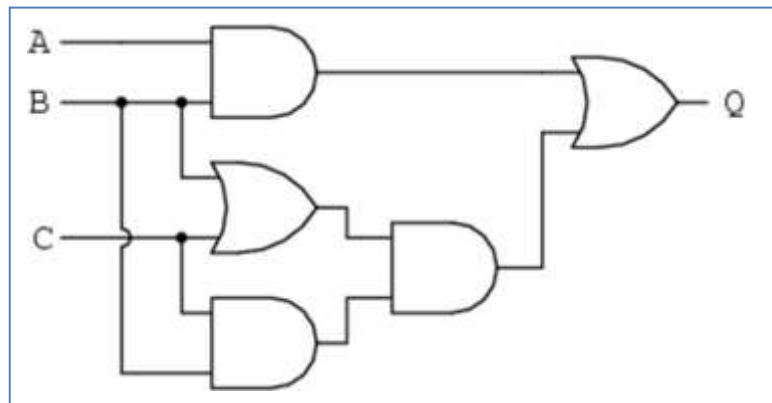# Problem #4

GOALS

- Create circuit diagrams from Boolean expression and vice versa
- Create Boolean expression and circuit diagram from truth table
- Simplify Boolean expression
- Experiment with adders and other logic circuits

Exercise 1:

1. For the following circuit diagram,

a. Apply the rules of Boolean algebra to reduce the expression to its simplest form (simplest defined as requiring the fewest gates to implement).

b. Implement the simplified expression with the "Logic Gates" applet and take a screenshot.

Exercise 2:

1. Start the "Logic Gates" applet.

2. Add two switches, one XOR and one output, and connect them.

3. Press the *Run* button and try out all four combinations of inputs for the switches, recording the results in a truth table (you should create a separate truth table in your word document and not a truth table in your applet!). Take 4 screenshots for each of those four possible combinations.

Exercise 3:

1. Start the "Logic Gates" applet again.

2. Create the same circuit as previously, but this time insert a NOT box between XOR and the output.

3. Press the *Run* button and try out all 4 values by changing the switch values. You do not have to take screenshots, but again record the results in a truth table (create a separate truth table in your word document and not a truth table in your applet!) so you can see the values.

Exercise 4:
Create the following half adder using the "Logic Gates" applet.
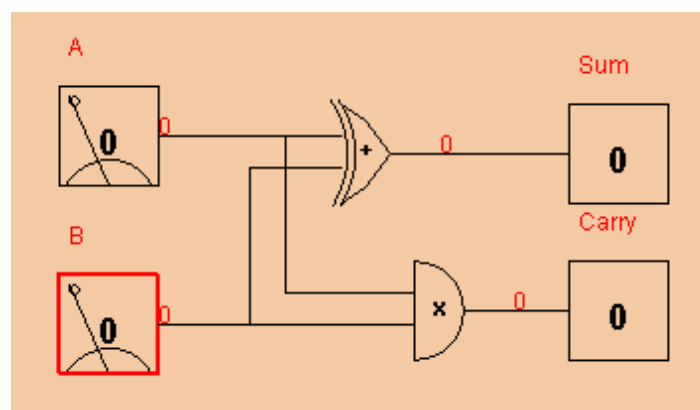
a. Write the truth table for this circuit. There are two inputs and two outputs.

b. Test the circuit using the applet. Make sure you label your switches (inputs) and outputs. Take a screenshot of the circuit that is created by the "Logic Gates" applet.
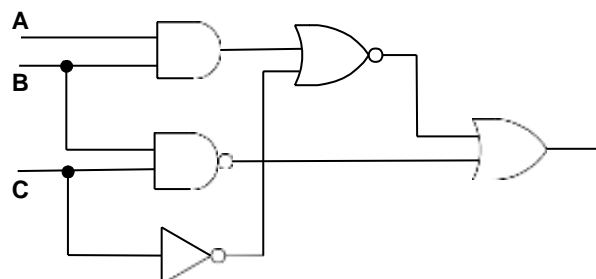
Exercise 5:

1. Given the following truth-table, where W is the output.

A	B	C	W
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

Implement the simplified expression with "Logic Gates" applet, and insert a screenshot here.

Exercise 6:

1. Use the "Logic Gates" applet to implement the following circuit and take a screenshot.

2. Analyze the behavior of the above circuit with a truth table and show the table here?