Multiplexer

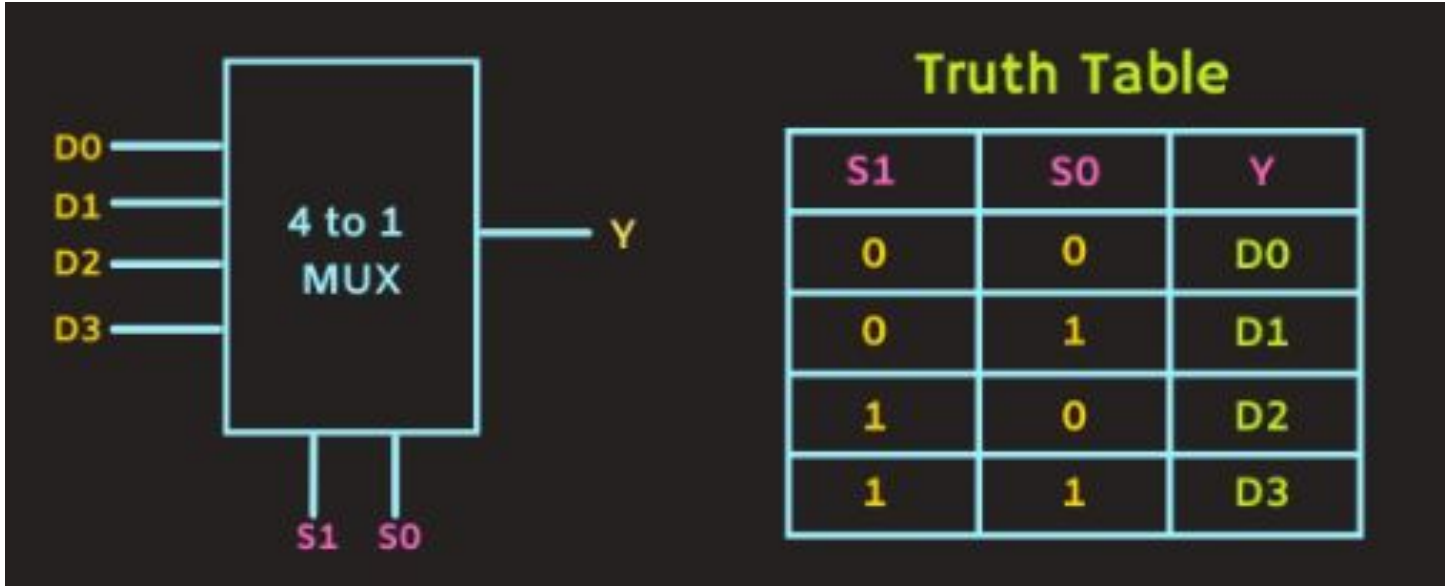
Silicon Community - Session 1

Multiplexer

A multiplexer, often abbreviated as MUX, is a combinational logic circuit that is used to select one of multiple inputs and route it to a single output based on control signals.

It can be thought of as a data selector that chooses the desired input to be passed through to the output.

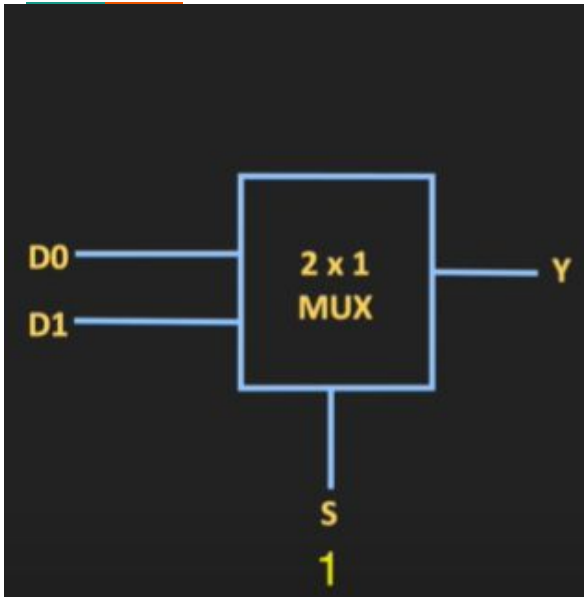
Multiplexer



Truth Table

S1	S0	Y
0	0	D0
0	1	D1
1	0	D2
1	1	D3

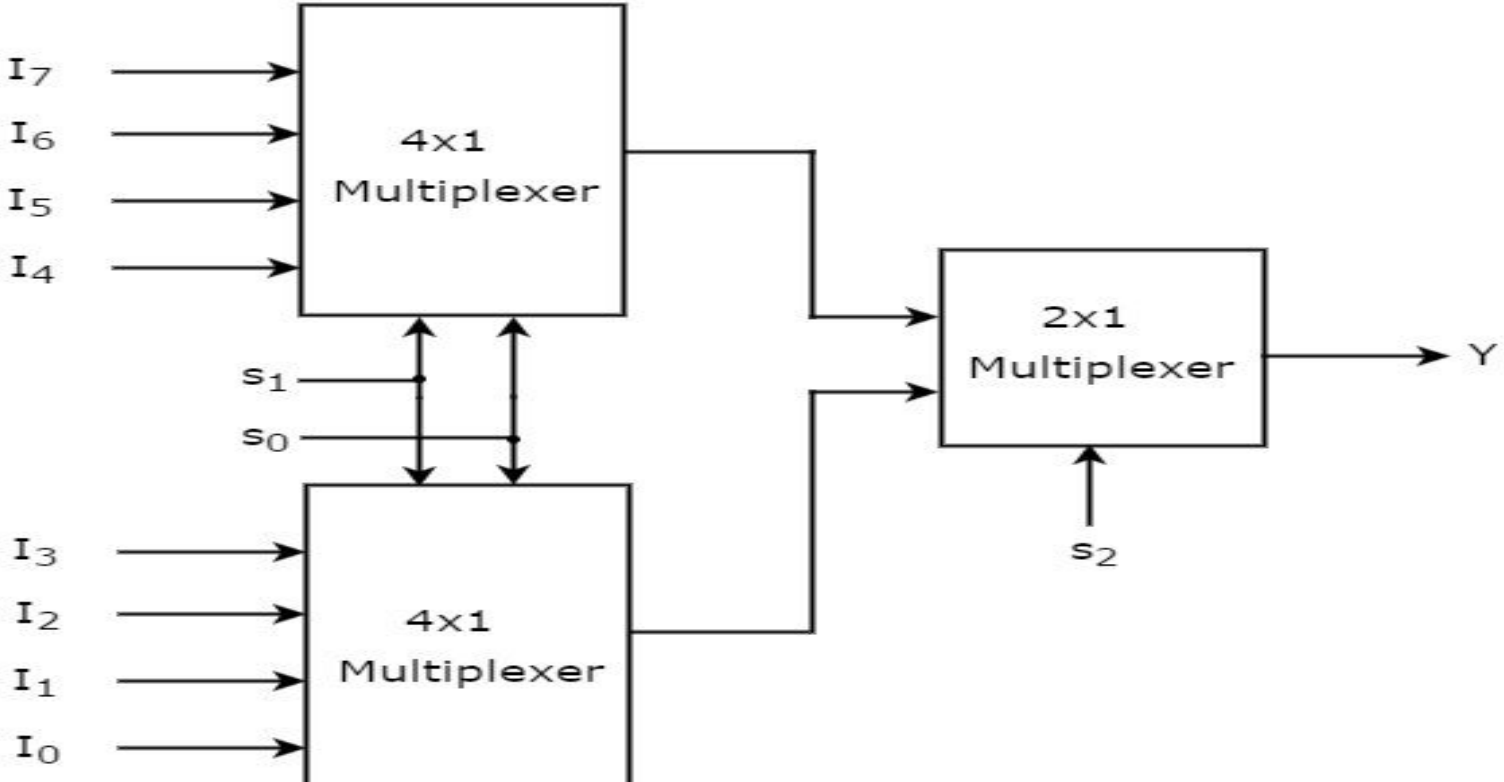
Multiplexer (2x1 MUX with extended Truth table)



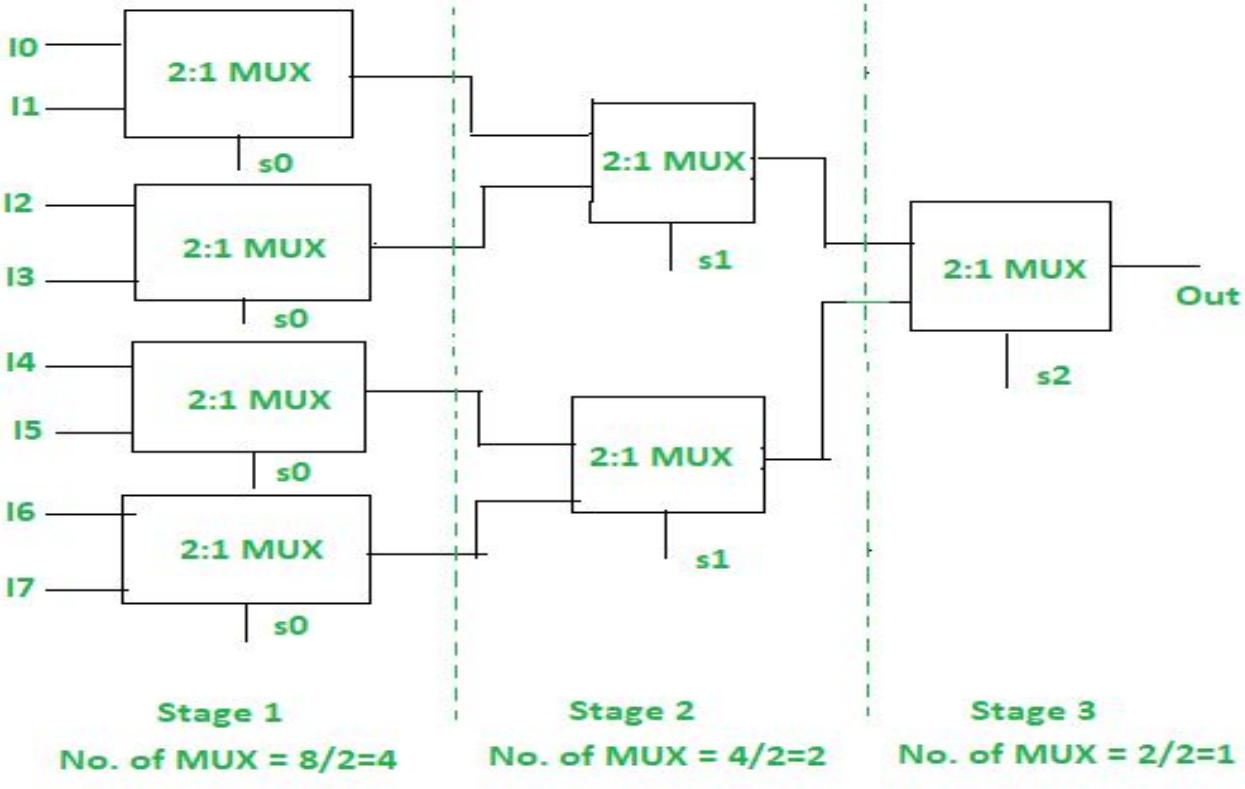
Truth Table

D1	D0	S	Y	Y
0	0	0	0	D0
0	0	1	0	D1
0	1	0	1	D0
0	1	1	0	D1
1	0	0	0	D0
1	0	1	1	D1
1	1	0	1	D0
1	1	1	1	D1

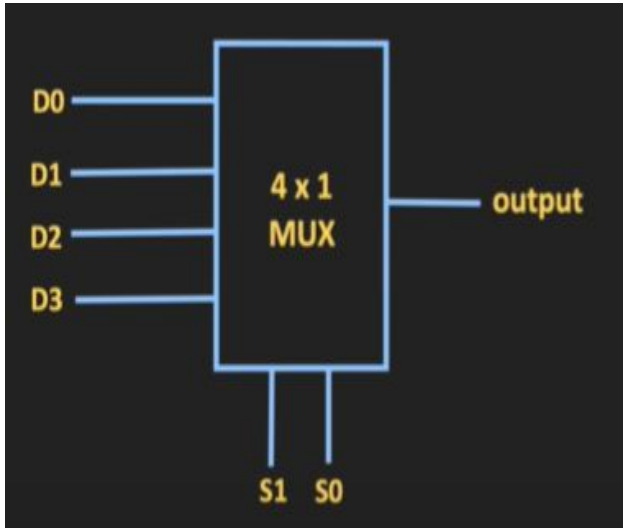
Multiplexer (8x1 using 4x1 MUX)

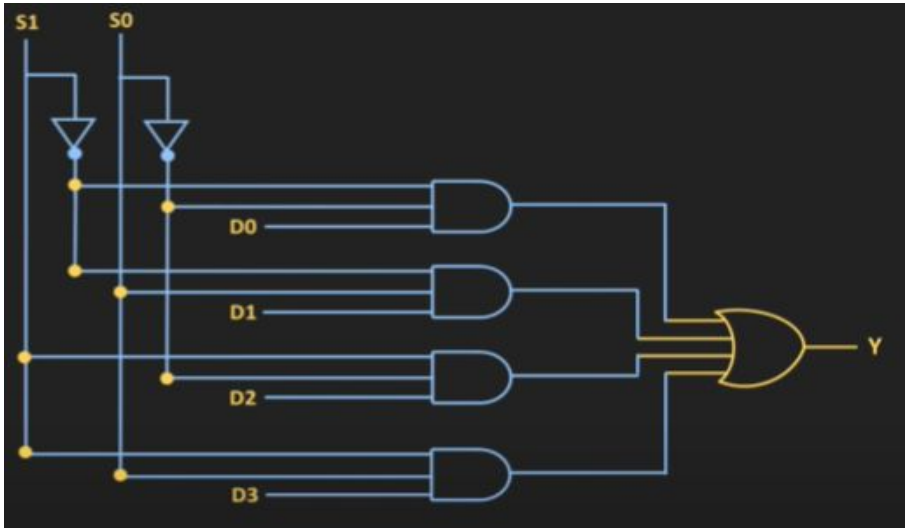


Multiplexer (8x1 using 2x1 MUX)



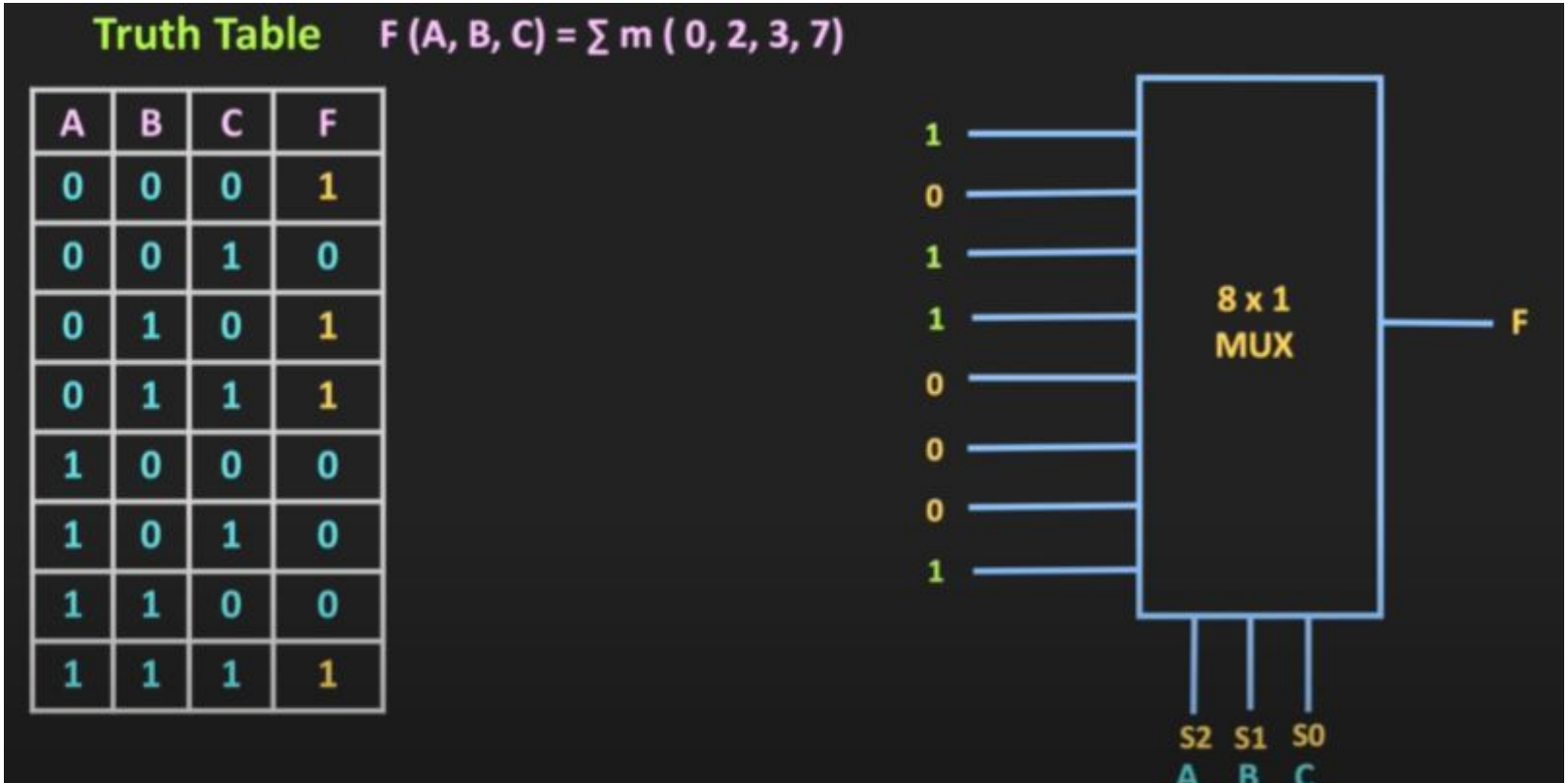
Boolean algebraic representation of MUX





$$Y = \overline{S1}\,\overline{S0}\ D0 + \overline{S1}\ S0\ D1 + S1\,\overline{S0}\ D2 + S1\ S0\ D3$$

Boolean Function implementation of MUX

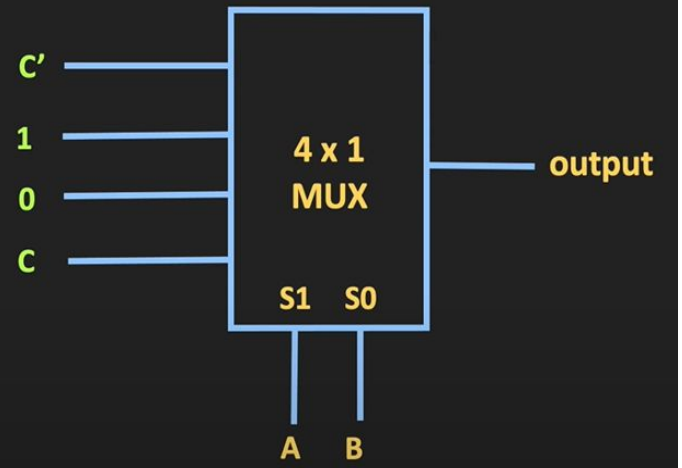


Boolean Function implementation of MUX (2)

$$F(A, B, C) = \sum m(0, 2, 3, 7)$$

Truth Table

A	B	C	F	
0	0	0	1	F = C’
0	0	1	0	
0	1	0	1	F = 1
0	1	1	1	
1	0	0	0	F = 0
1	0	1	0	
1	1	0	0	F = C
1	1	1	1	



Frequently asked Interview Questions on MUX

Q1: What is the purpose of a multiplexer (MUX) in digital circuits?

A1: The purpose of a multiplexer is to select and route one of several input signals to a single output based on control signals. It acts as a data selector.

Q2: What are the key components of a multiplexer?

A2: A multiplexer consists of multiple data inputs, one or more control inputs, and a single output. The control inputs determine which data input is selected and forwarded to the output.

Q3: How can you represent a multiplexer using a truth table?

A3: The truth table of a multiplexer shows the relationship between the control inputs, data inputs, and the output. Each row represents a unique combination of control inputs, and the corresponding output indicates which data input is selected.

Frequently asked Interview Questions on MUX (2)

Q4: How can you implement an n-to-1 multiplexer using smaller multiplexers?

A4: An n-to-1 multiplexer can be implemented by cascading smaller multiplexers. The outputs of the smaller multiplexers are connected to the inputs of a larger multiplexer to achieve the desired data selection.

Q6: How can you use a multiplexer to implement logic gates?

A6: By appropriately setting the control inputs of a multiplexer, you can implement various logic gates. For example, an AND gate can be implemented by connecting the inputs to the data inputs of the multiplexer and setting the control inputs accordingly.

Q7: What is the advantage of using a multiplexer in data compression?

A7: Multiplexers can be used in data compression to selectively choose specific patterns of data and route them to the output. This allows for efficient representation of data and

Frequently asked Interview Questions on MUX (3)

Q8: How is time-division multiplexing (TDM) related to multiplexers?

A8: Time-division multiplexing is a technique that uses multiplexers to combine multiple signals into a single communication channel. Each signal is given a dedicated time slot to transmit its data, allowing multiple signals to share the same channel.

Q9: How can you expand the number of inputs of a multiplexer without increasing the number of control inputs?

A9: The number of inputs of a multiplexer can be expanded by using multiplexer cascading. By connecting the outputs of smaller multiplexers to the inputs of a larger multiplexer, the number of selectable inputs can be increased.

Example: 8x1 using 4x1 and 2x1above

Applications of MUX

The applications include:

- Multiplexers are used in Communication Systems like telephone networks, Satellite systems, Telemetry.
- Broadcasting of Radio and Television signals would have been impossible without multiplexers.
- Multiplexer is also used in data routing within the computer. **For example**: The address information found in a protocol header is used by the multiplexer to determine which data should be routed.
- Multiplexers are widely used in computer memory to fetch data from specified memory locations.
- Multiplexer is used as a switch setting Comparator and Function Generator.

Practice Problems (1)

Problem 1: Design a 4-to-1 multiplexer using 2-to-1 multiplexers.

Problem 2: Implement a 2-input AND gate using a 4-to-1 multiplexer.

Problem 3: Create an 8-to-1 multiplexer using two 4-to-1 multiplexers.

Problem 4: Design a 16-to-1 multiplexer using four 4-to-1 multiplexers.

Problem 5: Construct a 2-bit binary-to-gray code converter using 4-to-1 multiplexers.

Problem 6: Implement a 3-variable function $F(A, B, C) = \Sigma(0, 2, 3, 4, 7)$ using a multiplexer.

Problem 7: Build a priority encoder using a multiplexer to encode four input signals (D3, D2, D1, D0) into a 2-bit binary code.

Problem 8: Design a 2-to-4 decoder using a multiplexer.