

Activity - Exploring Logic Gates

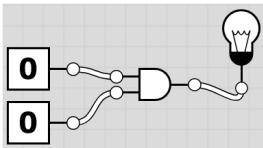
Getting Started:

1. Bring up a web-browser and navigate to
 - logic.ly/demo/
2. Deselect the "Display at Startup" option and click "Close" on the popup.

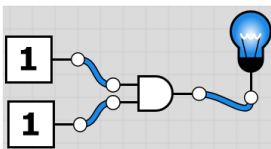
Activity One – The AND Gate

1. Using the menu system on the left side of the screen, drag out:
 - two "Low Constant" inputs from the "Input Controls"
 - one "Light Bulb"
 - one "AND" gate

Arrange them in roughly the following manner and "add wires" to create the following circuit



2. Notice that when the two inputs are 0s, the lightbulb does not light up. [The output is 0]. Given that the gate we are using is the "AND" gate, does this make sense? Why or why not?
3. One at a time click on the "Low Constant" inputs (the zeros) and delete them. Replace them with two High Constant inputs and wire them up so that they look like this:



4. Notice that when the two inputs are 1s, the lightbulb lights up. [The output is 1]. Given that the gate we are using is the "AND" gate, does this make sense? Why or why not?

5. Suppose that you replace the top "High Constant" input (a 1) with a "Low Constant" (a 0). PREDICT: Do you predict that the lightbulb will be on or off? Why?

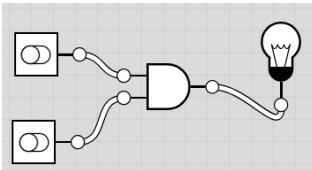


6. Try it. Were you right? If not, why do you think the circuit works the way it does?

7. Suppose you were to reverse the 1 and 0 so that the 1 is on the bottom and the 0 on the top. PREDICT: Do you predict that the lightbulb will be on or off? Why?

8. Try it. Were you right?

9. Replace the High/Low Constant inputs with two "Toggle Switch" icons and wire up like before:



10. Click on the switch icons several times each. What things change when you click on them?

11. Notice that one "version" of the switch acts like a "High Constant" input while the other acts like a "Low Constant" input. Describe which is which.

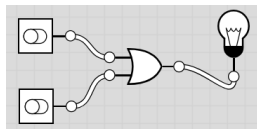
12. While this is largely a repeat of what you have seen so far, complete the following table to indicate whether the lightbulb is off/on for the four possible combinations of these two switches [Note: Off is switch to the left and On is switch to the right.]

Top Switch	Bottom Switch	Lightbulb status
Off	Off	
On	Off	
Off	On	
On	On	

13. Write a summary of how the AND gate works. How/where might you use an AND gate in a computer?

Activity Two – The OR Gate

1. Replace the AND gate in your diagram from #9 in the previous activity with an OR gate and connect it up again so it looks like this.



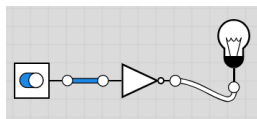
Similar to what you did in Activity One, complete the following table to indicate whether the lightbulb is off/on for the four possible combinations of these two switches.

Top Switch	Bottom Switch	Lightbulb status
Off	Off	
On	Off	
Off	On	
On	On	

2. Write a summary of how the OR gate works. How/where might you use an OR gate in a computer?

Activity Three – The NOT Gate

1. Replace the OR gate from the previous activity with a NOT gate (don't be distracted by the "Buffer" which has a similar, but slightly different, shape) and wire it up like the following:



Similar to what you did in the previous activities, complete the following table

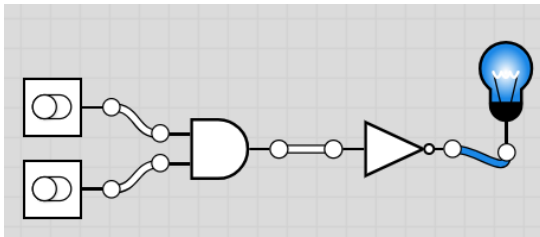
Switch	Lightbulb status
Off	
On	

2. Why are there only two rows in the table for the NOT gate when there were four rows in the tables for the AND gate and the OR gate?
3. Write a summary of how the NOT gate works. How/where might you use a NOT gate in a computer?

Activity Four – Combinations of Gates

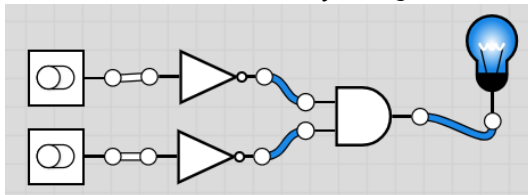
Most sources will refer to seven **basic** logic gate types. The previous activities discussed three – AND, OR, and NOT. The other four types (XOR, NAND, NOR, and XNOR) can be made from combinations of these three basic gates and how they can produce other gates when working together.

1. Consider the following circuit diagram. PREDICT how this will behave as you toggle the two switches. Test it. Were you right or wrong? Why or why not? [Suggestion: you might find a table like the one in Activities 1-3 to be helpful]



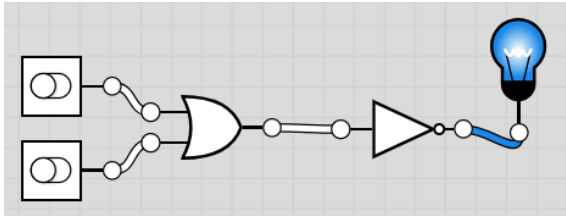
2. This combination produces the same results as the NAND gate. Write a summary of how the NAND gate works. How/where might you use a NAND gate in a computer?

3. Consider the following circuit diagram. PREDICT how this will behave as you toggle the two switches. Test it. Were you right or wrong? Why or why not?



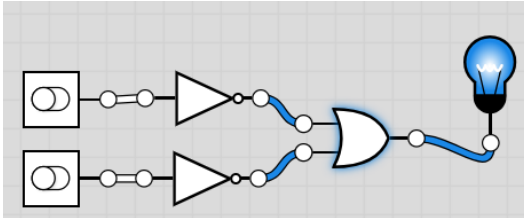
While this circuit was made from a combination of NOT and AND gates, notice that this is not the same as a NAND gate. The specific order of elements in a logic circuit matters.

4. Consider the following circuit diagram. PREDICT how this will behave as you toggle the two switches. Test it. Were you right or wrong? Why or why not? [Suggestion: you might find a table like the one in Activities 1-3 to be helpful]



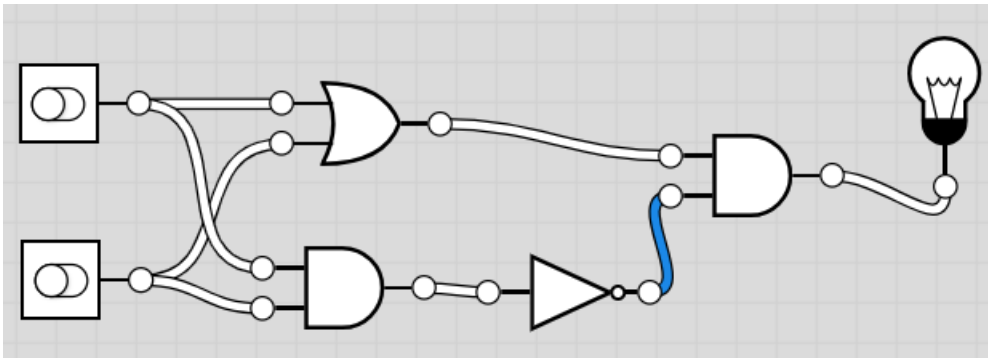
5. This combination produces the same results as the NOR gate. Write a summary of how the NOR gate works. How/where might you use a NOR gate in a computer?

6. Consider the following circuit diagram. PREDICT how this will behave as you toggle the two switches. Test it. Were you right or wrong? Why or why not?

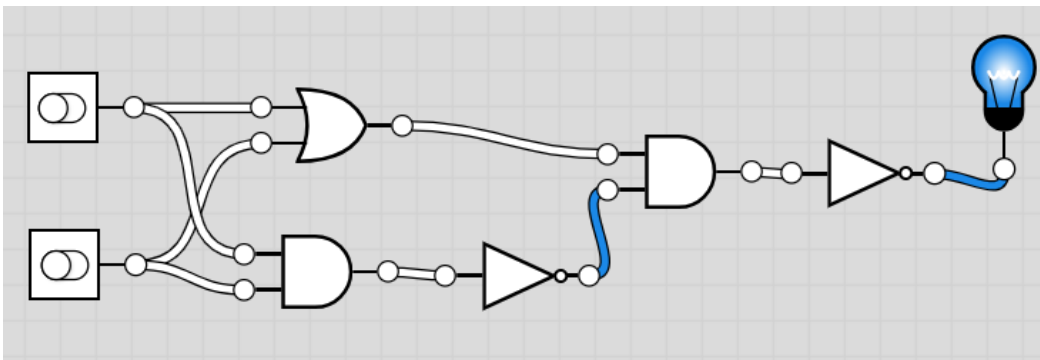


Again, while this circuit was made from a combination of NOT and OR gates, notice that this is not the same as a NOR gate. The specific order of elements in a logic circuit matters.

7. Consider the following circuit diagram. PREDICT how this will behave as you toggle the two switches. This one is getting a little more complex. So, think through the process carefully. Test it. Were you right or wrong? Why or why not?



8. This combination produces the same results as the XOR gate. Write a summary of how the XOR gate works. How/where might you use a XOR gate in a computer?
9. Consider the following circuit diagram. PREDICT how this will behave as you toggle the two switches. Test it. Were you right or wrong? Why or why not?



10. This combination produces the same results as the XNOR gate. Write a summary of how the XNOR gate works. How/where might you use a XNOR gate in a computer?