Multiplexer:

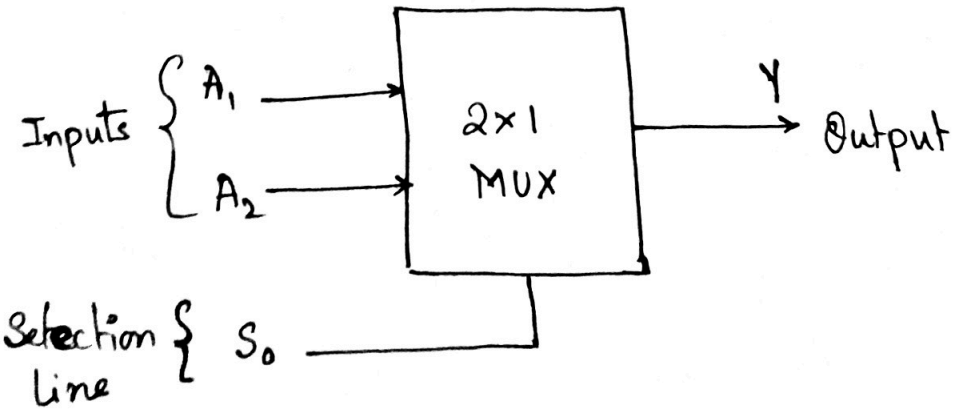
A multiplexer is a combinational circuit that has 2^n input lines and a sigle output line. The binary information is received from the input lines and directed to the output line. On the basis of the values of the selection lines, one of these data inputs will be connected to the output.

There are several different types of multiplexers, Some of them are given as follows,

2×1 Multiplexer:

In 2×1 multiplexer, there are only two inputs A_0 and A_1, one selection line S_0 and a single output Y. On the basis of the combination of inputs which are present at the selection line S_0, one of these two inputs will be connected to the output.

Block diagram:



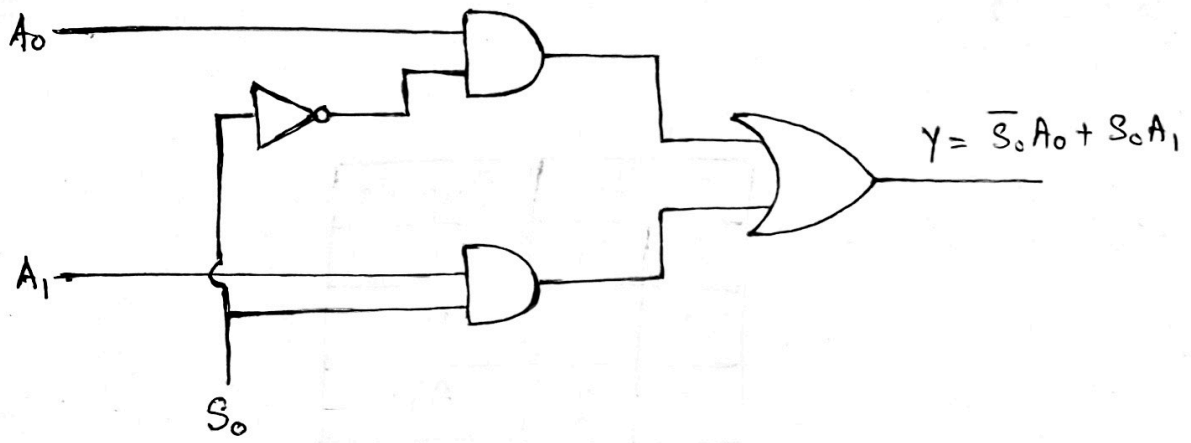
Truth Table

Inputs	Outputs
S_0	Y
0	A_0
1	A_1

The logical expression of the term Y (output) is,

$$Y = \overline{S}_0 A_0 + S_0 A_1$$

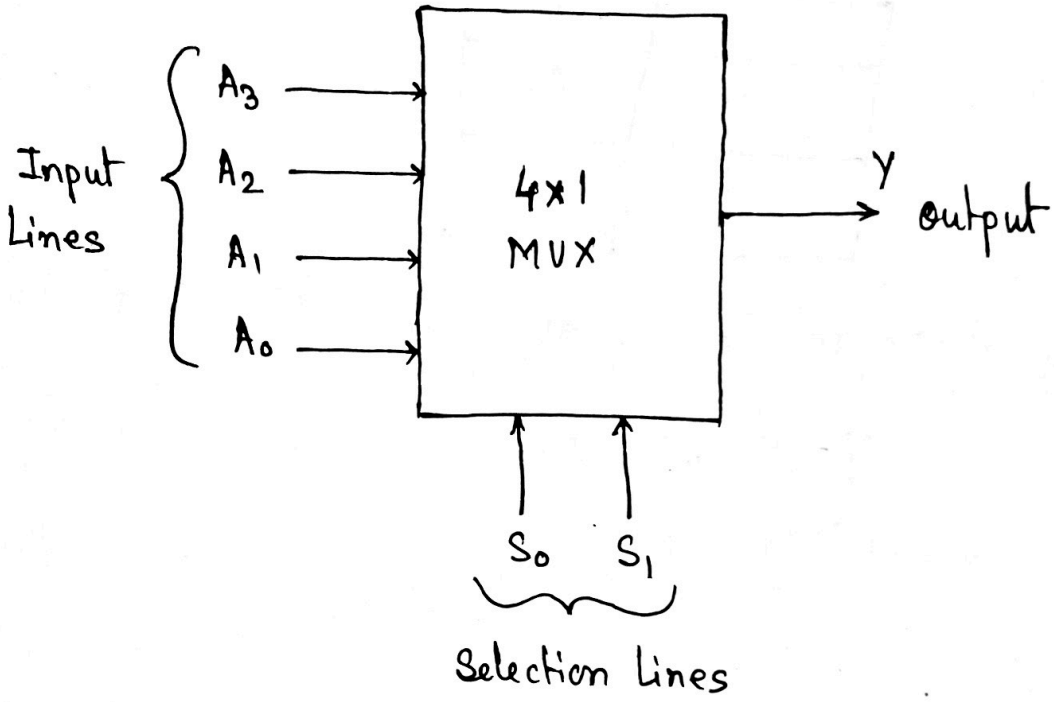
Logical circuit Diagram



4X1 Multiplexer:

In a 4X1 multiplexer, there is a total of four input lines A_0, A_1, A_2 and A_3, two selection lines S_0 and S_1 and one output line Y. On the basis of the combinations of inputs that are present in the selection lines S_0 and S_1 one of these four inputs are connected to the output.

Block Diagram:



Truth table:

Inputs		Outputs
S_0	S_1	Y
0	0	A_0
0	1	A_1
1	0	A_2
1	1	A_3

The logical expression of the term Y (output) is,

$$Y = \bar{S}_0 \bar{S}_1 A_0 + \bar{S}_0 S_1 A_1 + S_0 \bar{S}_1 A_2 + S_0 S_1 A_3$$

De-Multiplexer:

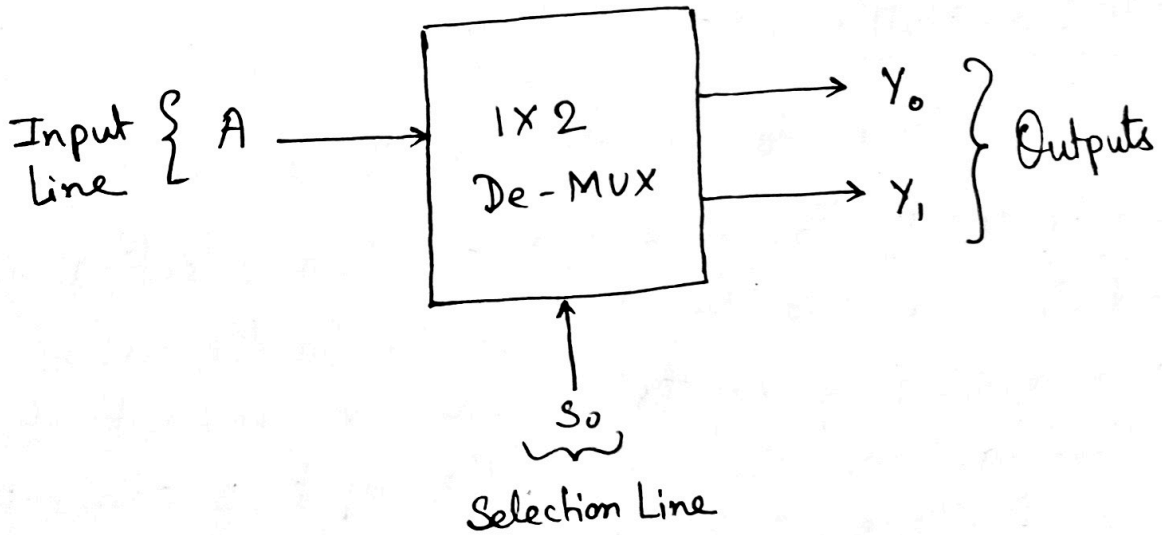
De-multiplexer is a combinational circuit that performs ~~that~~ the reverse operation of Multiplexer. It has only one input line and 2^n output lines. In simple words a de-multiplexer is a single-input and multi-output combinational circuit. On the basis of the values of the selection lines, the input will be connected to one of these outputs.

There are several types of De-multiplexer some of them are given as follows,

1×2 demultiplexer:

In the 1×2 de-multiplexer, there are only two outputs Y_0 and Y_1, one selection line S_0 and one input line A. On the basis of the selection line value the input will be connected to one of the outputs.

Block Diagram:



Truth Table:

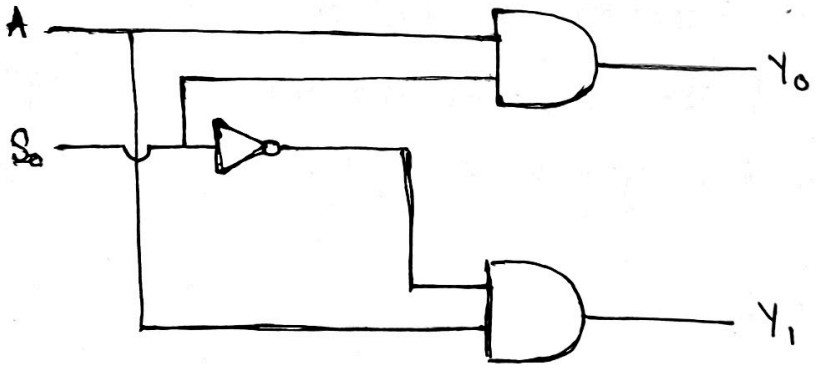
Inputs	Outputs	
S_0	Y_0	Y_1
0	0	A
1	A	0

The logical expression for the term Y (output) is,

$$Y_0 = S_0 A$$

$$Y_1 = \bar{S}_0 A$$

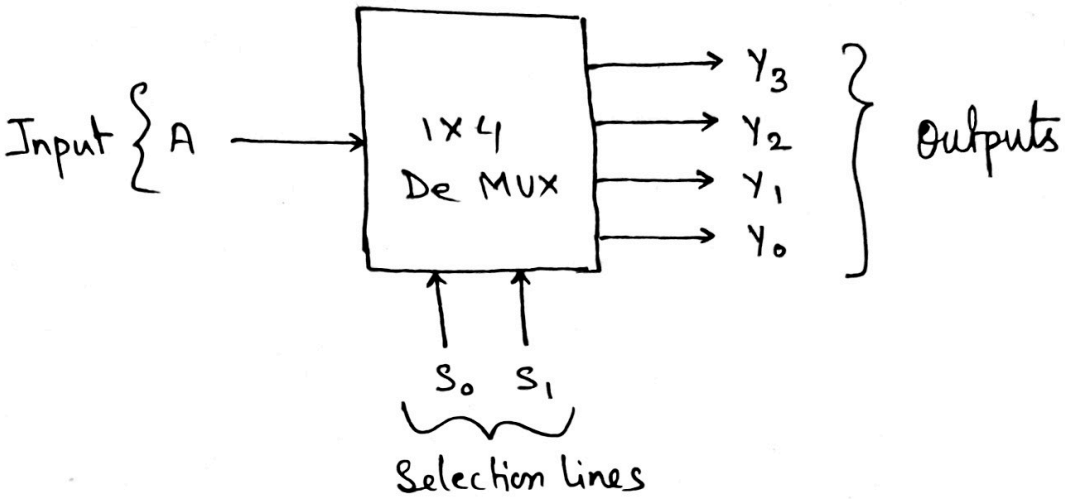
Logical circuit Diagram:



1X4 De-Multiplexer:

In 1X4 de-multiplexer, there are total of four output lines Y_0, Y_1, Y_2 and Y_3, two selection lines S_0 and S_1 and one input line A. On the basis of the combinations of inputs which are present at the selection lines S_0 and S_1 the input is connected to one of these outputs.

Block Diagram:



Truth Table:

Inputs		Outputs			
S_0	S_1	Y_3	Y_2	Y_1	Y_0
0	0	0	0	0	A
0	1	0	0	A	0
1	0	0	A	0	0
1	1	A	0	0	0

The logical expression for the term Y (output) is,

$$Y_3 = S_0 S_1 A$$

$$Y_2 = S_0 \bar{S}_1 A$$

$$Y_1 = \bar{S}_0 S_1 A$$

$$Y_0 = \bar{S}_0 \bar{S}_1 A$$