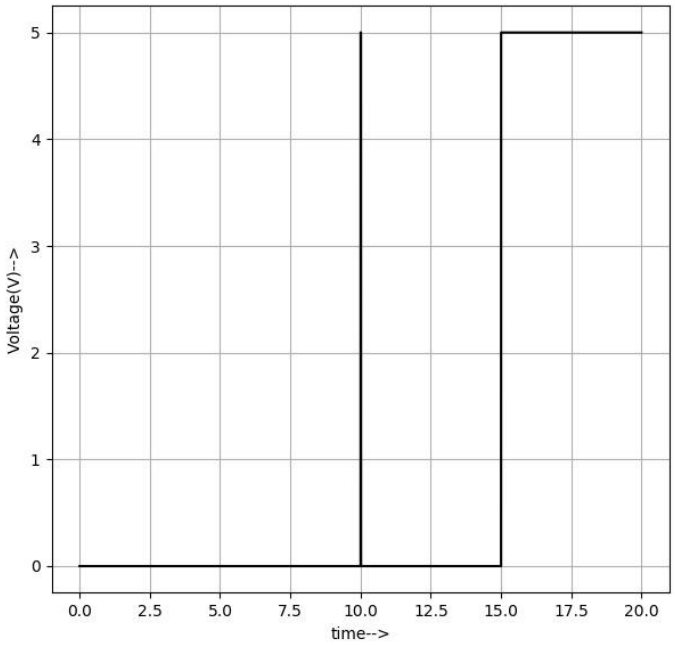
5) Y1


Voltage(V)-->
time-->
0
1
2
3
4
5
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0

6) Y2


Voltage(V)-->
time-->
0.0
0.1
0.2
0.3
0.4
0.5
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0

7) Y*3*



Conclusion: Using the circuit simulated, we have studied the logic and output of 1X4 Demultiplexer circuit. The results simulated follow the truth table, thus validating the correctness of the circuit simulated.

References:

https://www.tutorialspoint.com/digital_circuits/digital_circuits_demultiplexers.htm