Materials:

1 white flag and 1 black flag per student (can just be cut up pieces of construction paper)

Procedure:

Introduce the activity by talking to the class about how computers work. Computers work by passing electrical currents along and using many of them to form messages and memories, and make programs run.

In this activity, white flags represent 0, or no electric current. Black flags represent 1, or the presence of an electric current.

First, have students practice “passing an electrical current” around the room. Have them stand in a circle, and instruct them to raise the same color flag as the person in front of them. Then, pass at least 1 round of white and black flags around the circle. Essentially, they are acting as wires, passing on each message as it is.

Next, have the students practice being NOT gates, by reversing every flag they get. If the person in front of them has a white flag, raise a black flag, and if the student in front has a black flag, raise a white flag.

Put students in teams of 3: Input 1, Input 2, and Ouput. Have each team stand in a triangle with Input 1 and Input 2 behind and Output in front, with Output facing Inputs. Instruct Output to raise a black flag when both Inputs have raised a black flag, otherwise raise a white flag. Try a few times by having Inputs raise random flags and make sure Output is performing correctly.

Now, each group of three forms a computing component - an AND gate.

Next, instruct each Output to raise a black flag when either Input has a black flag - so only raise a white flag if both Inputs raise a white flag. Try a few times, make sure they are working correctly. Now, each group is an OR gate.

Finally, the students will make an XOR gate - exclusive or. Output should raise a black flag if either of the inputs has a black flag, but not if both do. So white-white should give white, white-black gives black, black-white gives black, and black-black gives white.

Now that the students know a lot of gates, try making a row of gates! What happens when you have NOT after an AND gate? What happens if you have an AND gate and an OR gate as inputs to another AND gate?