A Lab Report on Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates

Digital Electronics Lab

EC 212

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Aim of the Experiment: To analyse the truth table and working of 1x4 de-multiplexer and 4x1 multiplexer by using 3-input NAND, and 1-input NOT logic gates ICs, and using 3-input NAND, 3-input OR, and 1-input NOT logic gates ICs.

Components Used: IC 7404 [NOT Gate], IC 7411 [NAND Gate], IC 4072B [OR Gate], Digital Lab Trainer Kit — in VLabs software

Brief Theory: A multiplexer is a digital circuit which has 'n' input lines and one output line, along with select lines. The select lines determine the input line that is connected to the output line. For any particular combination of the select lines, a particular input line gets connected to the output line. It decides the data that is being transmitted incoming from the input lines. It has its application in time division multiplexing where the select lines keep on changing their combinations, so that data coming from multiple lines of input are transmitted through the same output line within a given time period. It is also known as a data selector. A multiplexer with n input lines is shown as nx1 multiplexer. Mainly, it is classified into four types:

- 2x1 multiplexer (1 select line)
- 4x1 multiplexer (2 select line)
- 8x1 multiplexer (3 select line)
- 16x1 multiplexer (4 select line)

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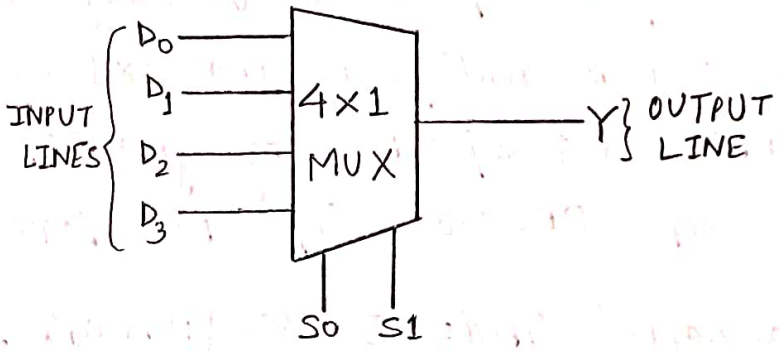
The 4x1 MUX circuit has 4 input lines D_0, D_1, D_2, and D_3, and one output line Y with two select lines S_0 and S_1. Based on the different combinations of S_0, S_1, different input lines are connected to Y and the corresponding data is transmitted. Its truth table is shown as follows:



▲Fig. 6.1 Block diagram of 4x1 multiplexer

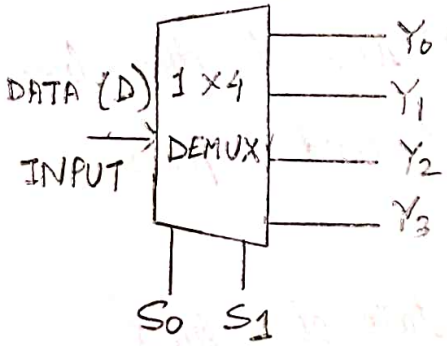
S_0	S_1	Y
0	0	D_0
0	1	D_1
1	0	D_2
1	1	D_3

▲Table 6.1 Truth table of 4x1 MUX

A demultiplexer on the other hand has one input line and 'm' output lines, along with select lines. For any given combination of select lines, the input line is connected to the corresponding output line and the incoming data gets transmitted along with it. In a multiplexed input, where the incoming data actually consists of multiple messages, the combinations of the select lines keep on changing continuously and the required data is transmitted along the corresponding output line. This demultiplexer is

represented in the form 1 x m de-multiplexer. It can also be classified into four types: 1x2 demultiplexer (1 select line), 1x4 demultiplexer (2 select lines), 1x8 demultiplexer (3 select line), 1x16 demultiplexer (4 select lines)

In the 1x4 DEMUX circuit, there is input D, and output lines Y_0, Y_1, Y_2, and Y_3, which also has two select lines S_0 and S_1. Based on the different combinations of S_0, S_1; the input line gets transmitted to a particular output.



▲Fig. 6.2 Block diagram of 1x4 demultiplexer

S_0	S_1	Y_0	Y_1	Y_2	Y_3
0	0	D	0	0	0
0	1	0	D	0	0
1	0	0	0	D	0
1	1	0	0	0	D

▲Table 6.2 Truth table of 1x4 DEMUX

Procedure: Multiplexer: 1) +5V supply is connected to the circuit.

2) 'ADD' button is first pressed to add basic state of output in the given table.

3) 'S_0' and 'S_1' are present to select the desired input line.

4) Any one button of $D_0/D_1/D_2$ and D_3 pressed to add inputs.

5) 'ADD' button is used to add the inputs and outputs in the given table.

6) Steps 3, 4 and 5 are repeated for next state of inputs and

their corresponding outputs.

7) 'PRINT' button is pressed after completion of simulation to get the results.

(iii) De-Multiplexer: 1) +5V supply is connected to the circuit.

2) 'ADD' button is first pressed to add basic state of output in the given table.

3) DATA (D) button is pressed for input.

4) 'S_0' and 'S_1' are pressed to select the desired output line.

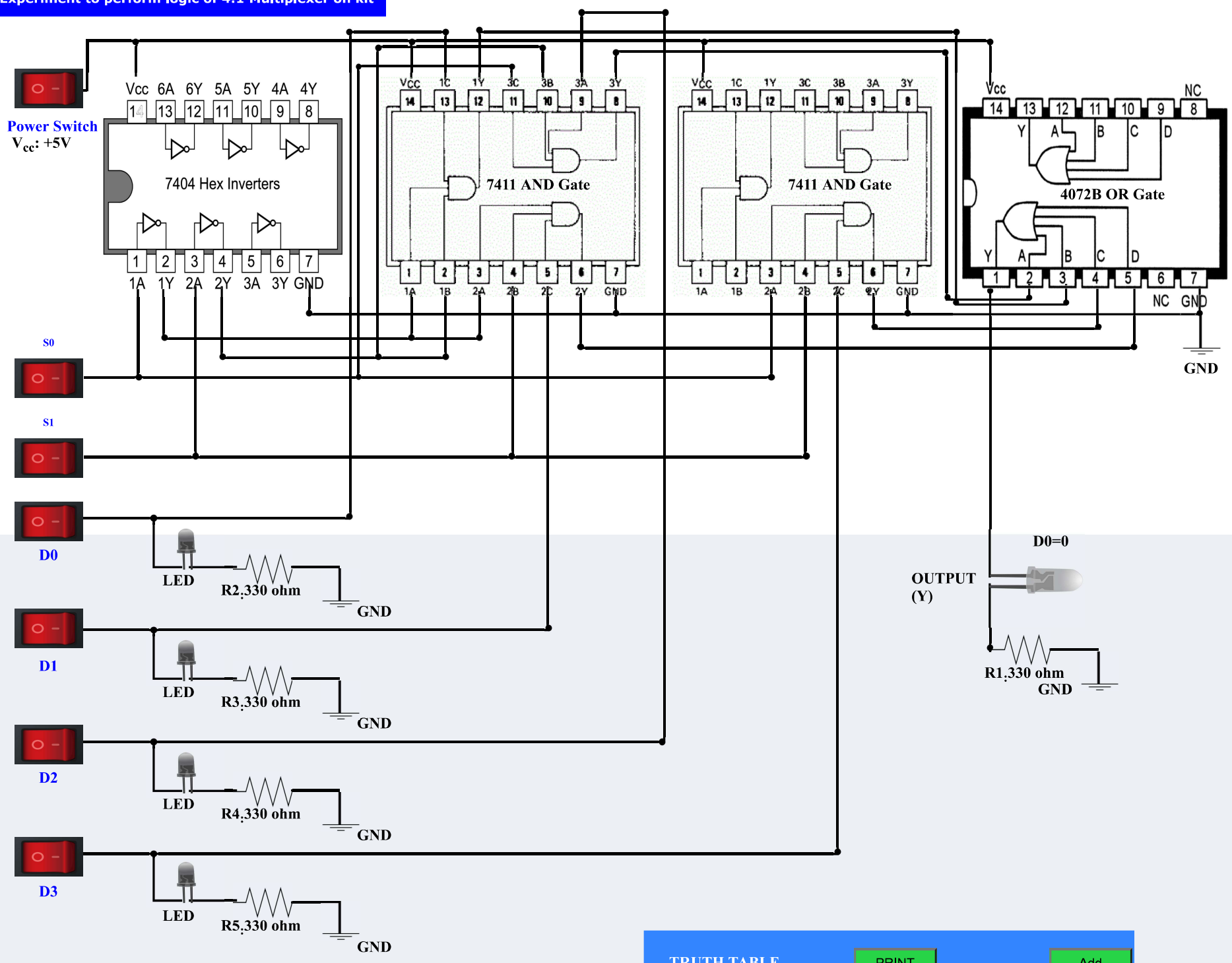
5) 'ADD' button is used to add the inputs and outputs in the gavien table.

6) Steps 4 and 5 are repeated for next state of inputs and their corresponding outputs.

7) 'PRINT' button is pressed after completion of simulation to get the results.

INSTRUCTIONS

Experiment to perform logic of 4:1 Multiplexer on kit

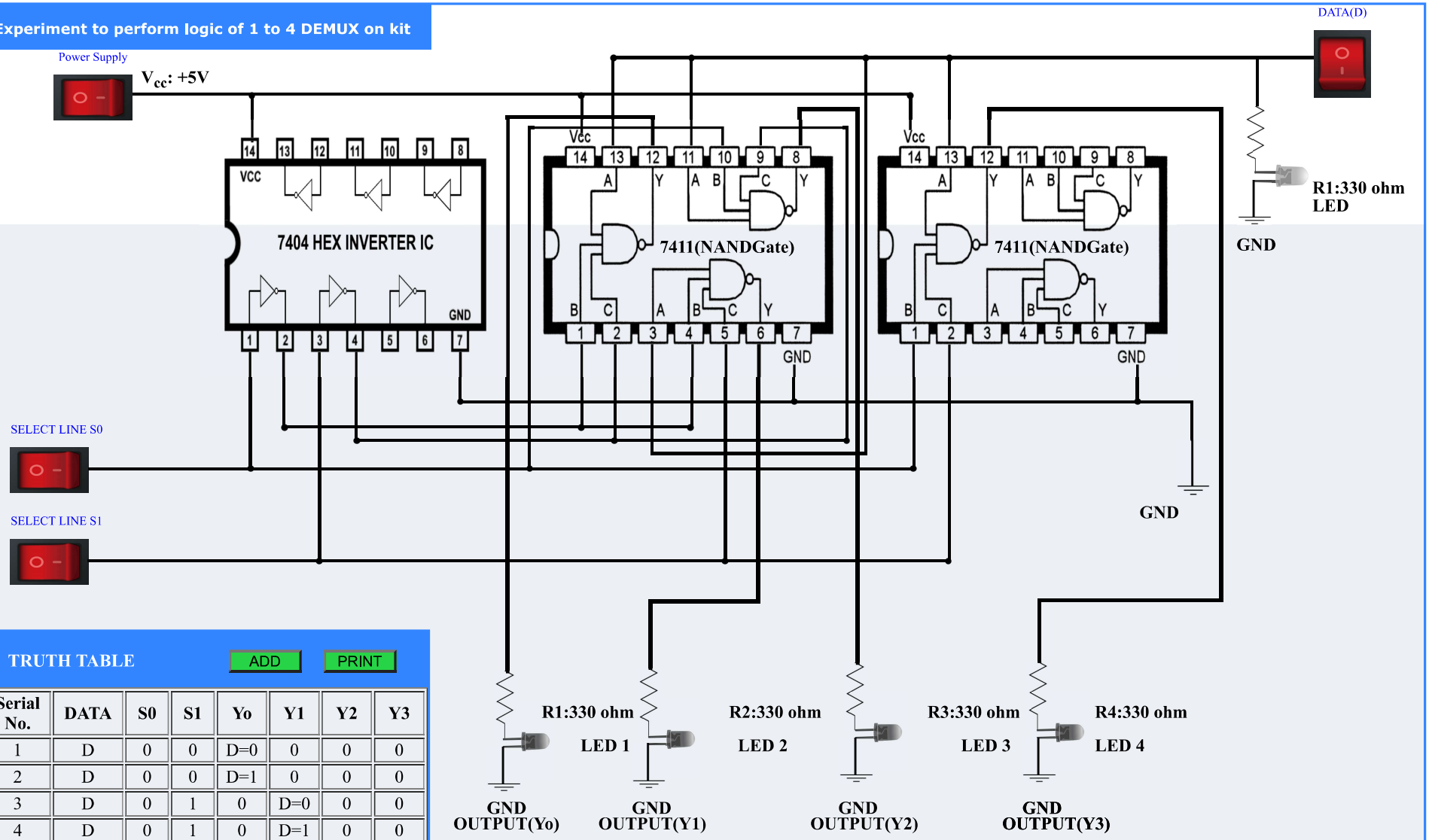


TRUTH TABLE PRINT Add

Serial No.	S0	S1	OUTPUT (Y)	OUTPUT VALUE
1	0	0	D0	0
2	0	0	D0	1
3	0	1	D1	0
4	0	1	D1	1
5	1	0	D2	0
6	1	0	D2	1
7	1	1	D3	0
8	1	1	D3	1

INSTRUCTIONS

Experiment to perform logic of 1 to 4 DEMUX on kit



TRUTH TABLE ADD PRINT

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=0	0	0
4	D	0	1	0	D=1	0	0
5	D	1	0	0	0	D=0	0
6	D	1	0	0	0	D=1	0
7	D	1	1	0	0	0	D=0
8	D	1	1	0	0	0	D=1

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Conclusion: Both the digital circuits of multiplexers and demultiplexers, their mode of working, and their applications have been studied. The working has been discussed in details using the 4×1 multiplexer and 1×4 de-multiplexer along with their truth tables for different combinations of select lines. In the simulators, both the circuits have been realised using logic gates, and these circuits have been run and verified.

Thus, the implementation and analysis of multiplexers and de-multiplexers has been carried out successfully.