Digital Logic

Lecture 9

2nd Stage

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Topics covered

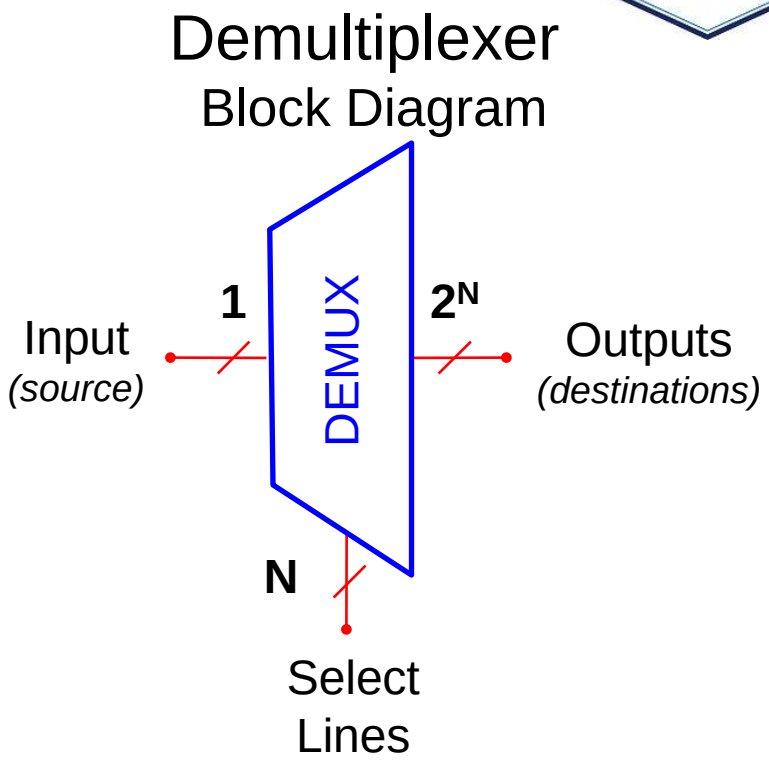
DeMultiplexers

- Applications of Demultiplexer
- 1:N DeMultiplexers
  - 1:2 DEMUX
  - 1:4 DEMUX
  - 1:8 DEMUX
  - 1:16 DEMUX

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.



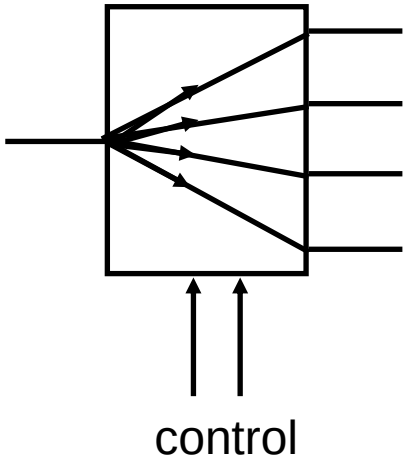
What is a Demultiplexer (DEMUX)?

- ✧ Demultiplexer is exactly reverse of multiplexer.
- ✧ Relationship between m & n is given by

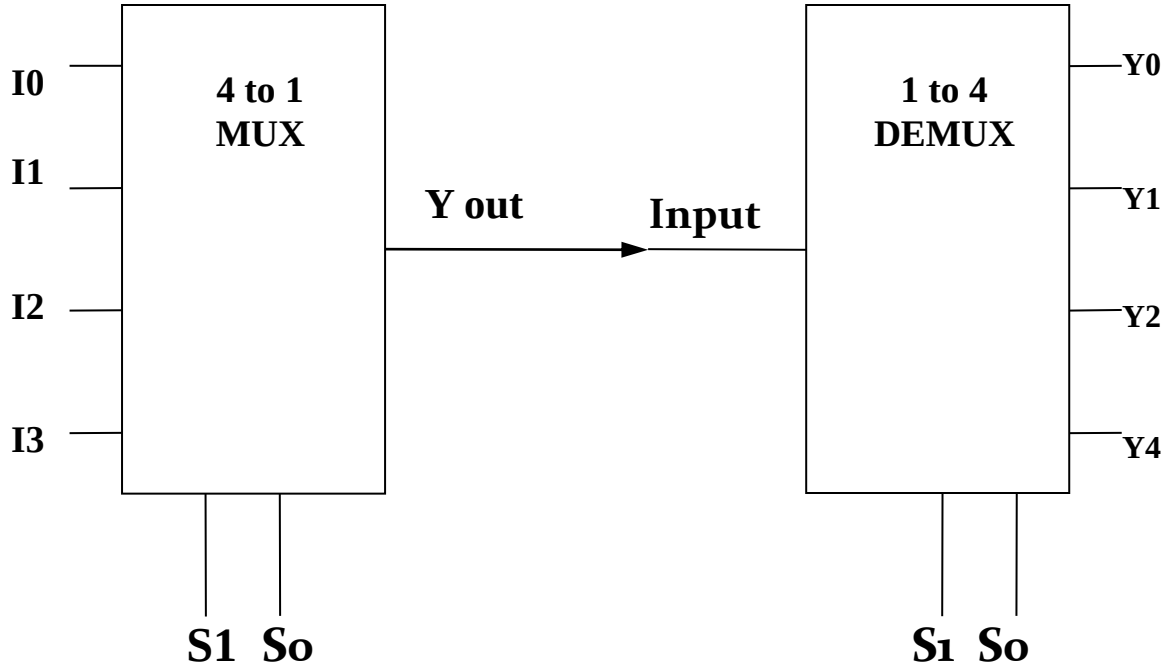
$$2^m = n$$

where m = no. of control lines, n = no. of output lines

- ✧ So we can have
  - 1:2 DEMUX; with 1 Select line
  - 1:4 DEMUX; with 2 Select lines
  - 1:8 DEMUX; with 3 Select lines
  - 1:16 DEMUX; with 4 Select lines

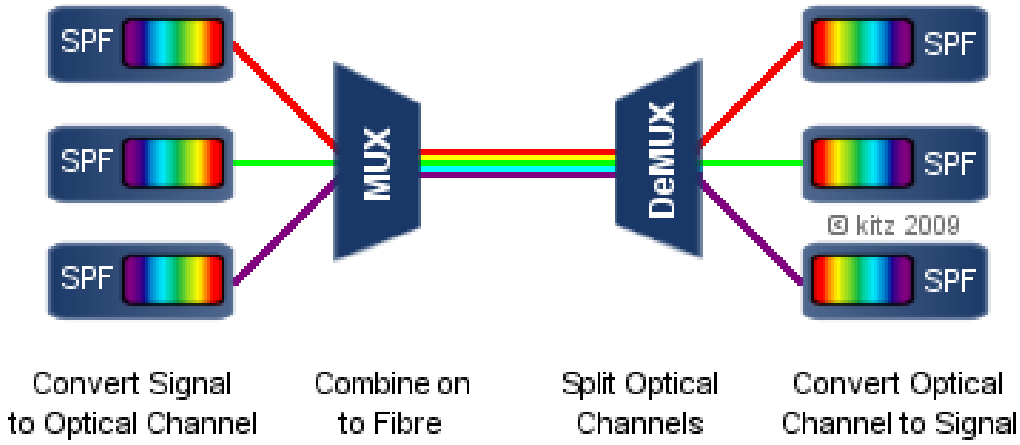


Relation between a Multiplexer and a Demultiplexer

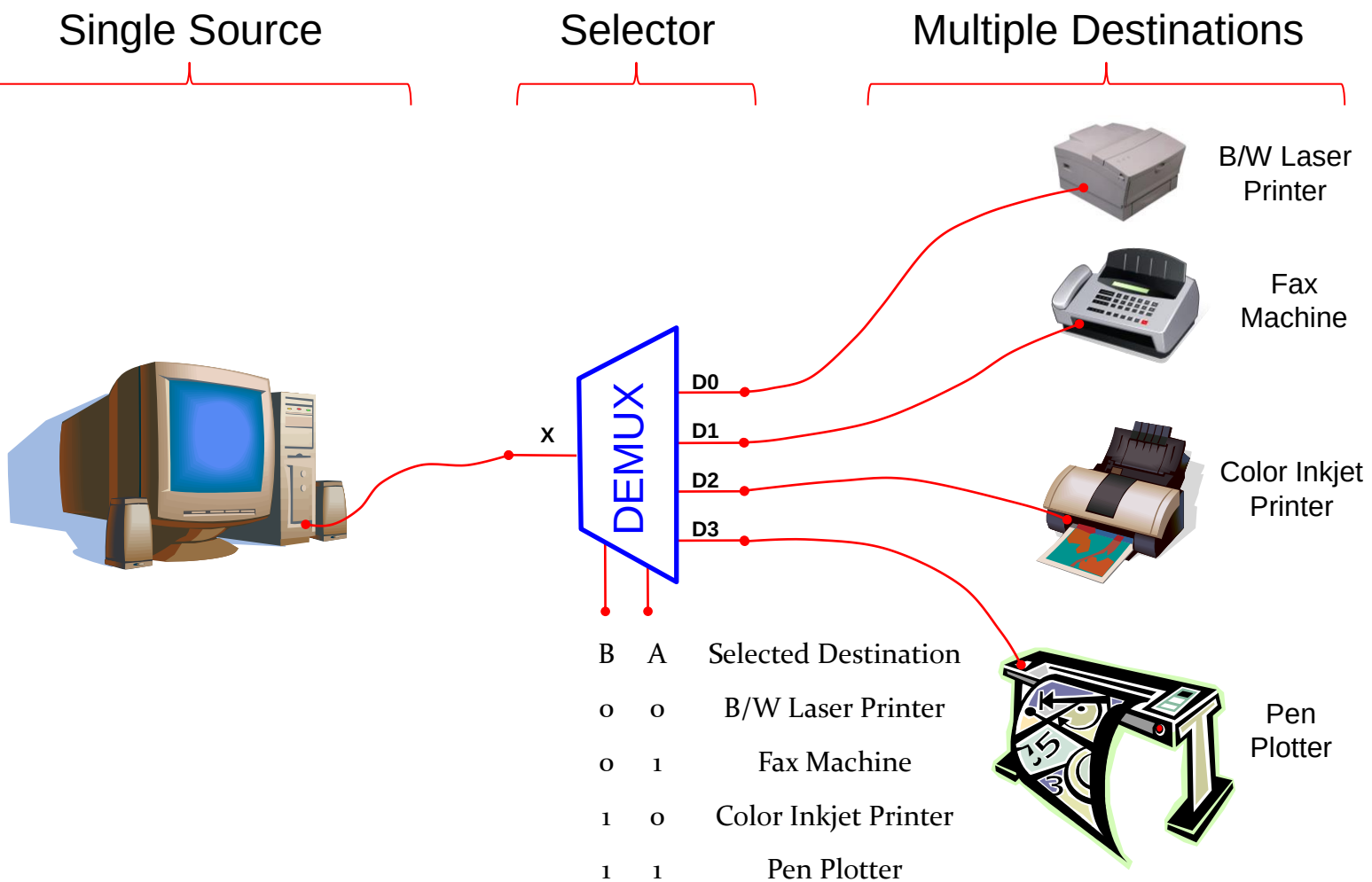


Applications of Demultiplexer

- Communication Systems
- Arithmetic Logic Unit
- Serial to Parallel Converter



Typical Application of a DEMUX



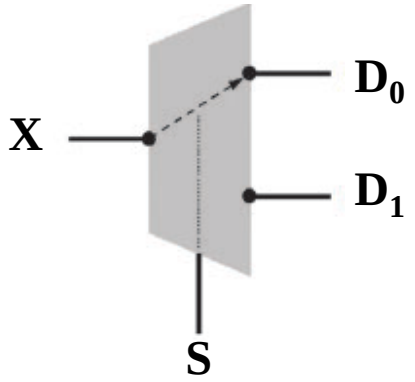
B	A	Selected Destination
0	0	B/W Laser Printer
0	1	Fax Machine
1	0	Color Inkjet Printer
1	1	Pen Plotter

1 to 2 Demultiplexer

1:2 Demultiplexer Truthtable

S	Do	D1
o	X	o
1	o	X

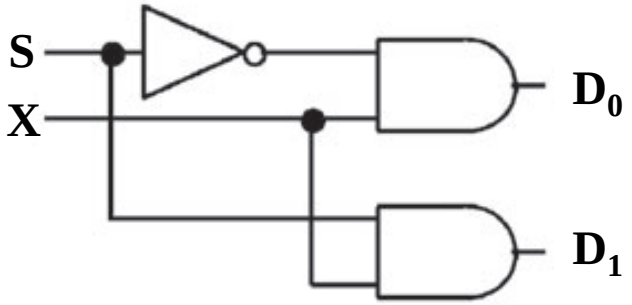
1:2 Demultiplexer Graphical Symbol



1:2 Demultiplexer Logic Expressions

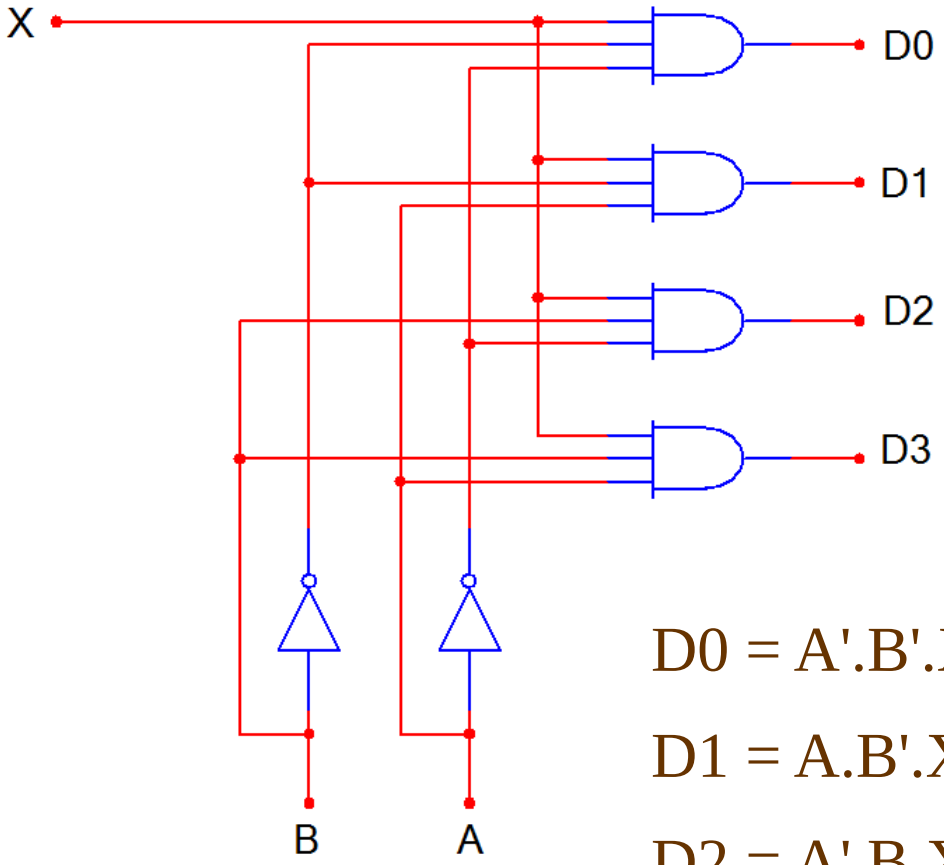
D0 = S'.X

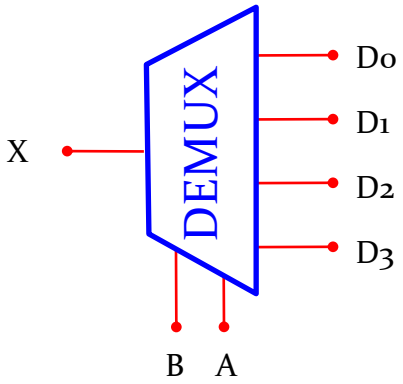
D1 = S.X



1:2 Demultiplexer Logic Diagram

1 to 4 Demultiplexer





D0 = A'.B'.X

D1 = A.B'.X

D2 = A'.B.X

D3 = A.B.X

B	A	Do	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

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

1 to 8 De-Multiplexer Truth Table

1 to 8 Demultiplexer

$$Y0 = D\,\overline{S2}\,\overline{S1}\,\overline{S0}$$

$$Y1 = D\,\overline{S2}\,\overline{S1}\,S0$$

$$Y2 = D\,\overline{S2}\,S1\,\overline{S0}$$

$$Y3 = D\,\overline{S2}\,S1\,S0$$

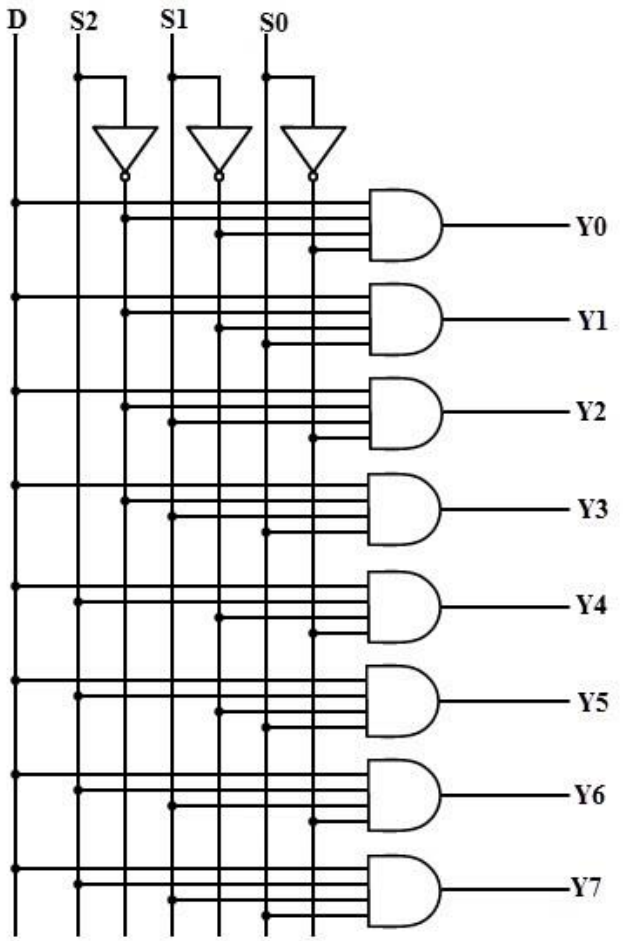
$$Y4 = D\,S2\,\overline{S1}\,\overline{S0}$$

$$Y5 = D\,S2\,\overline{S1}\,S0$$

$$Y6 = D\,S2\,S1\,\overline{S0}$$

$$Y7 = D\,S2\,S1\,S0$$

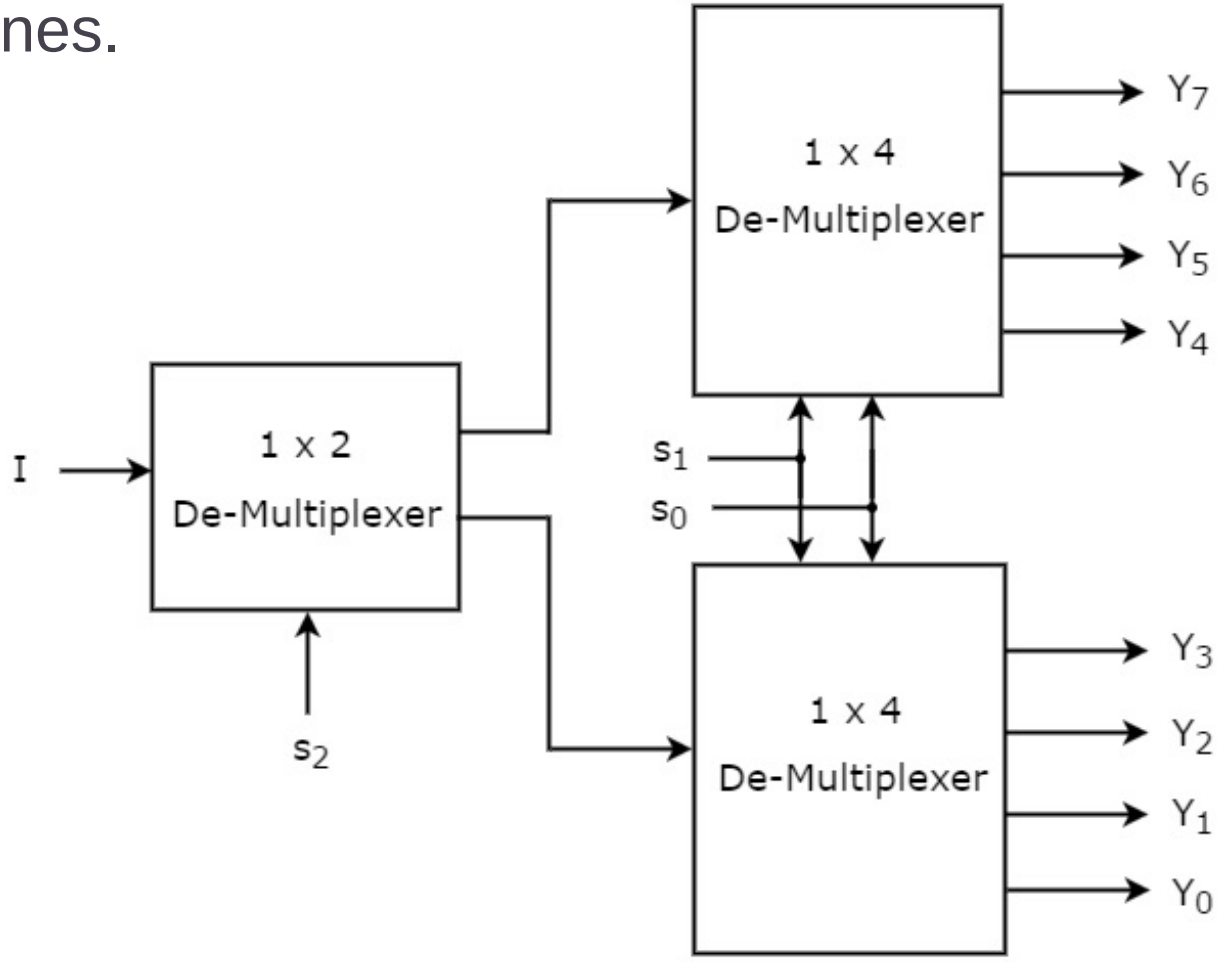
1 to 8 Demultiplexer Logic Expression



1 to 8 Demultiplexer Logic Diagram

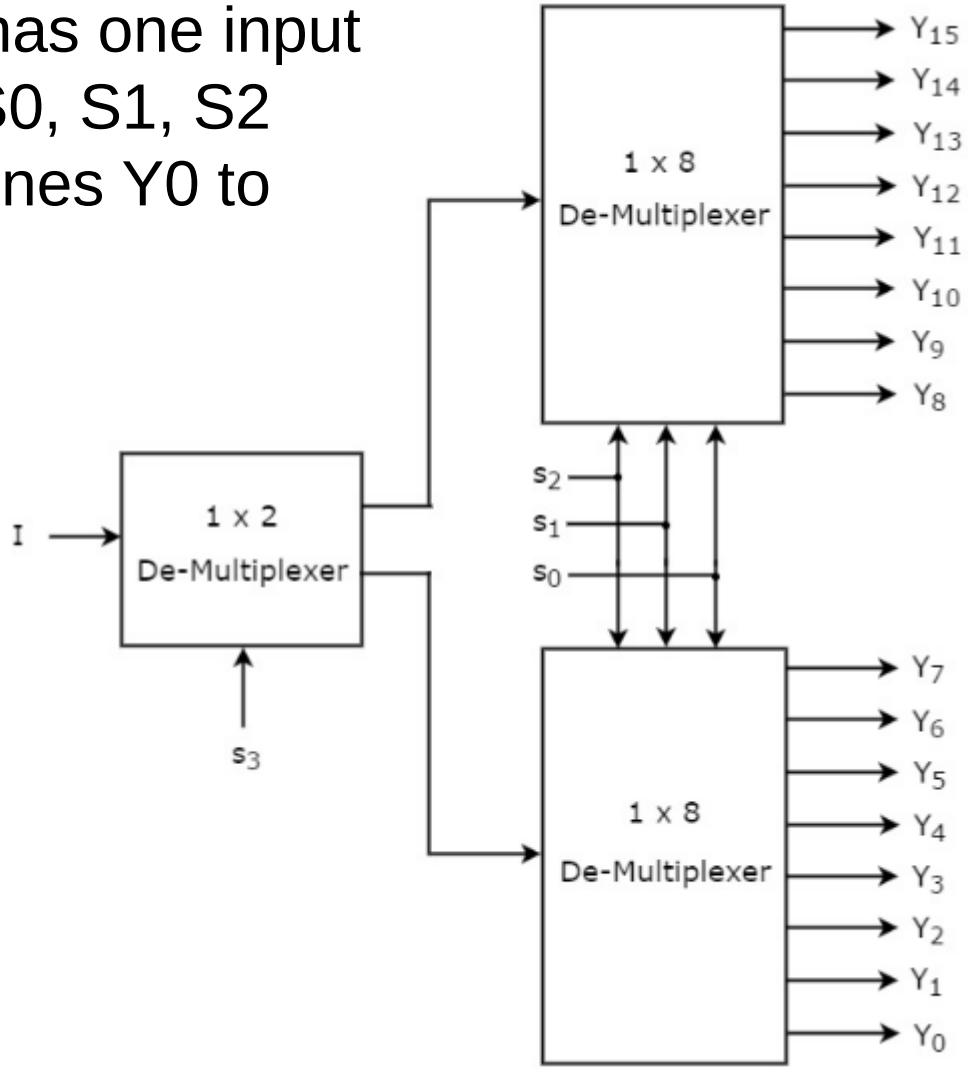
1 to 8 Demultiplexer

A 1 to 8 demultiplexer consists of one input line, 8 output lines and 3 select lines.

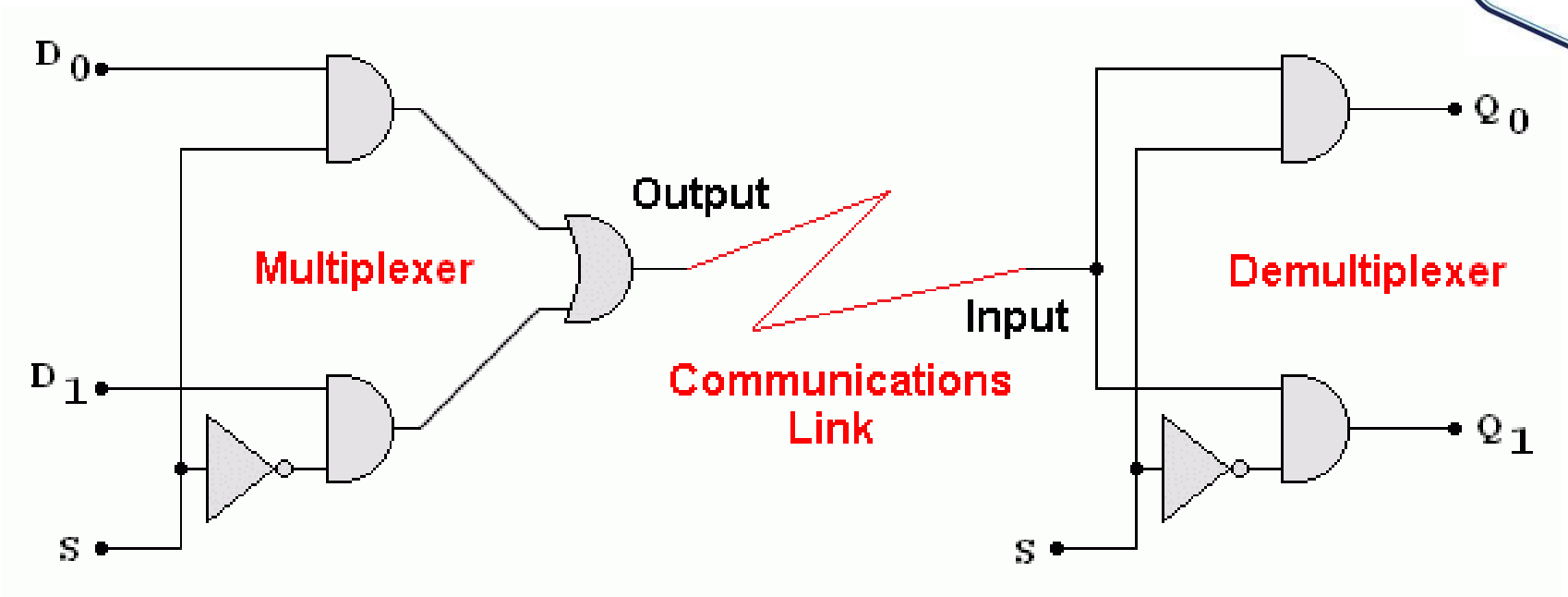


1 to 16 Demultiplexer

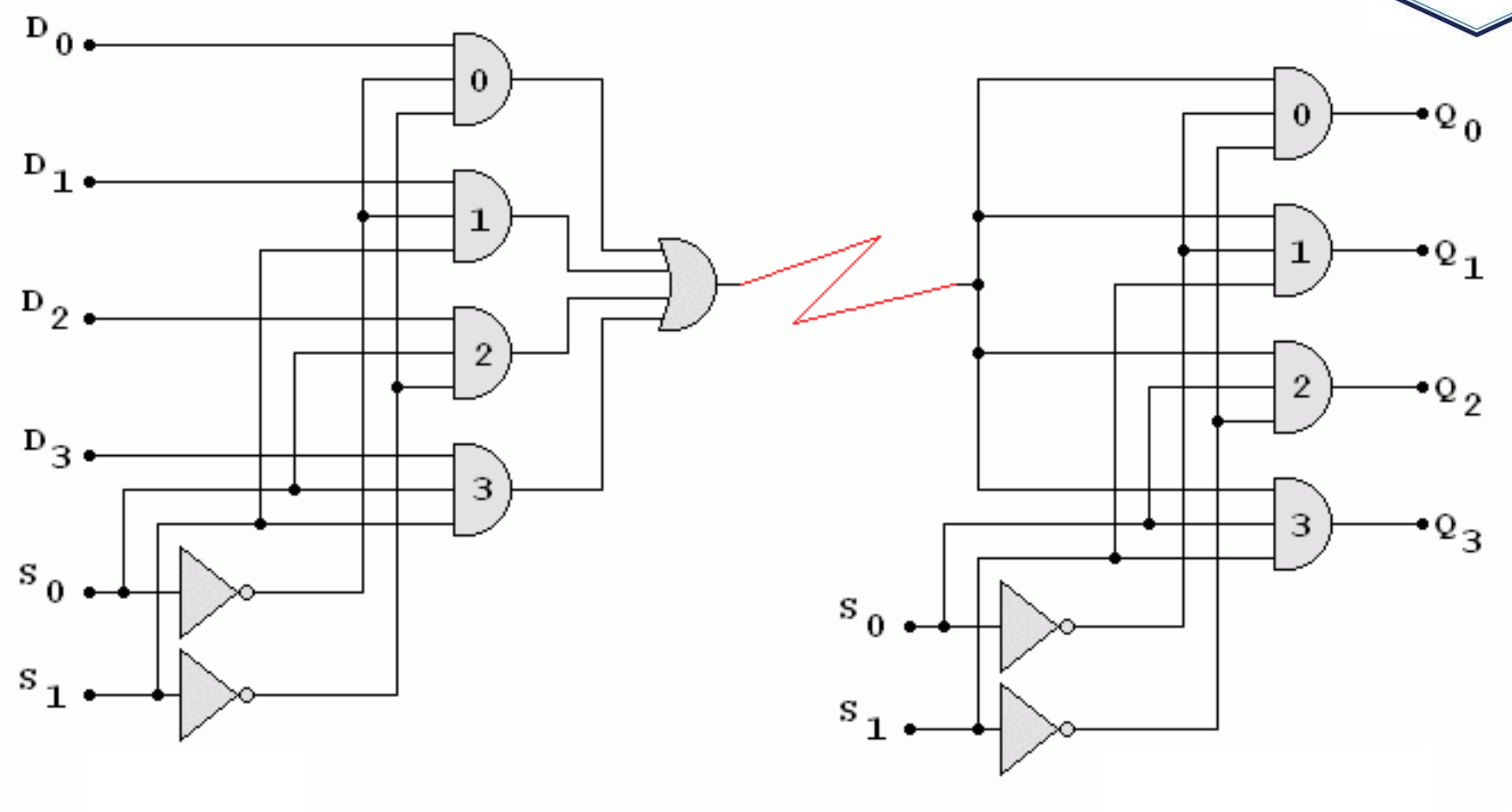
1 to 16 de-multiplexer has one input data, four select lines S0, S1, S2 and S3 and 16 output lines Y0 to Y15.



2:1 MUX and 1:2 DEMUX Communication



4:1 MUX and 1:4 DEMUX Communication



4:1 MUX

1:4 DEMUX

Try

Q1) Construct a 16:1 multiplexer with 2:1 multiplexers only. Use block diagrams, and logic diagrams

Q2) Construct a 1:16 demultiplexer with 1:2 demultiplexers only. Use block diagrams, and logic diagrams