

UNIT-III

Introduction to Combinational Logic Circuits

Lecture 20

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Multiplexer / Demultiplexer

This presentation will demonstrate

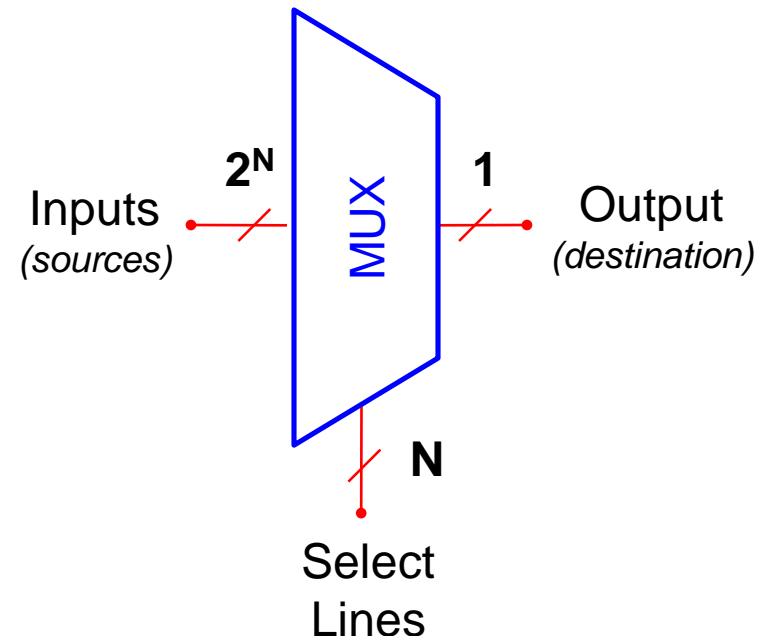
- The basic function of the Multiplexer (MUX).
- The typical application of a MUX.
- A 4-to-1 MUX designed with Small Scale Integration (SSI).
- A 4-to-1, 8-to-1, & 16-to-1 Medium Scale Integration (MSI) MUX.
- The basic function of the Demultiplexer (DEMUX).
- The typical application of a DEMUX.
- A 1-to-4 DEMUX design with Small Scale Integration (SSI).
- A 1-to-4, 1-to-8, & 1-to-16 Medium Scale Integration (MSI) DEMUX.
- A 7-segment message display using MUX/DEMUX.



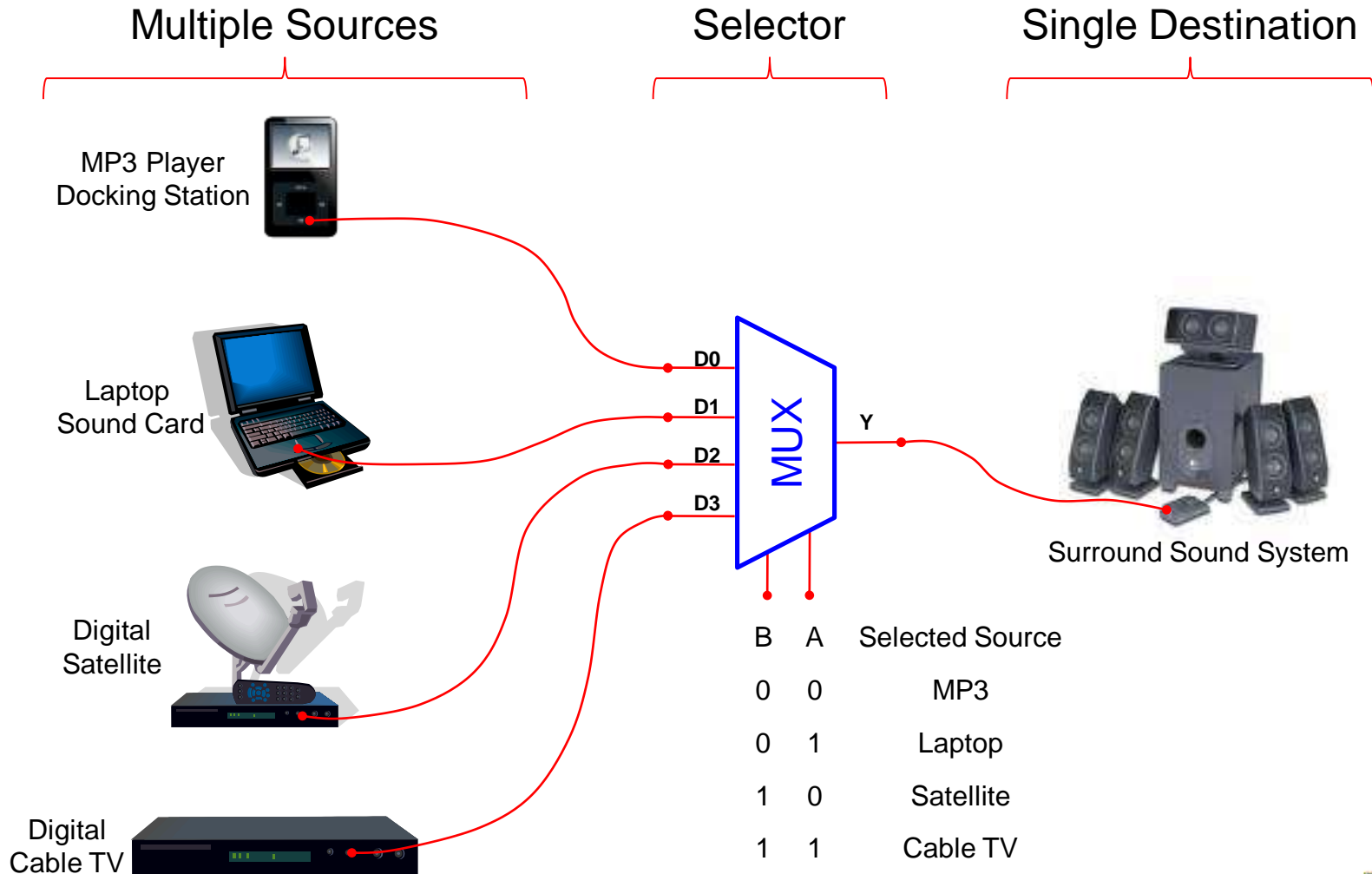
What is a Multiplexer (MUX)?

- A MUX is a digital switch that has multiple inputs (sources) and a single output (destination).
- The select lines determine which input is connected to the output.
- MUX Types
 - 2-to-1 (1 select line)
 - 4-to-1 (2 select lines)
 - 8-to-1 (3 select lines)
 - 16-to-1 (4 select lines)

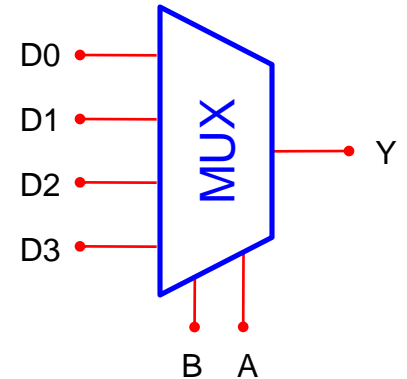
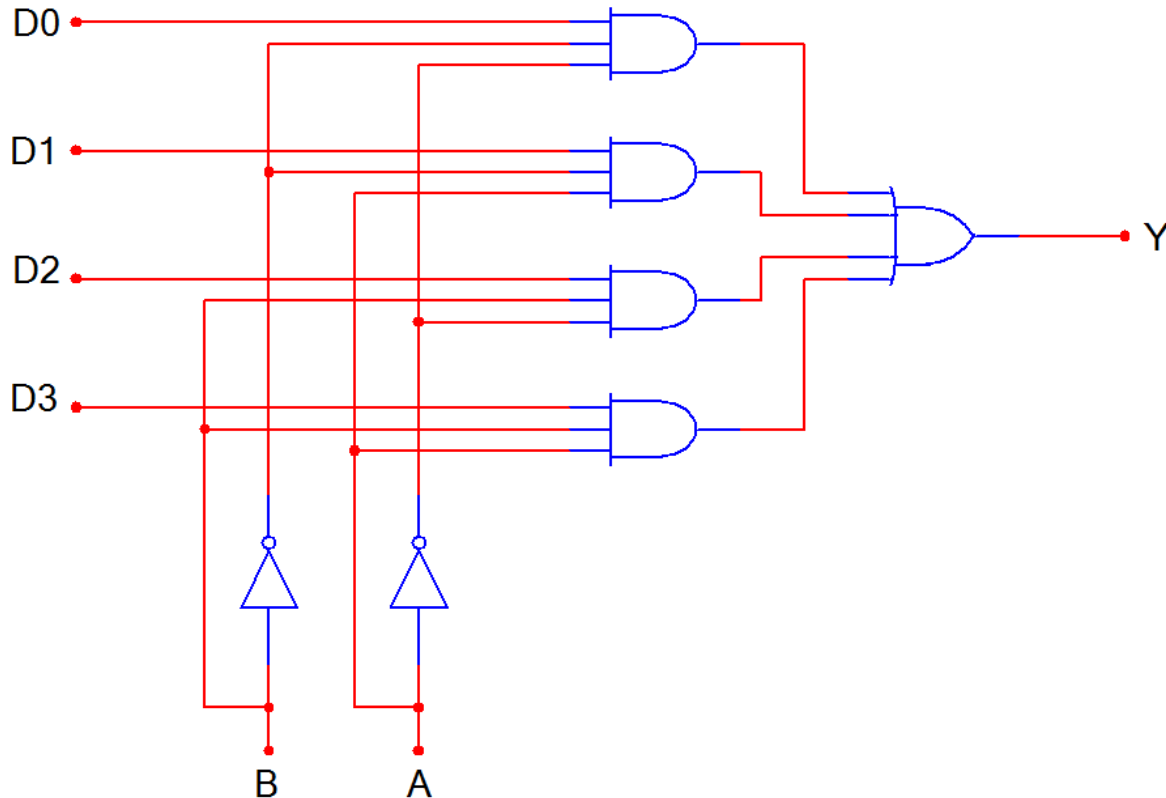
Multiplexer
Block Diagram



Typical Application of a MUX



4-to-1 Multiplexer (MUX)



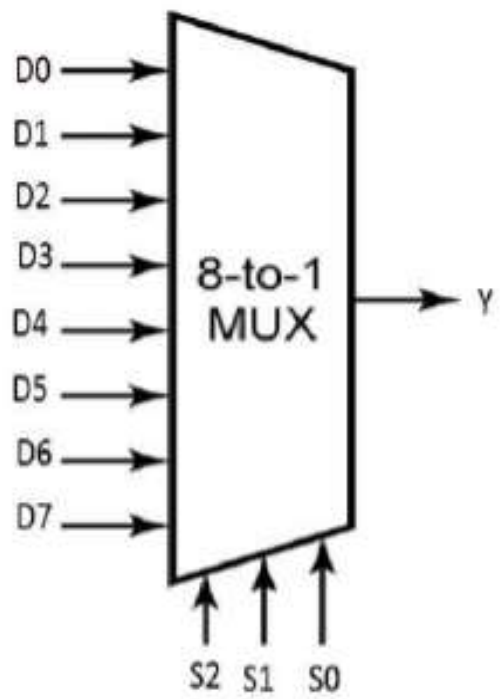
B	A	Y
0	0	D0
0	1	D1
1	0	D2
1	1	D3



8-TO-1 (3 SELECT LINES) MULTIPLEXER

- 8:1 MUX has 8 inputs(D0, D1, D2, D3, D4, D5, D6, D7) & 3 select lines(S0,S1, S2,)

BLOCK DIAGRAM

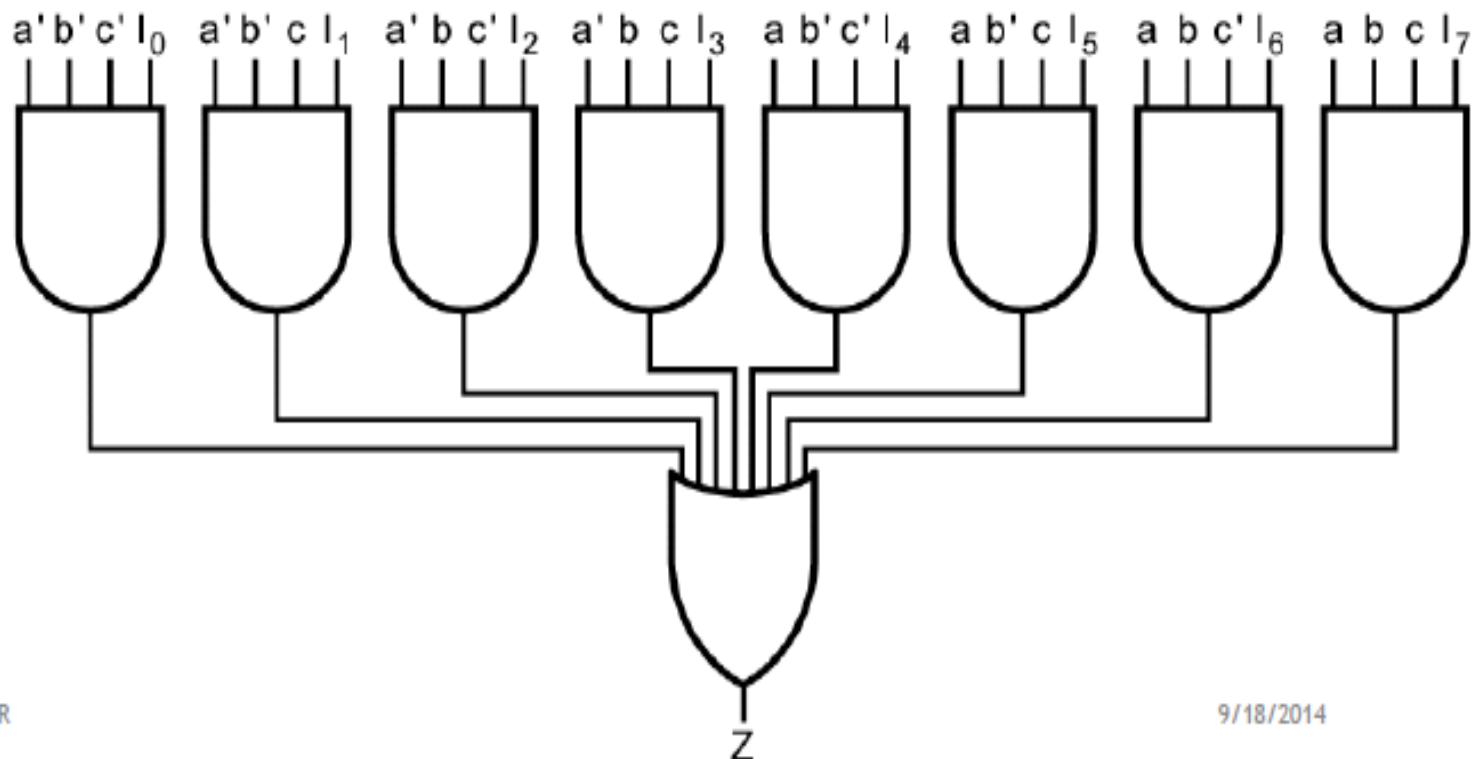


TRUTH TABLE

S2	S1	S0	Y
0	0	0	D0
0	0	1	D1
0	1	0	D2
0	1	1	D3
1	0	0	D4
1	0	1	D5
1	1	0	D6
1	1	1	D7



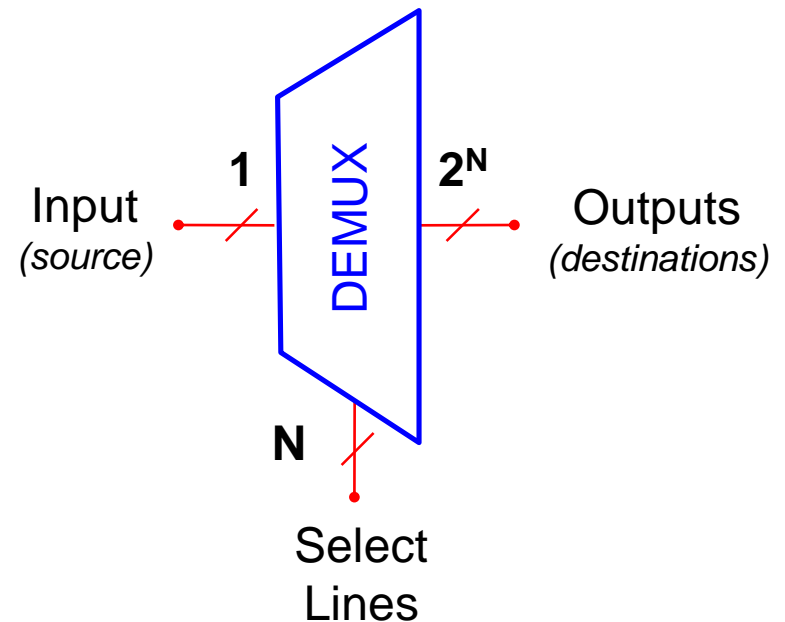
- The logical level applied to the S input determines which AND gate is enabled, so that its data input passes through the OR gate to the output.



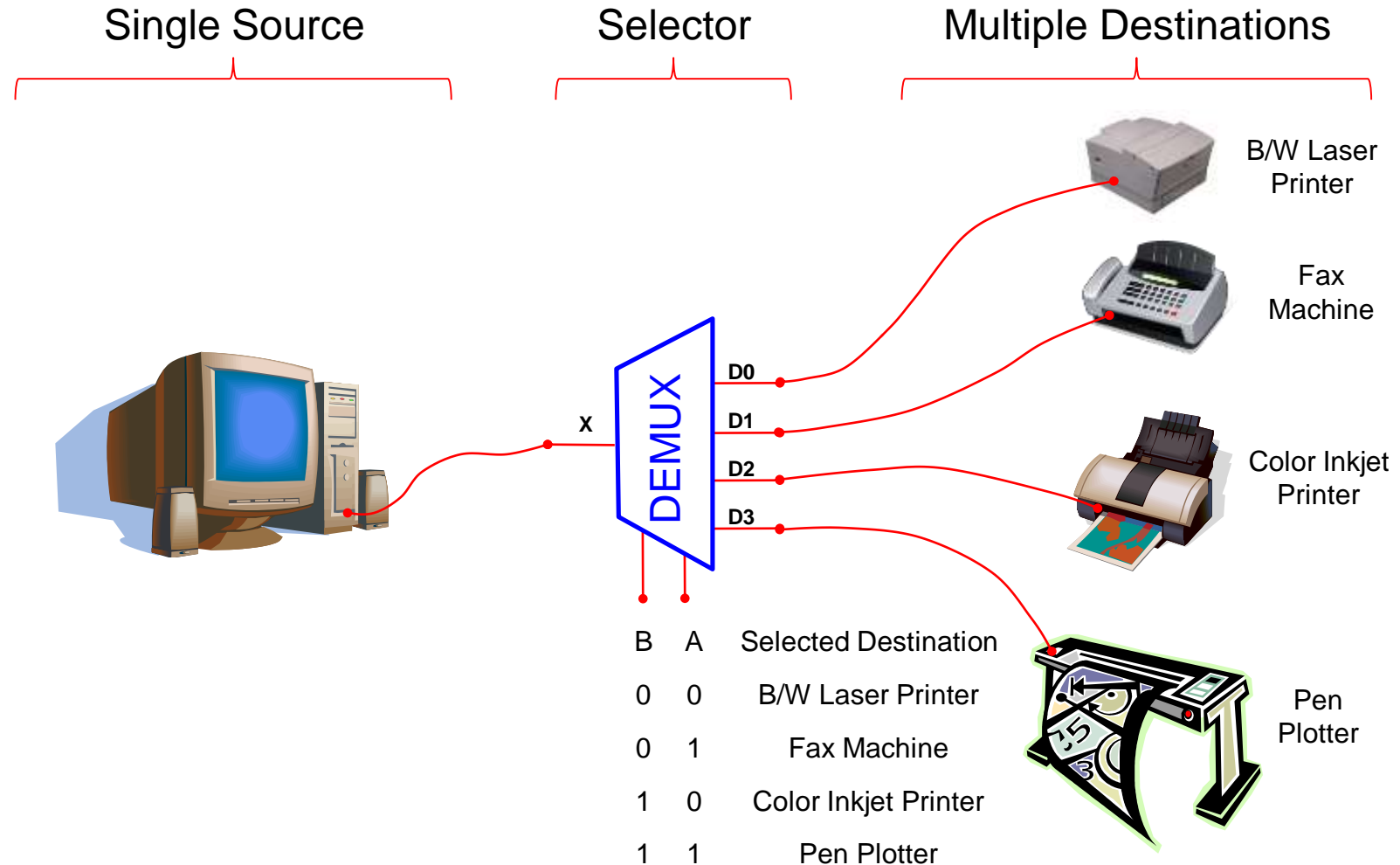
What is a Demultiplexer (DEMUX)?

- A DEMUX is a digital switch with a single input (source) and a multiple outputs (destinations).
- The select lines determine which output the input is connected to.
- DEMUX Types
 - 1-to-2 (1 select line)
 - 1-to-4 (2 select lines)
 - 1-to-8 (3 select lines)
 - 1-to-16 (4 select lines)

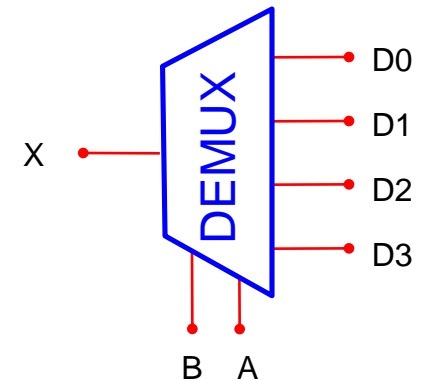
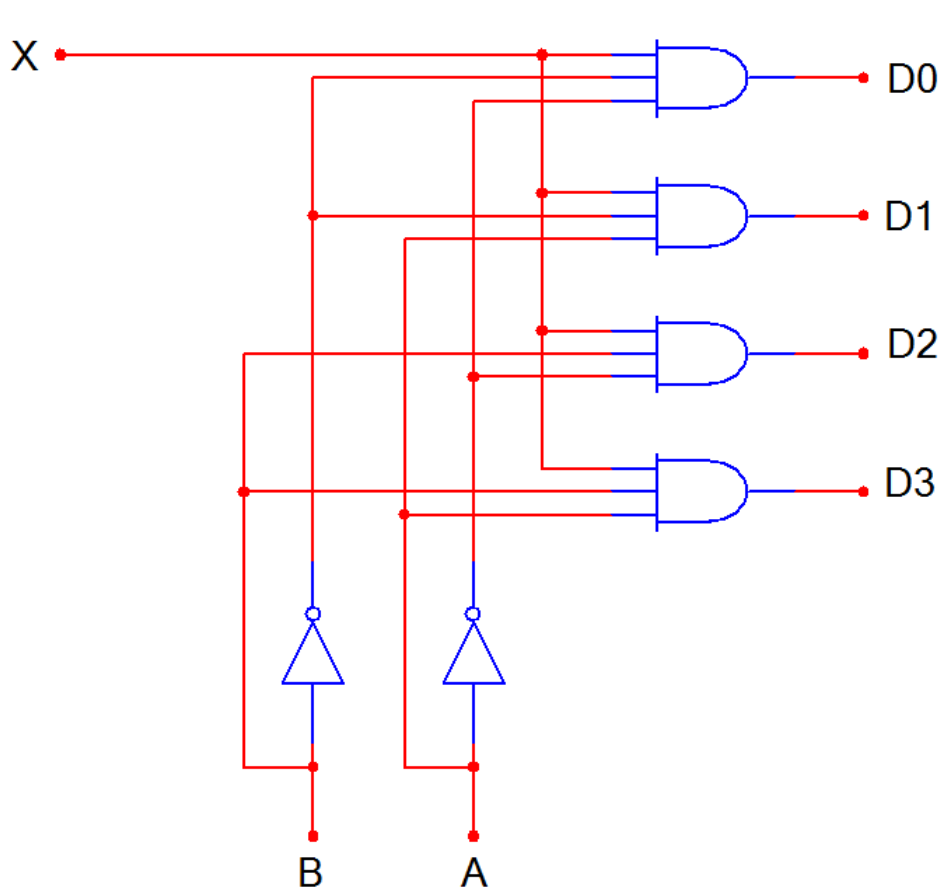
Demultiplexer
Block Diagram



Typical Application of a DEMUX



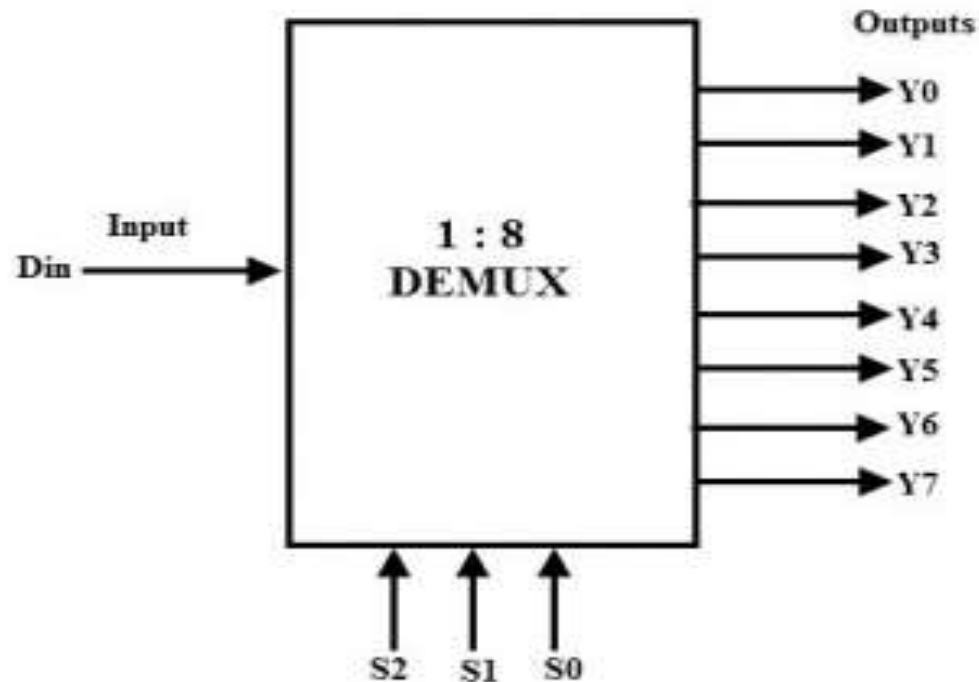
1-to-4 De-Multiplexer (DEMUX)



B	A	D0	D1	D2	D3
0	0	X	0	0	0
0	1	0	X	0	0
1	0	0	0	X	0
1	1	0	0	0	X

1-to-8 Demultiplexer

The below figure shows the block diagram of a 1-to-8 demultiplexer that consists of single input D, three select inputs S2, S1 and S0 and eight outputs from Y0 to Y7.



Truth Table

Data Input	Select Inputs			Outputs							
D	S ₂	S ₁	S ₀	Y ₇	Y ₆	Y ₅	Y ₄	Y ₃	Y ₂	Y ₁	Y ₀
D	0	0	0	0	0	0	0	0	0	0	D
D	0	0	1	0	0	0	0	0	0	D	0
D	0	1	0	0	0	0	0	0	D	0	0
D	0	1	1	0	0	0	0	D	0	0	0
D	1	0	0	0	0	0	D	0	0	0	0
D	1	0	1	0	0	D	0	0	0	0	0
D	1	1	0	0	D	0	0	0	0	0	0
D	1	1	1	D	0	0	0	0	0	0	0

$$Y_0 = D \overline{S_2} \overline{S_1} \overline{S_0}$$

$$Y_1 = D \overline{S_2} \overline{S_1} S_0$$

$$Y_2 = D \overline{S_2} S_1 \overline{S_0}$$

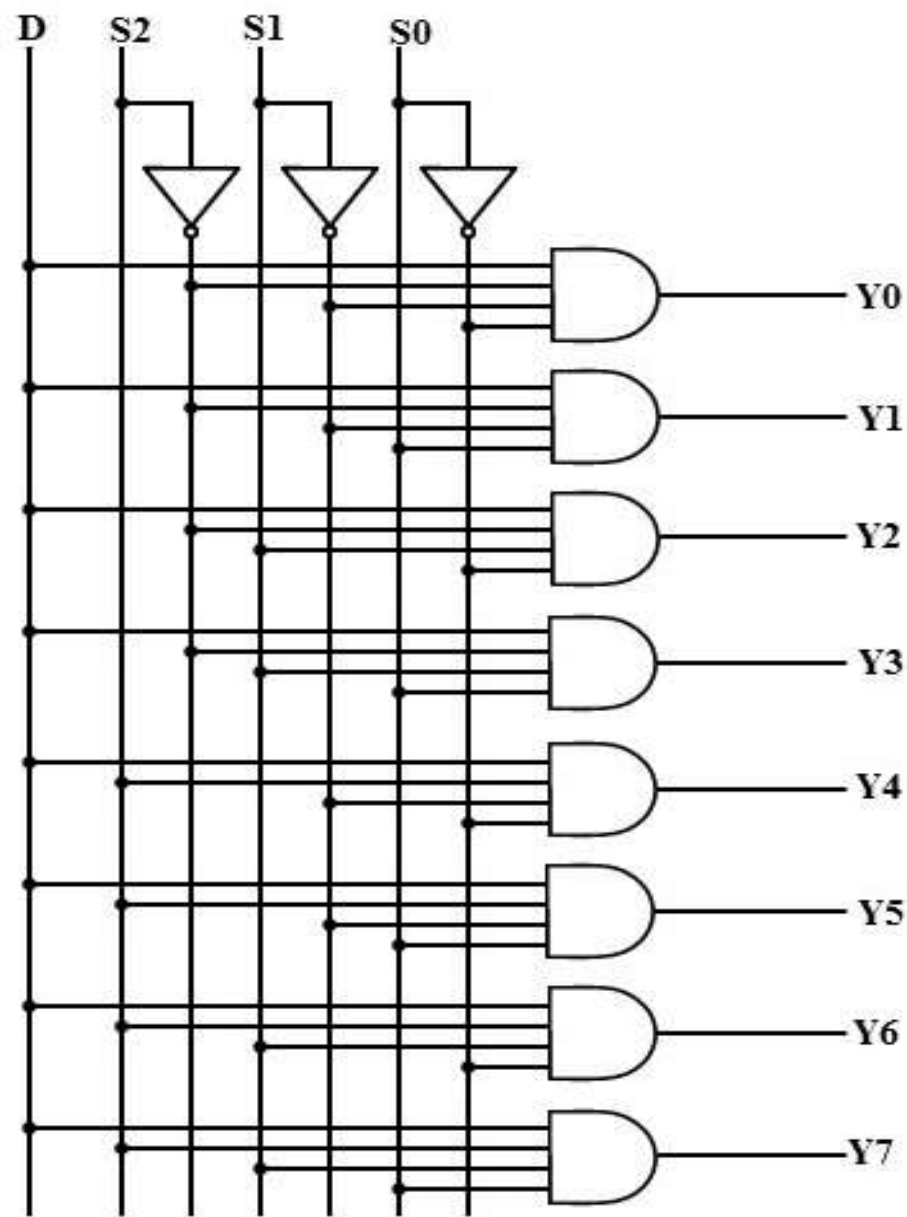
$$Y_3 = D \overline{S_2} S_1 S_0$$

$$Y_4 = D S_2 \overline{S_1} \overline{S_0}$$

$$Y_5 = D S_2 \overline{S_1} S_0$$

$$Y_6 = D S_2 S_1 \overline{S_0}$$

$$Y_7 = D S_2 S_1 S_0$$



Quick Quiz (Poll 1)

What is a multiplexer?

- a) It is a type of decoder which decodes several inputs and gives one output
- b) A multiplexer is a device which converts many signals into one
- c) It takes one input and results into many output
- d) It is a type of encoder which decodes several inputs and gives one output

Quick Quiz (Poll 2)

Which combinational circuit is renowned for selecting a single input from multiple inputs & directing the binary information to output line?

- a) Data Selector
- b) Data distributor
- c) Both data selector and data distributor
- d) DeMultiplexer

Quick Quiz (Poll 3)

What is the function of an enable input on a multiplexer chip?

- a) To apply V_{cc}
- b) To connect ground
- c) To active the entire chip
- d) To active one half of the chip

Quick Quiz (Poll 4)

How many NOT gates are required for the construction of a 4-to-1 multiplexer?

- a) 3
- b) 4
- c) 2
- d) 5

