Logical Design

Lecture 13

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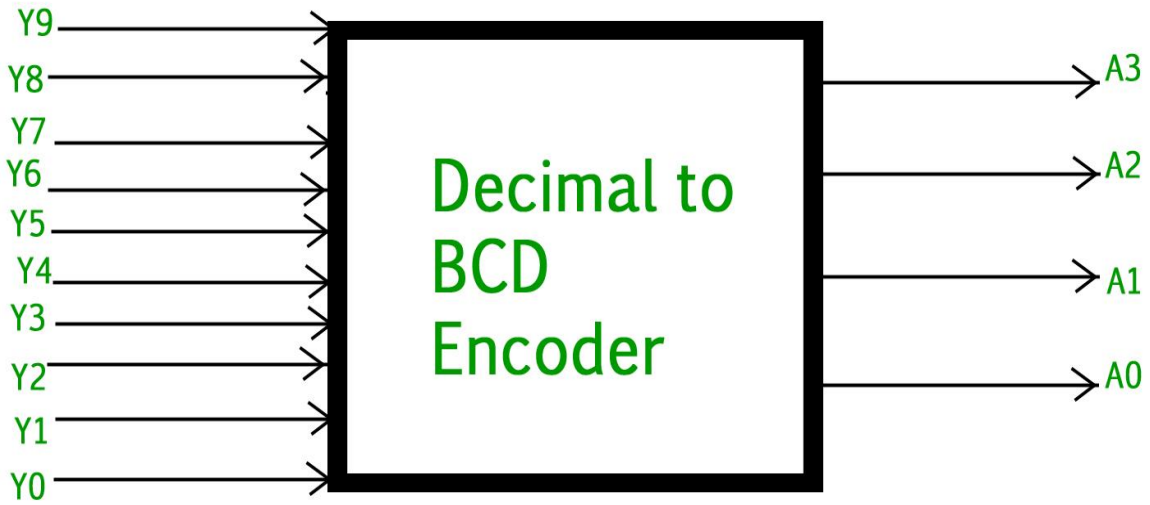
Decimal to BCD Encoder

Homework:

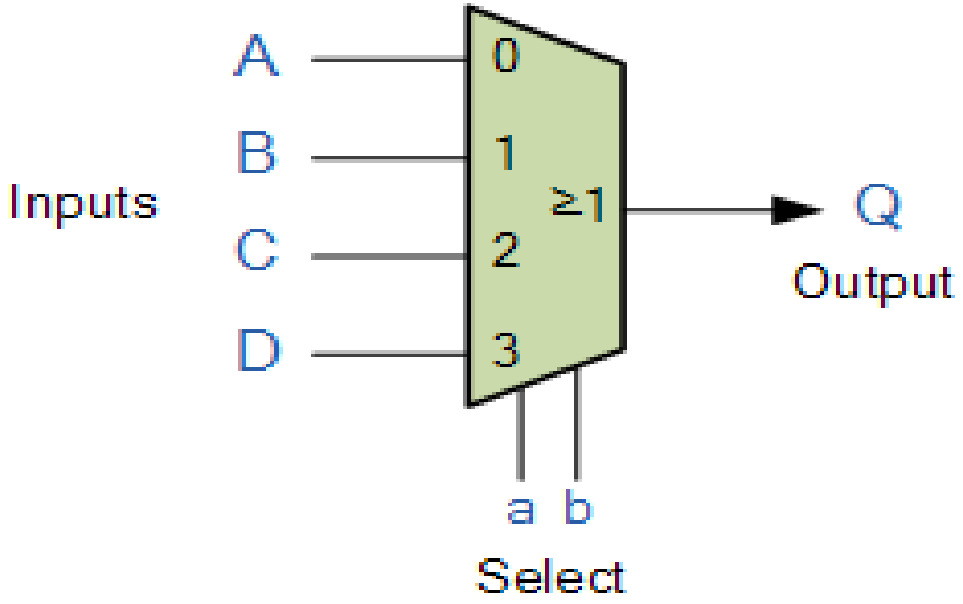
Design a decimal to binary encoder. The decimal to binary encoder consists of **10 input lines** and **4 output lines**. Each input line corresponds to each decimal digit and 4 outputs correspond to the BCD code. This encoder accepts the decoded decimal data as an input and encodes it to the BCD output which is available on the output lines.



Multiplexers (MUX)

The **multiplexer** is a combinational logic circuit designed to switch one of several input lines to a single common output line

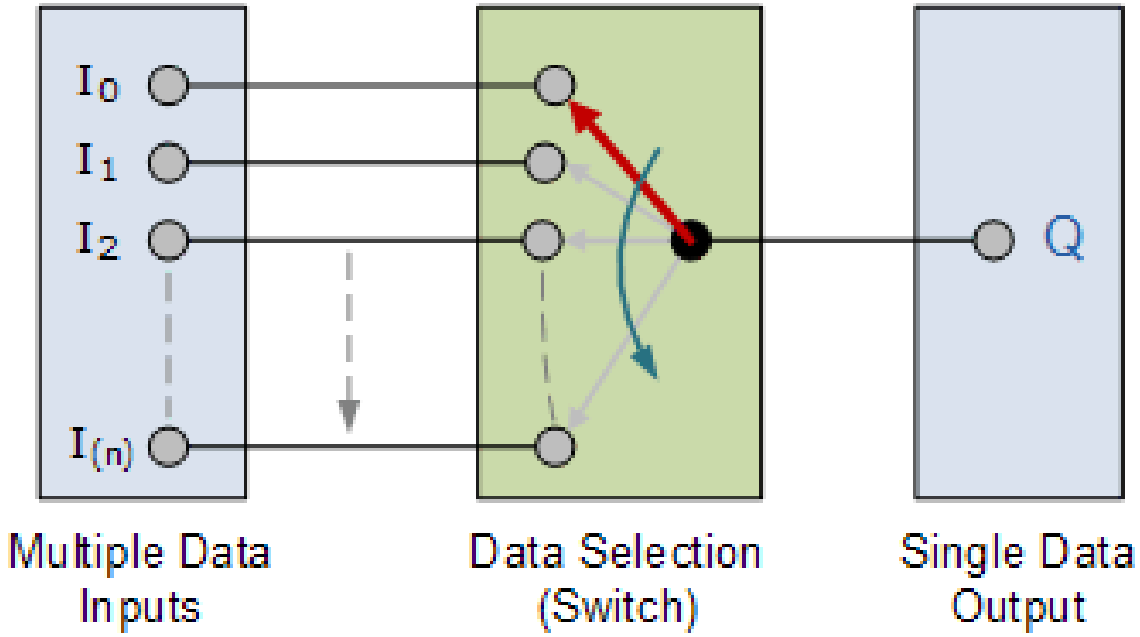
- Reduce the number of wires
- Reduce circuit complexity and cost
- The multiplexer is a very useful electronic circuit that has uses in many different applications such as signal routing, data communications and data bus control applications.



Multiplexers

multiplexers are also known as data selectors because they can “select” each input line.

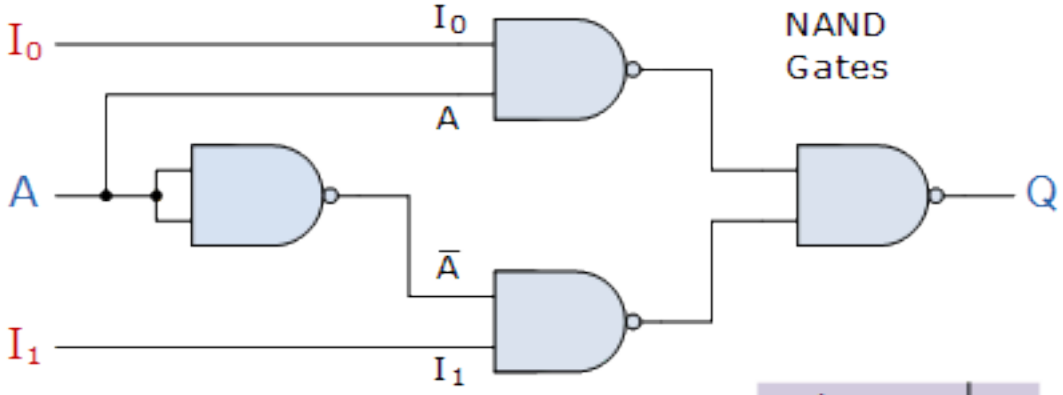
Generally, the selection of each input line in a multiplexer is controlled by an additional set of inputs called ***control lines*** and according to the binary condition of these control inputs, either “HIGH” or “LOW” the appropriate data input is connected directly to the output.

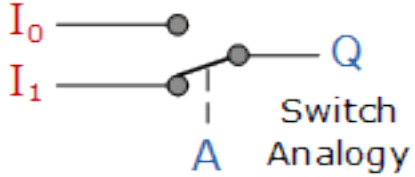


2-input Multiplexer Design

The input A of this simple 2-1 line multiplexer circuit constructed from standard NAND gates acts to control which input (I_0 or I_1) gets passed to the output at Q.

From the truth table, we can see that when the data select input, A is LOW at logic 0, input I_1 passes its data through the NAND gate multiplexer circuit to the output, while input I_0 is blocked. When the data select A is HIGH at logic 1, the reverse happens and now input I_0 passes data to the output Q while input I_1 is blocked.





Truth Table

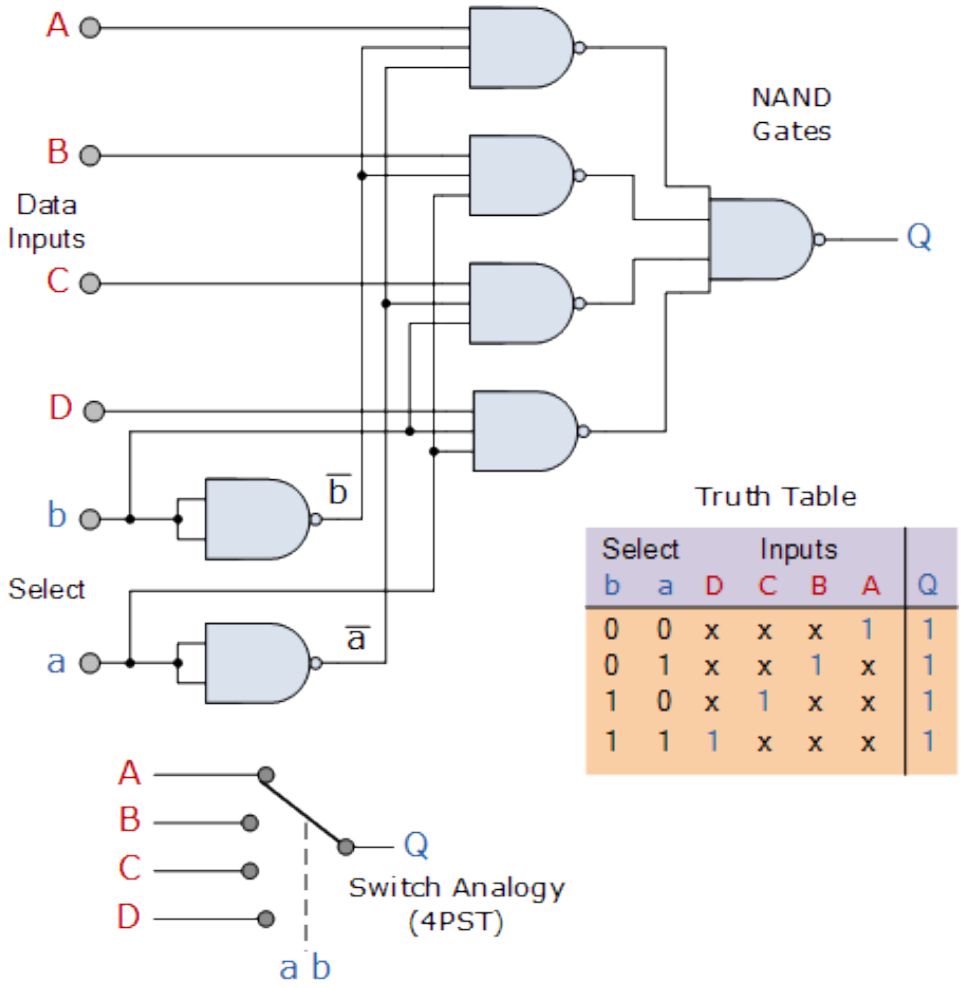
Inputs			
A	I_1	I_0	Q
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

4-to-1 Channel Multiplexer

Larger multiplexer circuits can be created using smaller 2-to-1 multiplexers as their basic building blocks, and the number of data inputs can be increased simply by following the same approach.

The Boolean expression for this 4-to-1 **Multiplexer** above with inputs A to D and data select lines a, b is given as:

$$Q = \overline{a}\overline{b}A + a\overline{b}B + \overline{a}bC + abD$$



Demultiplexers (Demux)

The *demultiplexer* is a combinational logic circuit designed to switch one common input line to one of several separate output line.

The *demultiplexer* takes one single input data line and then switches it to any one of a number of individual output lines one at a time. The **demultiplexer** converts a serial data signal at the input to a parallel data at its output lines as shown in the figure.