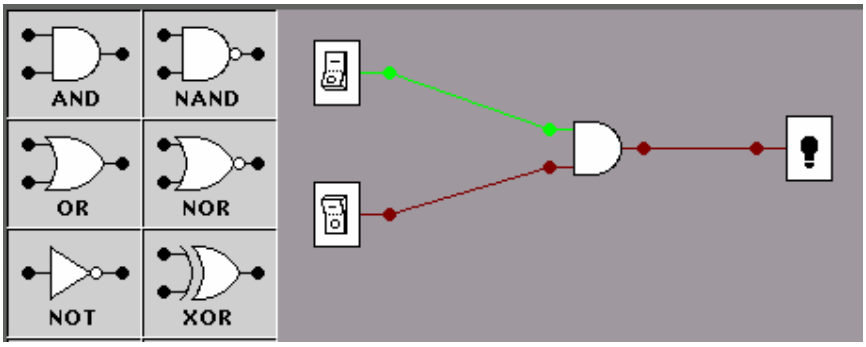
Circuit Emulator

A circuit emulator is available at:
http://www.brookscole.com/compsci_d/templates/student_resources/0534953654_deckerhirchfield/aeonline/course/7/1/index.html

A copy is located on your course CD under Circuits.



This circuit contains a single AND gate. It represents a **burglar alarm.** The top switch turns the alarm on and off. The bottom switch represents a sensor in the door, which produces a signal when the door is opened. The light represents the alarm signal, which goes on if the door opens when the alarm is active.

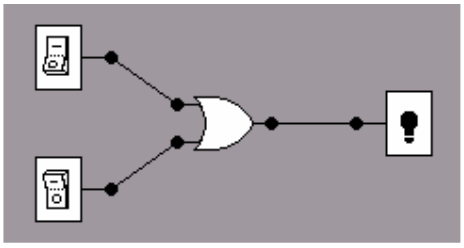
(1) Use the circuit emulator to construct this circuit. Then fill in the following chart.

Alarm	**Door**	**Alert = Light**
Off	Closed (off)	Off – no alarm
Off	Open (on)	
On	Closed (off)	
On	Open (on)	On – ALARM!!

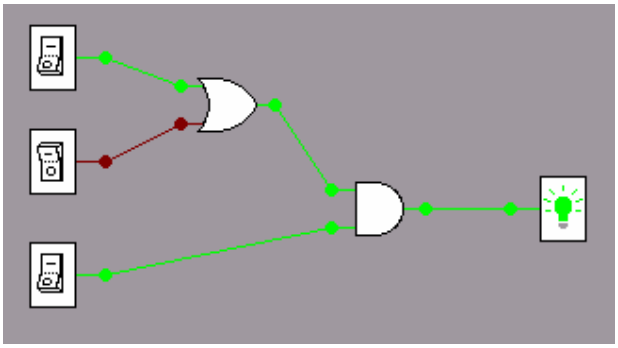
(2) For simplicity, circuit signals are represented as 1 (on) or 0 (off). Here is the chart for the burglar alarm, written with 1's and 0's. Fill in the last column with 1's and 0's.

Alarm	**Door**	**Alert = Light**
0	0	
0	1	
1	0	
1	1	

(3) Similar circuits can be constructed with each of the **Logic Gates.** Construct the table for an **OR gate**, and fill in the corresponding truth table.

OR gate	**Input A**	**Input B**	**Output (A OR B)**
	**0**	**0**	_____
	0	**1**	_____
	1	**0**	_____
	1	**1**	_____

(4) Using an **XOR gate,** construct the circuit, sketch it on paper, and write the truth table**.**
Then do the same for **NOR** and **NAND.**



The circuit above represents a burglar alarm. One of the switches turns the alarm on and off. The other two switches represent sensors: one sensor on a door, the other sensor on a window.

(5) Label the switches as **Alarm, Door, and Window.**

(6) Label the **logic gates** with the standard names.

(7) Fill in the truth table for the circuit:

Alarm	Door	Window	Alert = Light
0	0	0	0
0	0	1	
0	1	0	
1	1	1	1

(8) **Sketch** a circuit with 3 switches, an **AND gate** and an **OR gate,** but reverse the positions from the circuit above. Without building the circuit, write a truth table and **predict** what the outputs will be. Then build the circuit and check your predictions.

(9) **Sketch** a circuit with 3 switches, and 2 **XOR gates.** Without building the circuit, write a truth table and **predict** what the outputs will be. Then build the circuit and check your predictions.

(10) ***Stairwell Light Switches***

A light in a stairwell can be turned on or off by the switch on the bottom floor.
It can also be turned on or off by the switch on the middle floor.
It can also be turned on or off by the switch on the top floor.
Here is the truth table describing the logic:

Switch A	Switch B	Switch C	Light
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

Using any gates you wish, build a circuit for this problem.