Lab Report No 10

Digital Logic Design

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Solution:

Brief description (3-5 lines)

Components:
- Basic logic gates (AND gates, NOT gates)

Here's the step-by-step process to design and implement the 2 x 4 decoder:

Step 1:

Understanding the 2 x 4 decoder A 2 x 4 decoder has two input lines (A and B) and four output lines (Y0, Y1, Y2, Y3). The decoder selects one of the four output lines based on the combination of input values A and B.

The truth table for a 2 x 4 decoder is as follows:

A	B	Y0	Y1	Y2	Y3
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

Step 2:

Implementing the logic circuit Using the basic logic gates, you can implement the 2 x 4 decoder as follows:

- Connect input lines A and B to the input switches or buttons on the trainer board.
- Implement the logic gates for the decoder according to the truth table:
  - Y0 = A' * B'
  - Y1 = A' * B
  - Y2 = A * B'
  - Y3 = A * B

You will need a combination of AND gates and NOT gates to implement these logic equations. Connect the appropriate inputs and outputs of the gates according to the equations.

- Connect the outputs Y0, Y1, Y2, and Y3 to LEDs or output pins on the trainer board to observe the output.

Step 3:

Power up the circuit and input values

- Ensure that the power supply for the trainer board is connected and turned on.
- Set the input values A and B to the desired values (0 or 1). Use switches or buttons on the trainer board to input the values.

Step 4:

Observe the output

- Once the inputs are set, observe the LEDs or output pins connected to the outputs Y0, Y1, Y2, and Y3.
- The LEDs will display the output values according to the truth table for the given input combination of A and B.

Verification:
- Verify the correctness of the 2 x 4 decoder by comparing the observed output values with the expected values from the truth table.

The code

The results (Screenshot)

A	B	D0	D1	D2	D3
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1
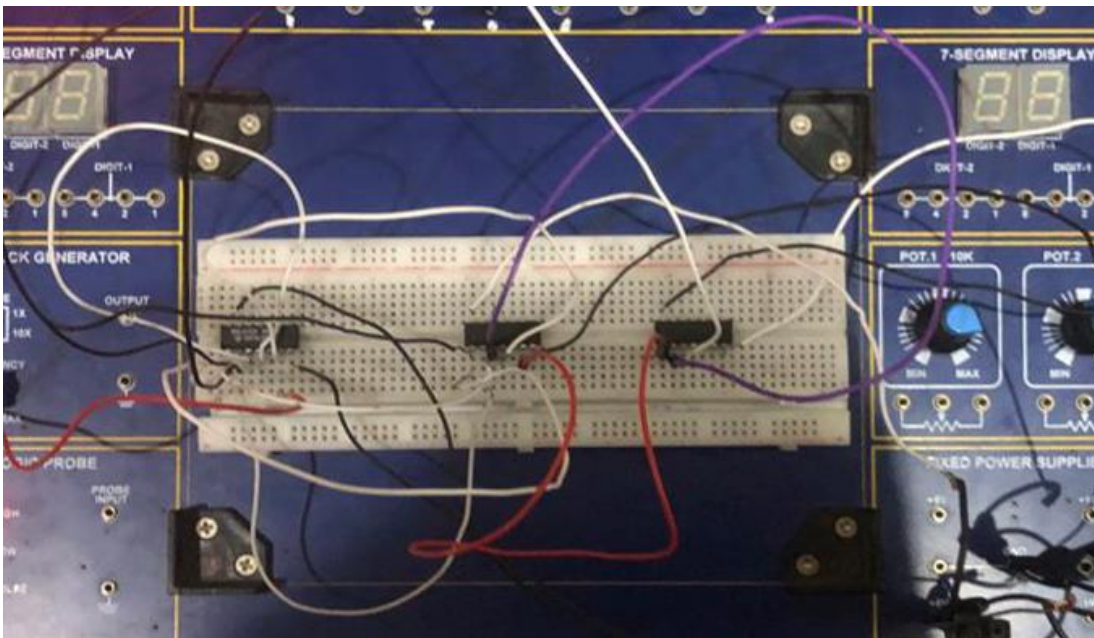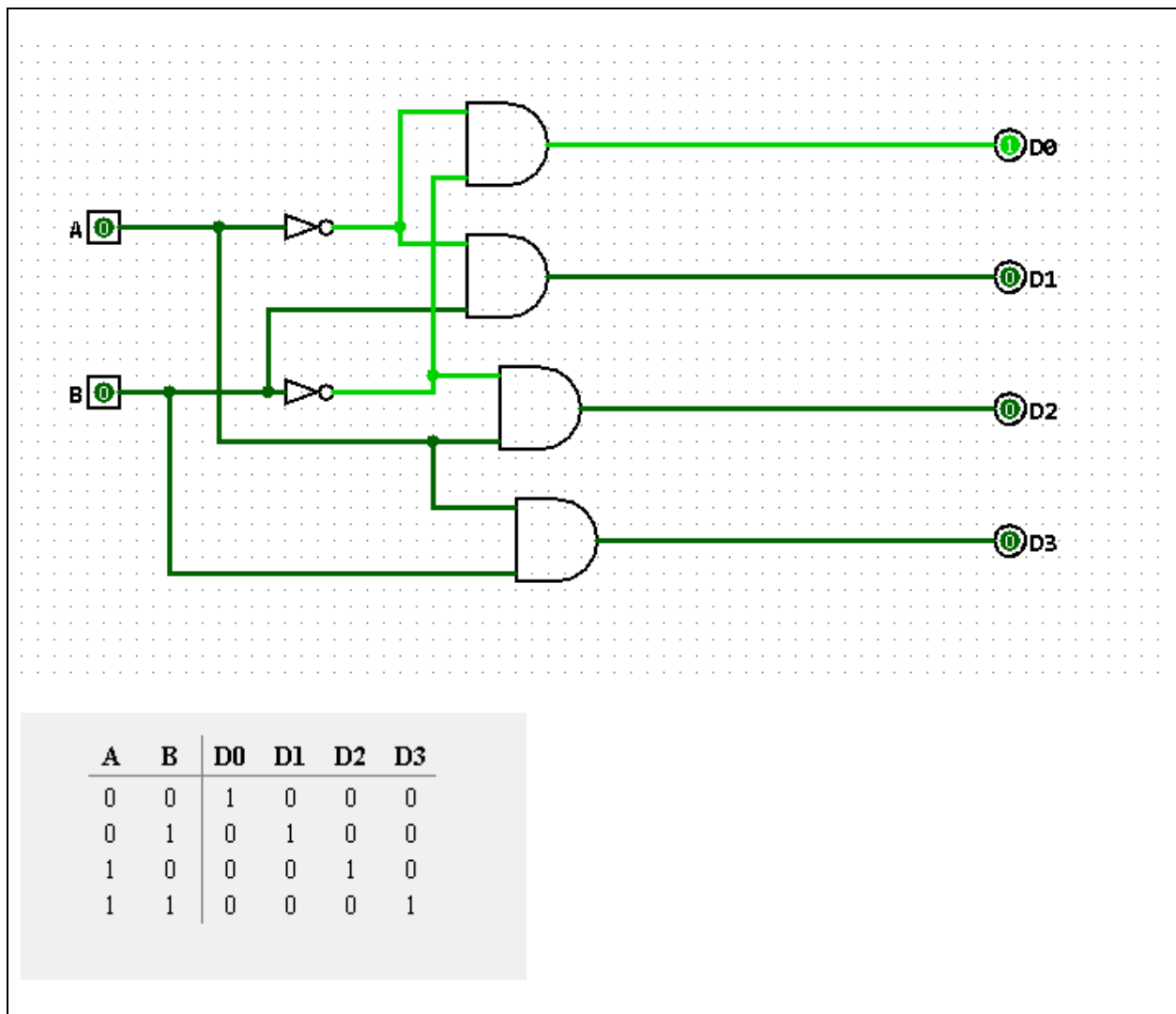
Lab Task No 2:

Design, implement and verify the 3 X 8 decoder using the basic logic gates with Logisim.

Solution:

Brief description (3-5 lines)
Step 1: Launch Logisim Open Logisim on your computer. If you don't have it installed, you can download it from the Logisim website. **Step 2:** Create a new circuit Create a new blank circuit by selecting "File" and then "New" or using the shortcut Ctrl+N.

Step 3:

Add components Add the required components to the circuit by selecting them from the toolbar on the left-hand side and placing them on the circuit canvas.

Components needed:
- Basic logic gates (AND gates, NOT gates)

Step 4:

Connect the components Connect the inputs and outputs of the components to create the 3 x 8 decoder circuit.

- Label the input lines as A2, A1, and A0. These represent the three input lines of the decoder.
- Connect A2 to the input of an NOT gate.
- Connect the output of the NOT gate to the input of an AND gate.
- Connect A1 and A0 directly to the inputs of other AND gates.
- Connect the outputs of the AND gates to the respective inputs of an OR gate.
- Connect the output of the OR gate to the output lines of the decoder. Label these output lines as Y0, Y1, Y2, Y3, Y4, Y5, Y6, and Y7.

Step 5:

Connect outputs Connect LEDs or output pins to the output lines (Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7) of the decoder to observe the output.

Step 6:

Simulate and verify

- Click on the "Simulate" button in the toolbar to enter the simulation mode.
- Set the input values A2, A1, and A0 to the desired values (0 or 1). You can use switches or buttons available in Logisim to input the values.
- Observe the LEDs or output pins connected to the output lines (Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7) of the decoder.
- The LEDs will display the output values according to the input combination of A2, A1, and A0.

Verification:

- Verify the correctness of the 3 x 8 decoder by comparing the observed output values with the expected values based on the input combination.

The code
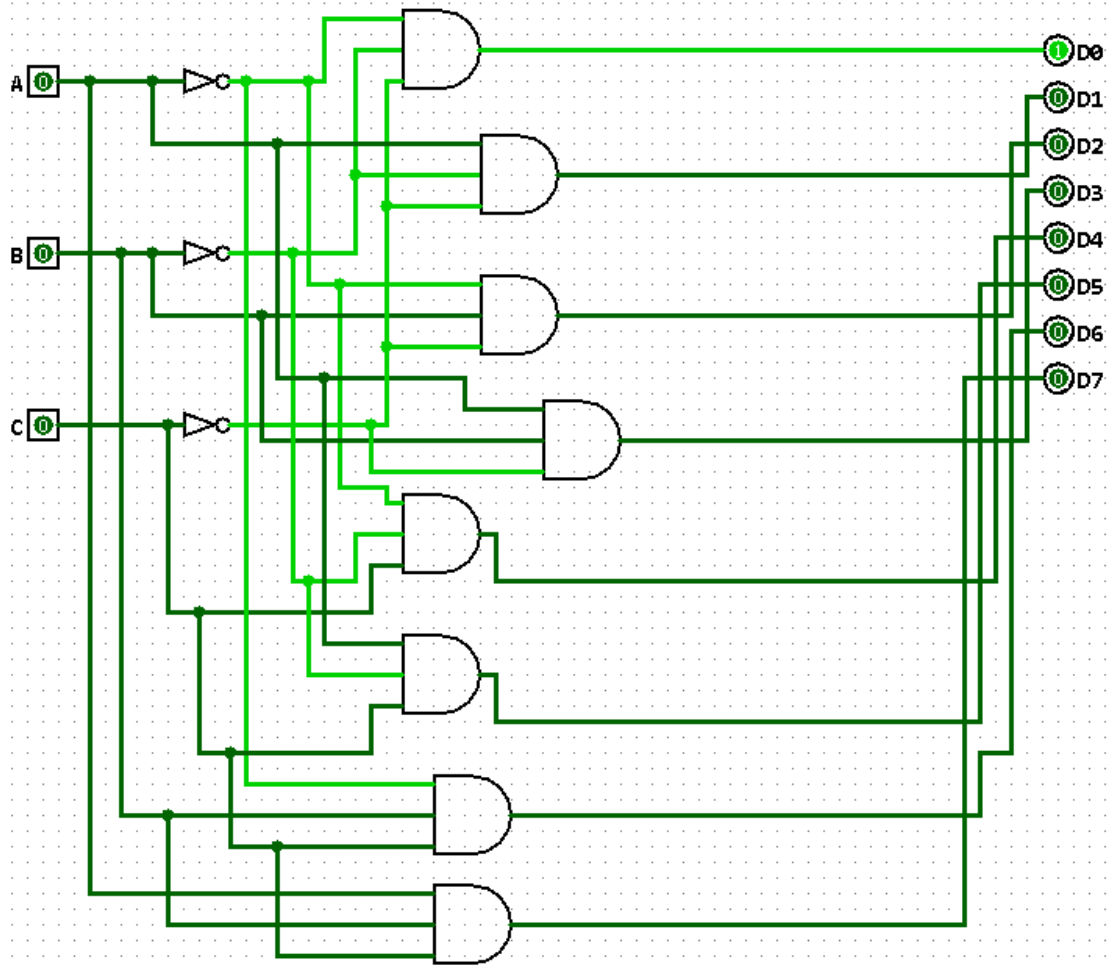
The results (Screenshot)

C	B	A	D0	D1	D2	D3	D4	D5	D6	D7
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0
0	1	0	0	0	1	0	0	0	0	0
0	1	1	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0
1	0	1	0	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	1	0
1	1	1	0	0	0	0	0	0	0	1