

Multiplexers

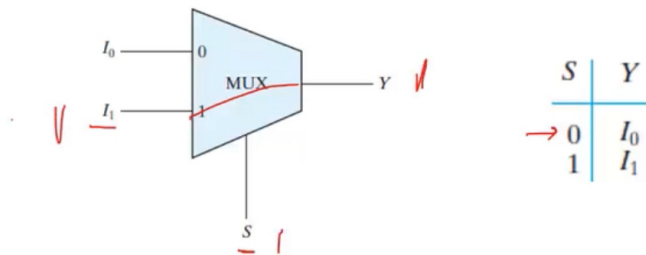
module 10

10/30/2023

1 Multiplexers

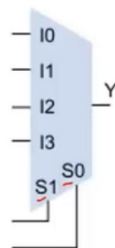
A multiplexer is an electronic switch → switches multiple inputs to one output. It does this according to a **select line**:

- Determine what input is switched to the output
- Passes an input to output
- Max # of inputs = , where n is # of select lines



* 4 inputs need 2 select lines. S_1 is the MSB

S_1	S_0	Y
0	0	I_0
0	1	I_1
1	0	I_2
1	1	I_3



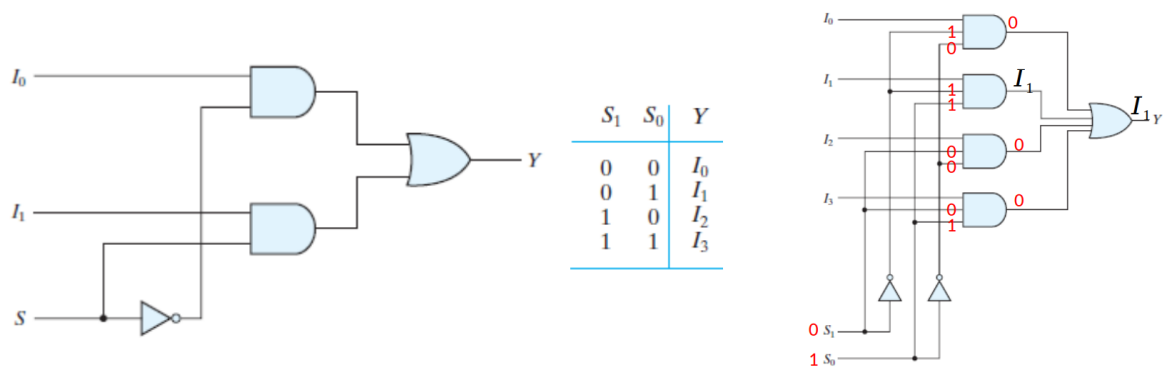
In the above image, S_1 is the MSB and S_0 is the LSB.

1.1 Inside of a Multiplexer

inside of a multiplexer uses the Laws of AND and OR. They are used to activate only one AND gate.

- A AND 1 is A

- A OR 0 is A

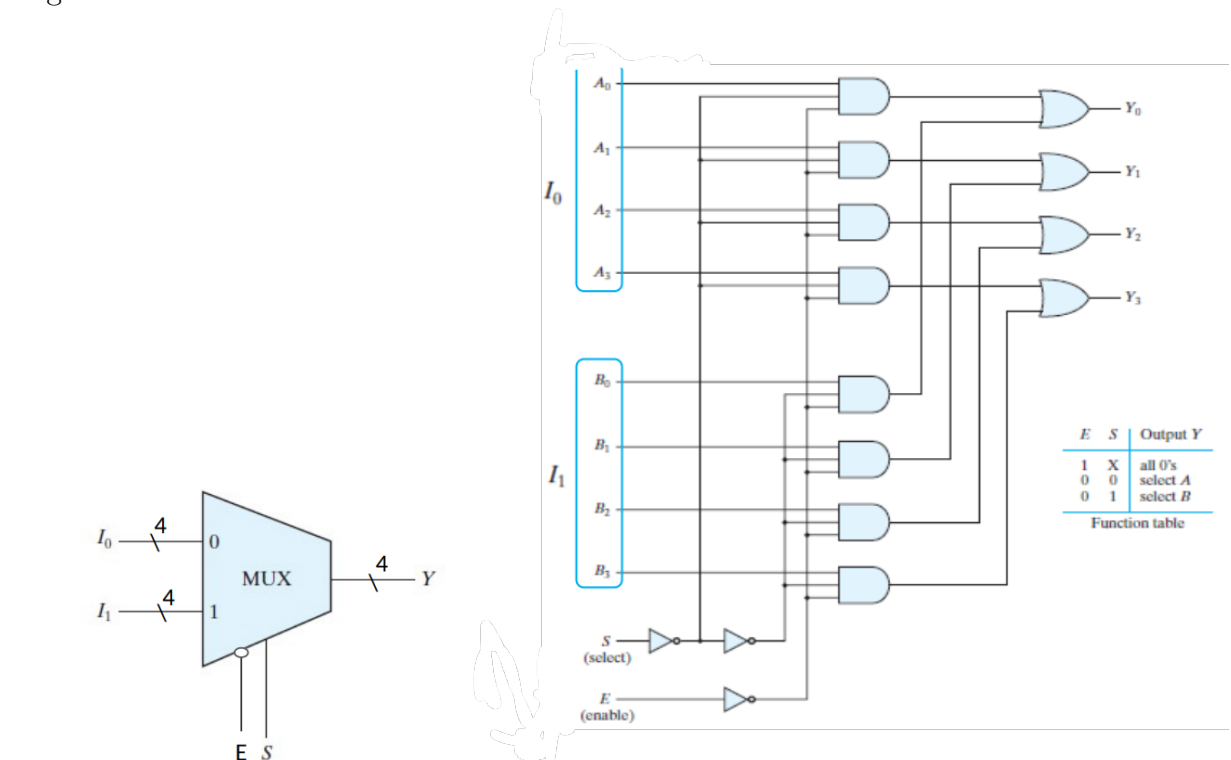


2 Mutliple bit multiplexer

A bus

- Multiple bits passed through input or output
- number denotes how many bits are on said bus

The figure below has a one bit enable and a 1 bit select line



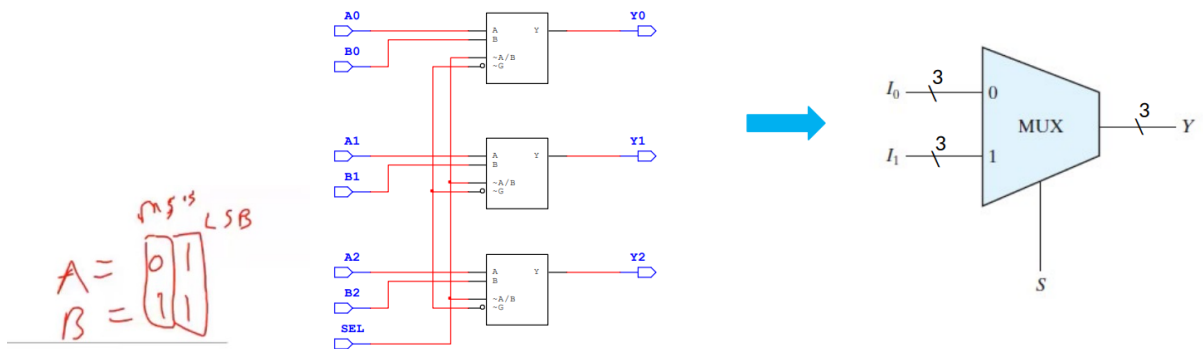
I_0 would be the LSB, while I_1 is the MSB.

2.1 Parallel multiplexer

achieving abus input without so many logic gates everywhere → Placing the multiplexers in parell will allow for bs inputs

- # multiplexers in parallel = number of bits on each bus inputs Each multiplexer will switch one digit of the multi-bit number

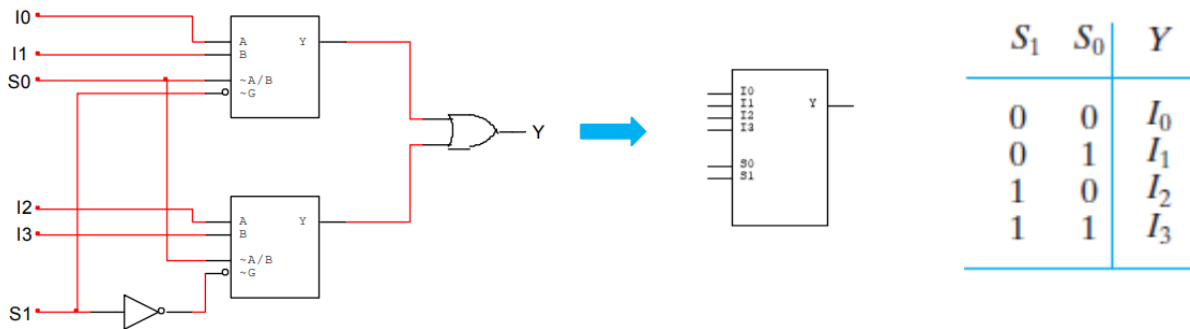
- EX: one switches MSB while other switches LSB on 2 bit number



A0 would be the LSB of input A and A2 the MSB.

2.2 Cascading Multiplexers

- Use the enable on multiplexer to create an additional select line
- Connect remaining select lines together
- OR outputs for each multiplexer



bottom multiplexer is the MSB multiplexer, top is the LSB in this example.

3 Implementing Combinational Circuits

Multiplexers can implement outputs of a truth table (implementing minterms).

- There will be one multiplexer per output.
- number of select lines on multiplexers is $\#$ inputs - 1
- Remaining bits become the inputs to the select lines
- 3 inputs truth table uses 2 select lines, which is a 4 input multiplexer
- Divide truth table rows by two, and compare how LSB changes to output. This becomes the input to the multiplexer

Example

$$\#s = 3 - 1 = 2$$

$$2^2 = 4$$

Implement truth table with multiplexer

