

Course Name:	Digital Design Laboratory	Semester:	III
Date of Performance:	14/08/2025	Batch No:	B2
Faculty Name:		Roll No:	16010124107
Faculty Sign & Date:		Grade/Marks:	___/25

Experiment No: 3

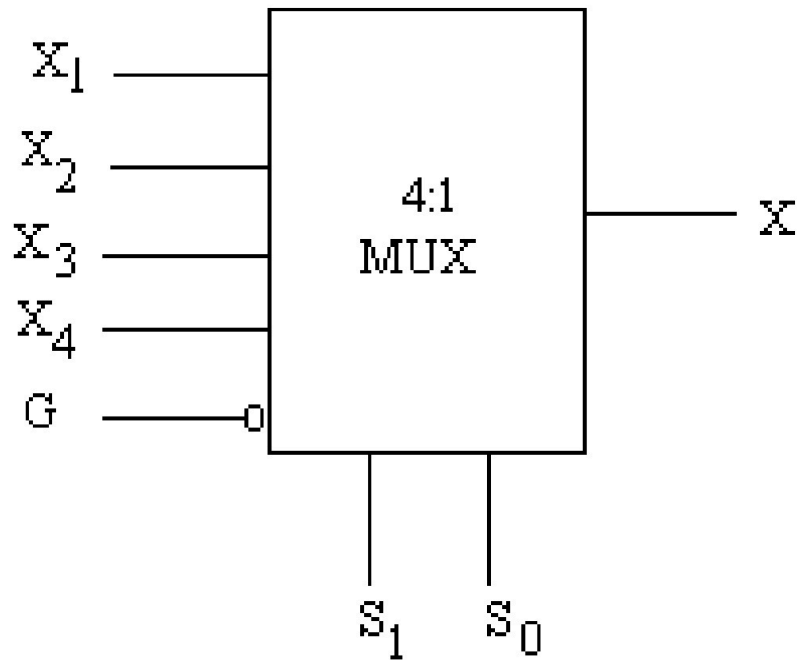
Title: 4:1 Multiplexer and 3: 8 Decoder

Aim and Objective of the Experiment:
To design and implement a 4:1 multiplexer and 3: 8 Decoder

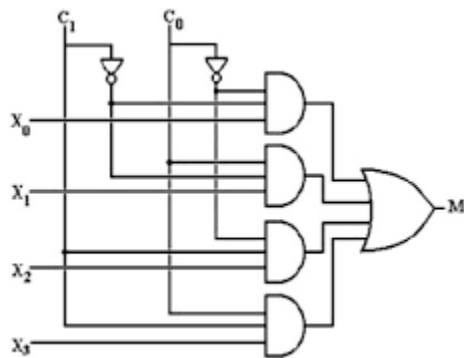
COs to be achieved:
CO2: Use different minimization techniques and solve combinational circuits.

Tools used:
Trainer kits

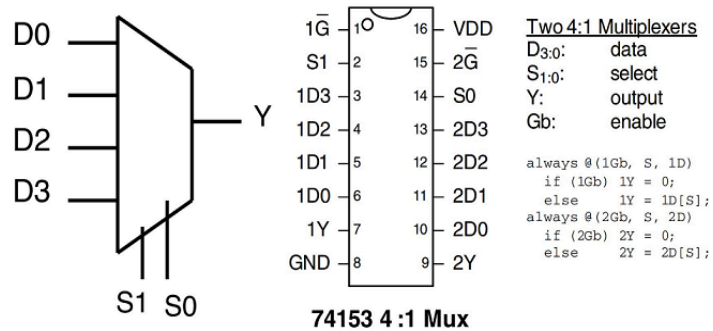
Theory:
<p>Multiplexer: Multiplexer is a special type of combinational circuit. It is a digital circuit that selects one of the n data inputs and routes it to the output. The selection of one of the n inputs is done by the select lines. To select n inputs we require m select lines, such that $2^m = n$. Depending on the digital code applied at the select inputs, one out of the n data sources is selected and transmitted to a single output.</p> <p>Decoder: A decoder is a multiple-input, multiple-output logic circuit that converts coded inputs into coded outputs, where the input and output codes are different. The input code generally has fewer bits than the output code, and there is a one-to-one mapping from input code words into output code words. The general structure of a decoder circuit is shown in the Figure below. The enable inputs, if present, must be asserted for the decoder to perform its normal mapping function. The most commonly used input code is an N-bit binary code, where an N-bit word represents one of 2^N different coded values. Normally, they range from 0 through $2^N - 1$. The input code lines select which output is active. The remaining output lines are disabled.</p> <p>Implementation Details: 4:1 Multiplexer Block Diagram</p>



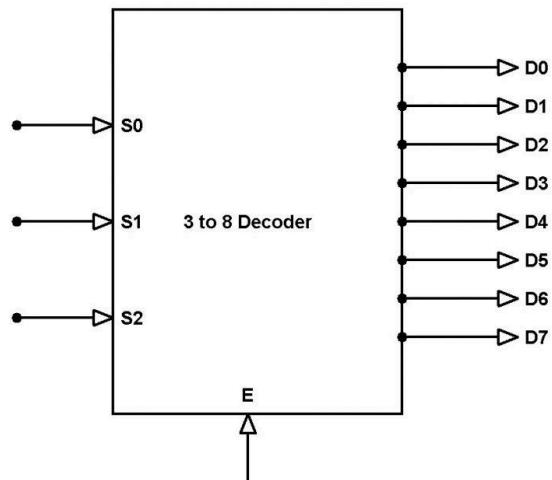
4:1 Multiplexer Circuit



Pin Diagram IC74153



Implementation Details: 3:8 Decoder Block Diagram



3:8 Decoder Circuit

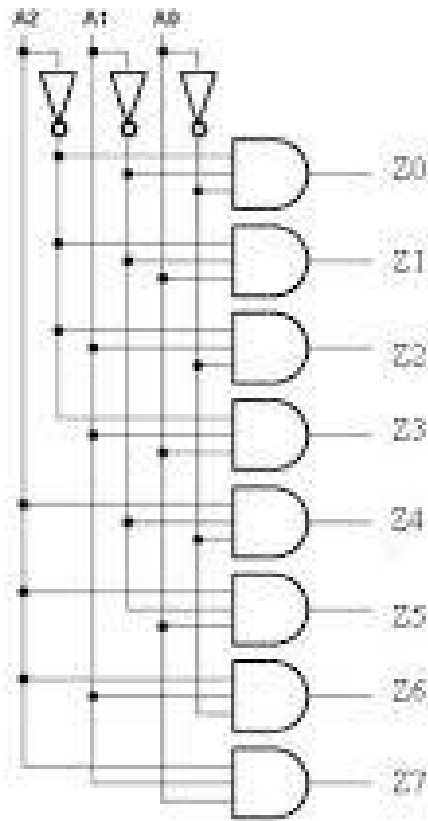
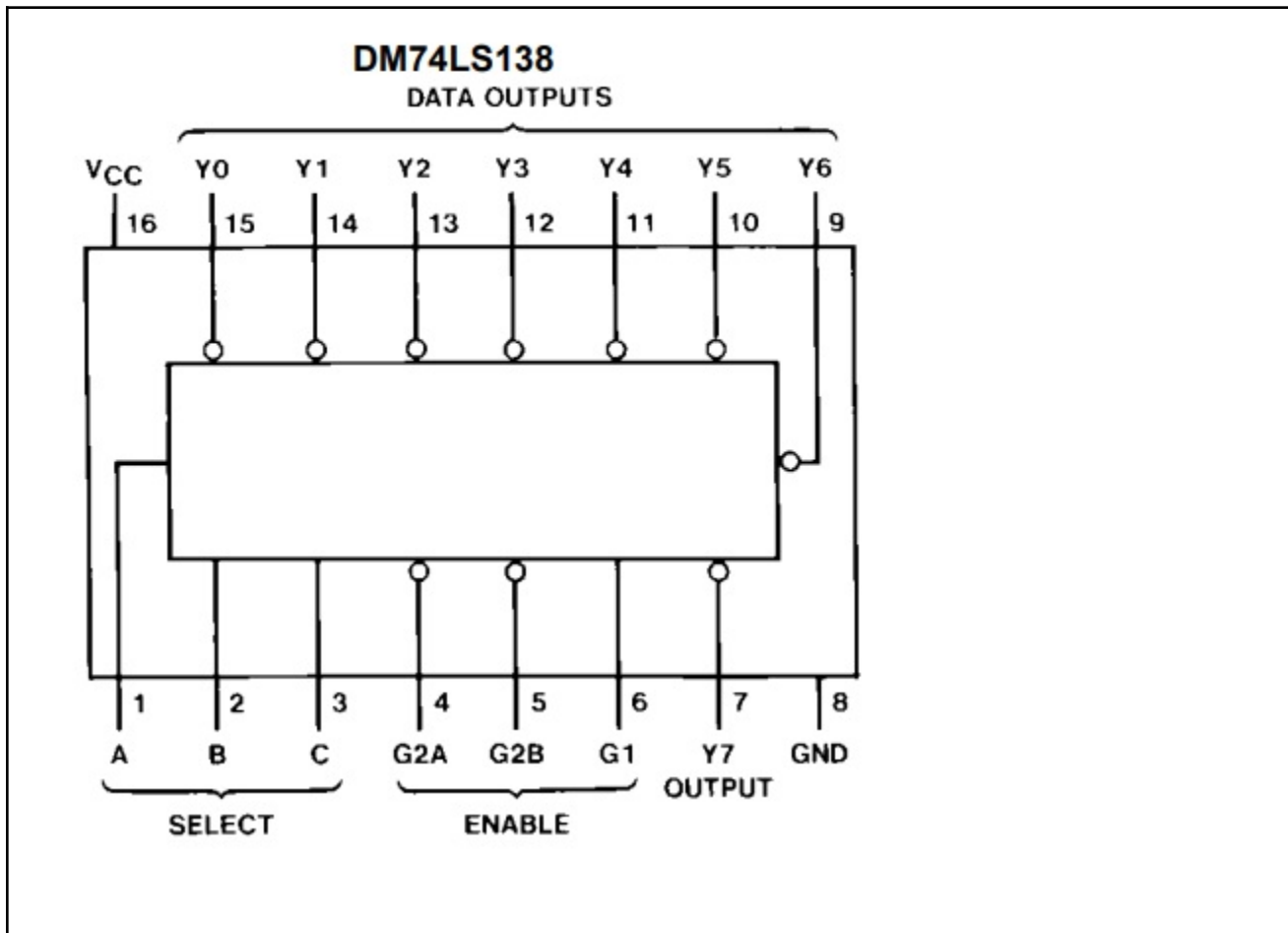


fig. 3 Logic Diagram of 3:8 decoder

Pin Diagram IC74138



Implementation Details

Procedure:

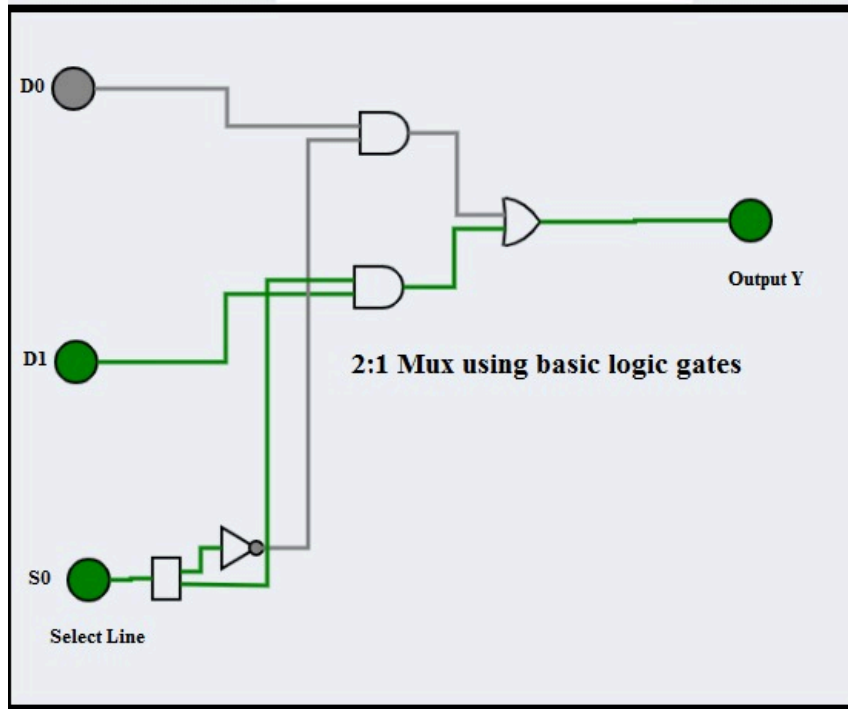
- 1) Locate the IC 74153 and place the IC on trainer kit.
- 2) Connect VCC and ground to respective pins of IC trainer kit.
- 3) Implement the circuit as shown in the circuit diagram.
- 4) Connect the inputs to the input switches in the trainer kit.
- 5) Connect the outputs to the O/P LEDs
- 6) Apply various combinations of inputs according to the truth table and observe the condition of the LEDs.
- 7) Note down the corresponding output readings for various combinations of inputs.
- 8) Repeat the same for IC 74138

In Lab Implementation:

https://drive.google.com/drive/folders/1rhPmalijB4qoFEJA_JMMFjrs5f6RltDR?usp=sharing

Post Lab Subjective/Objective type Questions:

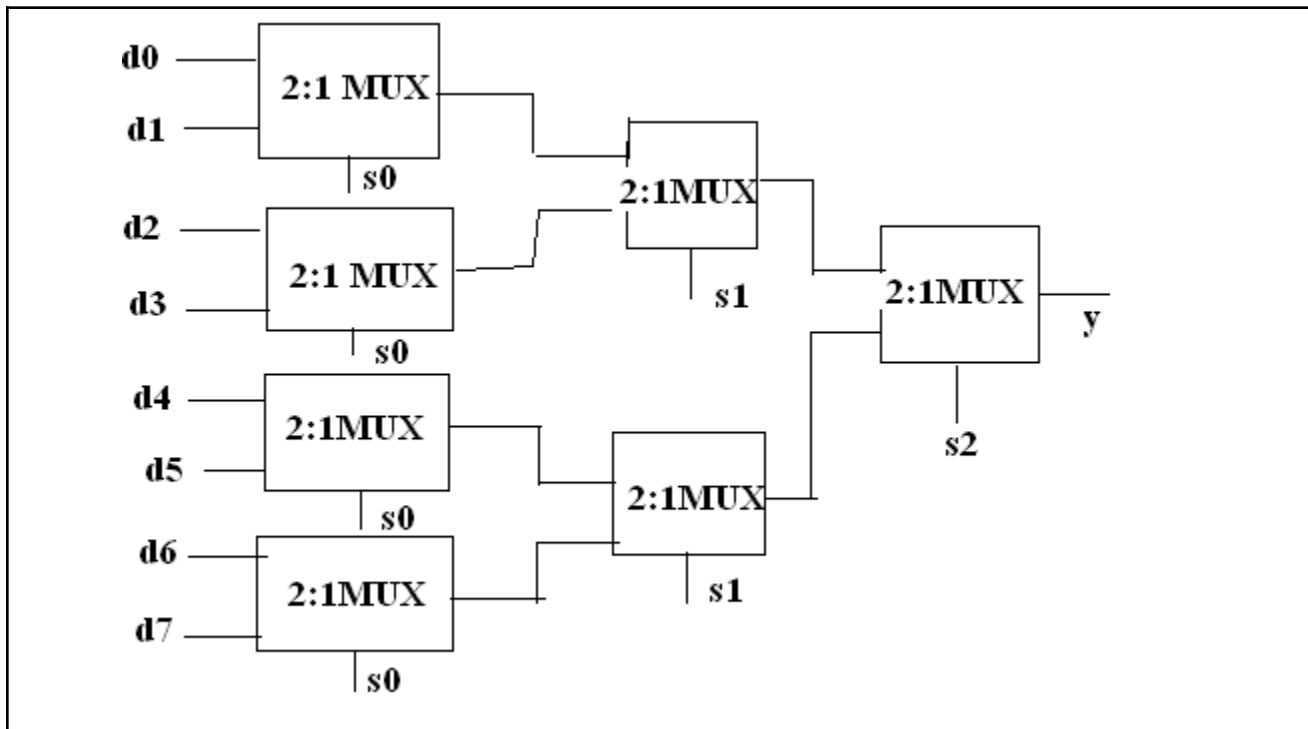
1. Design and verify a 2:1 multiplexer using logic gates.



truth table

S_0	I_0	I_1	Y
0	0	X	0
0	1	X	1
1	X	0	0
1	X	1	1

2. Build an 8:1 multiplexer using only 2:1 multiplexers.



Conclusion:

Multiplexers are digital circuits that select one of several input lines and route it to a single output line. It is helpful in reducing hardware when building gates.

A decoder is used to translate encoded data into a form that's understandable by other components or systems, enabling efficient data management and communication. It is used in memory addressing largely.

Multiplexers have several input lines and one output line, often accompanied by some select lines. Decoders have multiple input and output lines and basically helps convert encoded data to understandable data. In our 3:8 decoder, when we send input 001, the 2nd bit of output is turned on, indicating the decimal equivalent of 001 = 1. (Since the numbering is done 0 to 7)

Signature of faculty in-charge with Date: