Exploring Logic Gates

Getting Started:

1. Manager, assign one person to use their computer to use for this activity. All students should be able to see this one computer.
2. Bring up a browser and navigate to logic.ly/demo/
3. Go ahead and deselect the "Display at Startup" option and click "Close" on the popup

Activity One – The AND Gate (15 minutes) Start Time: _____________

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

   ![Diagram]

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:

![Diagram](image1)

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?

![Diagram](image2)

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?

![Diagram](image3)

8. Try it. Were you right?

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

![Diagram](image4)
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

<table>
<thead>
<tr>
<th>Top Switch</th>
<th>Bottom Switch</th>
<th>Lightbulb status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td>On</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td>Off</td>
<td>On</td>
<td></td>
</tr>
<tr>
<td>On</td>
<td>On</td>
<td></td>
</tr>
</tbody>
</table>

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

Activity Two – The OR Gate (10 minutes)                      Start Time: _____________

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

2. 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

<table>
<thead>
<tr>
<th>Top Switch</th>
<th>Bottom Switch</th>
<th>Lightbulb status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td>On</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td>Off</td>
<td>On</td>
<td></td>
</tr>
<tr>
<td>On</td>
<td>On</td>
<td></td>
</tr>
</tbody>
</table>

3. Write a summary for how the OR gate works? How might you use an OR gate in a computer?
1. Replace the OR gate from the previous activity with a NOT gate and wire it up like the following:

![Diagram of OR gate replaced with NOT gate]

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

<table>
<thead>
<tr>
<th>Switch</th>
<th>Lightbulb status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td></td>
</tr>
<tr>
<td>On</td>
<td></td>
</tr>
</tbody>
</table>

3. Write a summary for how the NOT gate works? How might you use NOT gate in a computer?

4. Why are there only two rows in the table from #2 when there were four rows in the previous tables?

5. 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? [Hint, you might find a table like the one in Activities 2 and 3 to be helpful]

![Diagram of circuit diagram]

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?

![Diagram of circuit diagram]