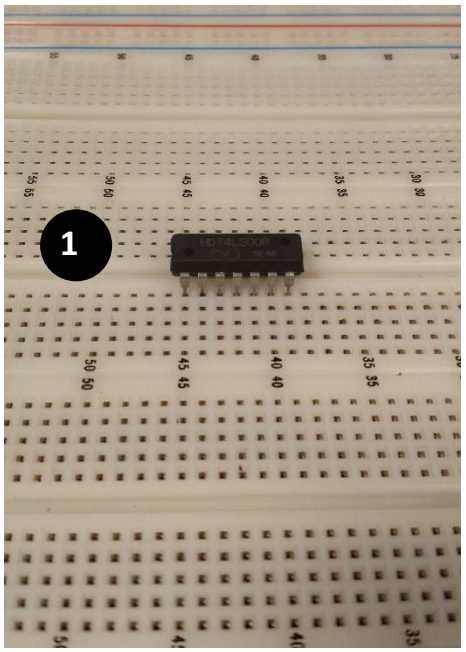
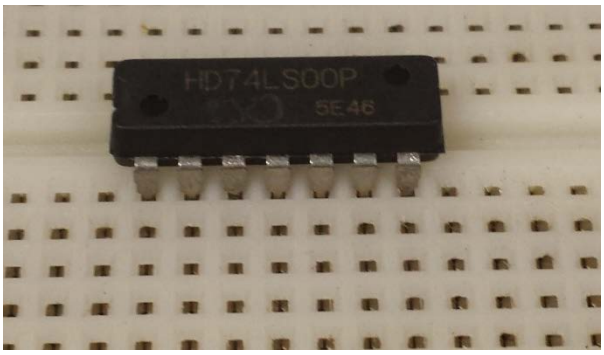
Lab experiment 1 circuit connection guide

Different colour wires (they are the same functionally) are usually used to make circuit connections easier to trace. Students are encouraged to use the same wire colours as this guide so that it is easier to follow the logic signals as well as troubleshoot in the event the connected circuit does not function as expected.

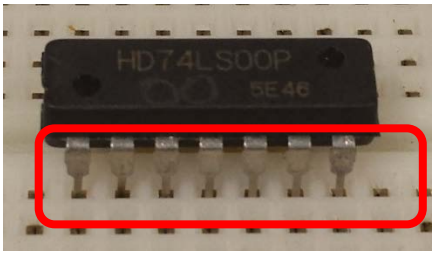
1. Mount the IC 74LS00 (quad NAND) on the breadboard across the gutter. Press the IC down **firmly** to ensure each metal pin is pushed into the breadboard.



The IC must sit across a gutter

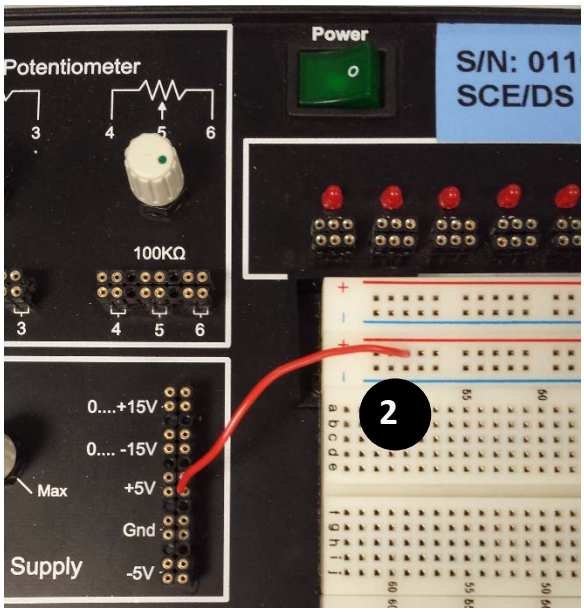


Each pin must fit firmly into a hole



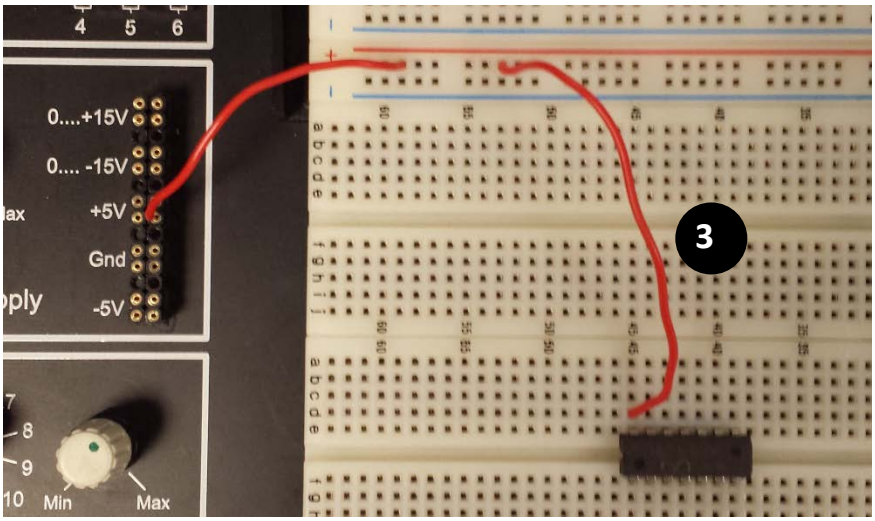
The metal pins are not fully inserted into the breadboard. This is incorrect.

2. Make a connection from the Power supply (+5V) to the breadboard's red colour rail. **Red** wire.
   Every hole on the same rail is internally connected. So it does not matter which hole is chosen for the connection.

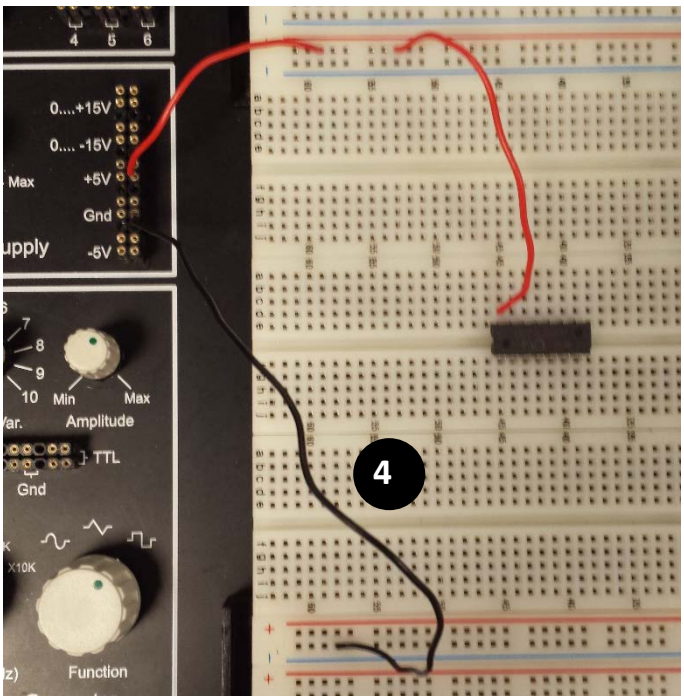


Red colour rail on breadboard

3. Make a connection from the red colour rail to the IC's Vcc (pin 14 in this case). **Red** wire. This completes the connection of power supply to Vcc of the IC.

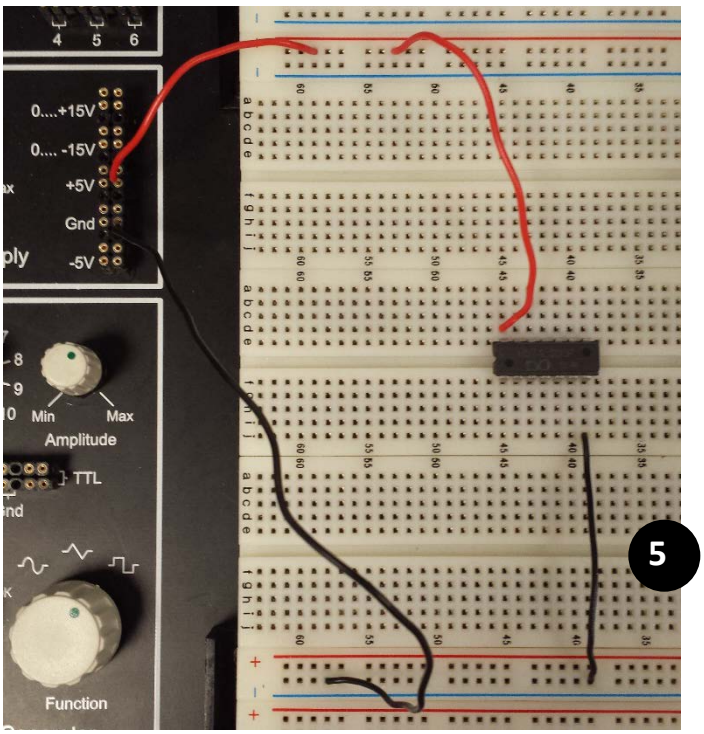


4. Make a connection from the power supply (Gnd) to the breadboard's blue colour rail. **Black** wire.

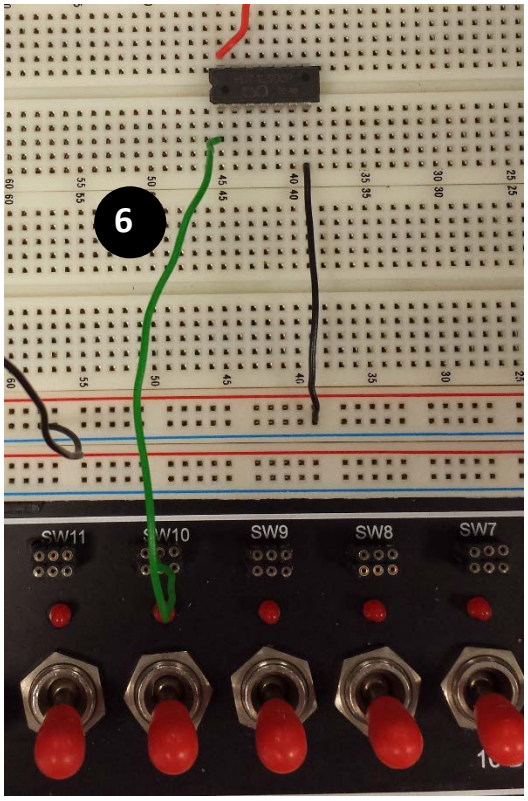


Blue colour rail on breadboard

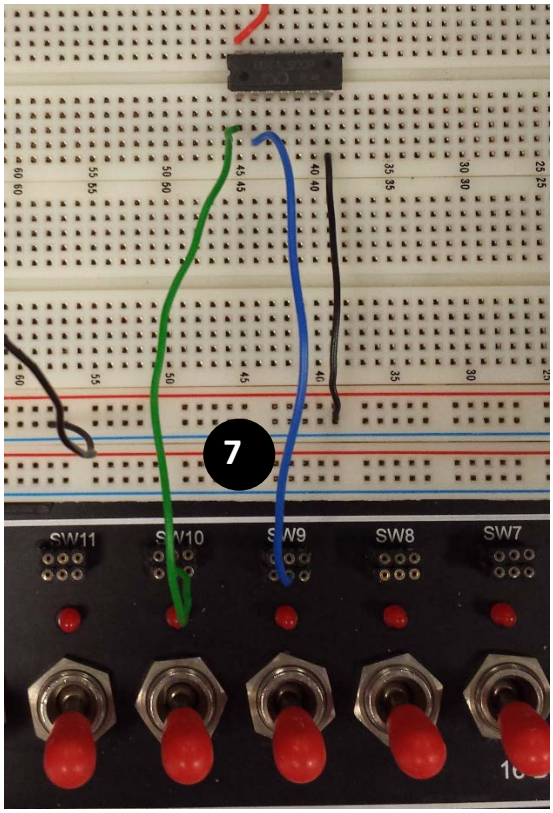
5. Make a connection from the blue colour rail to the IC's Gnd (pin 7 in this case). **Black** wire. This completes the connection from power supply to Gnd of the IC.



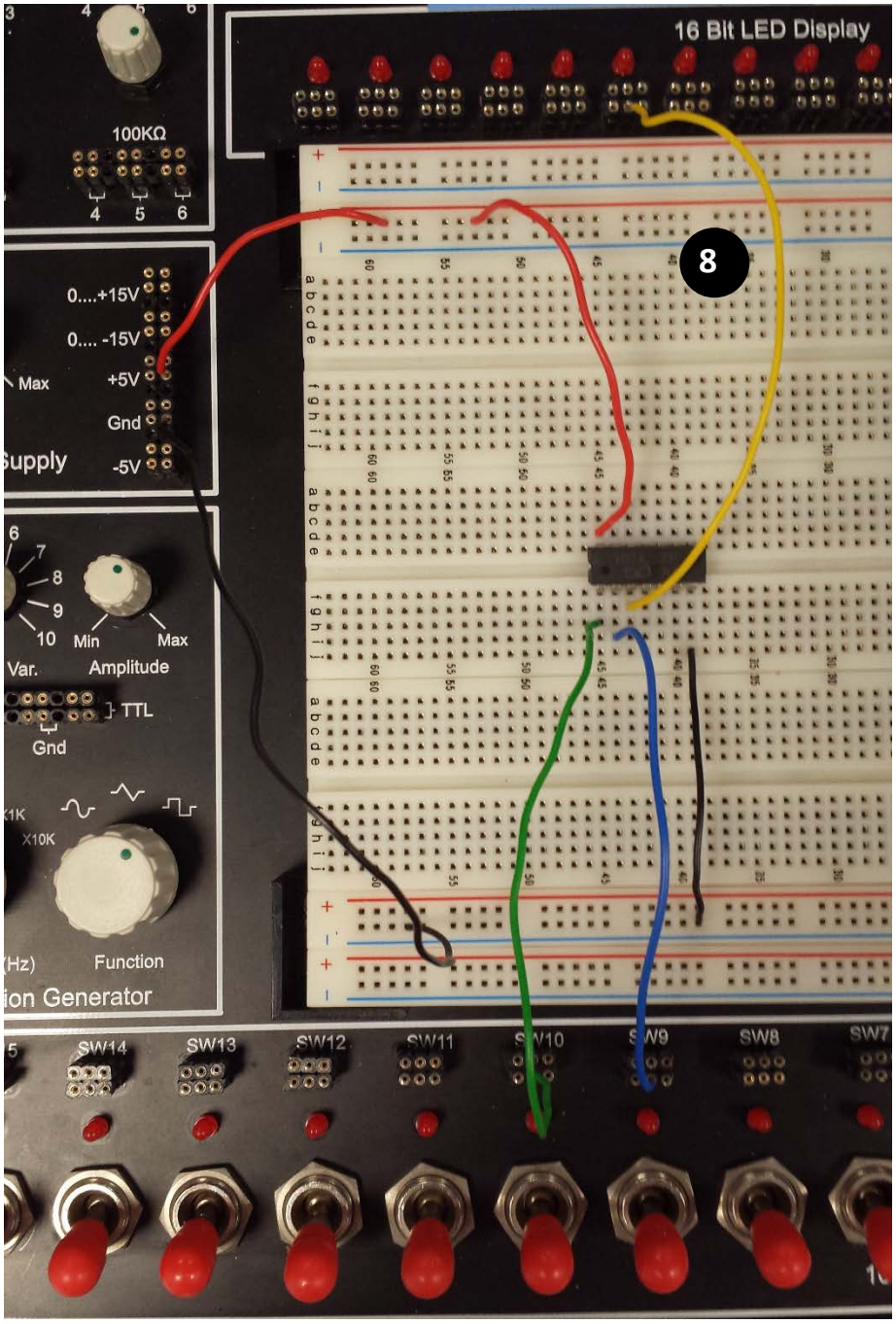
6. Make a connection from toggle switch to an input pin (pin 1 in this case). **Green** wire.



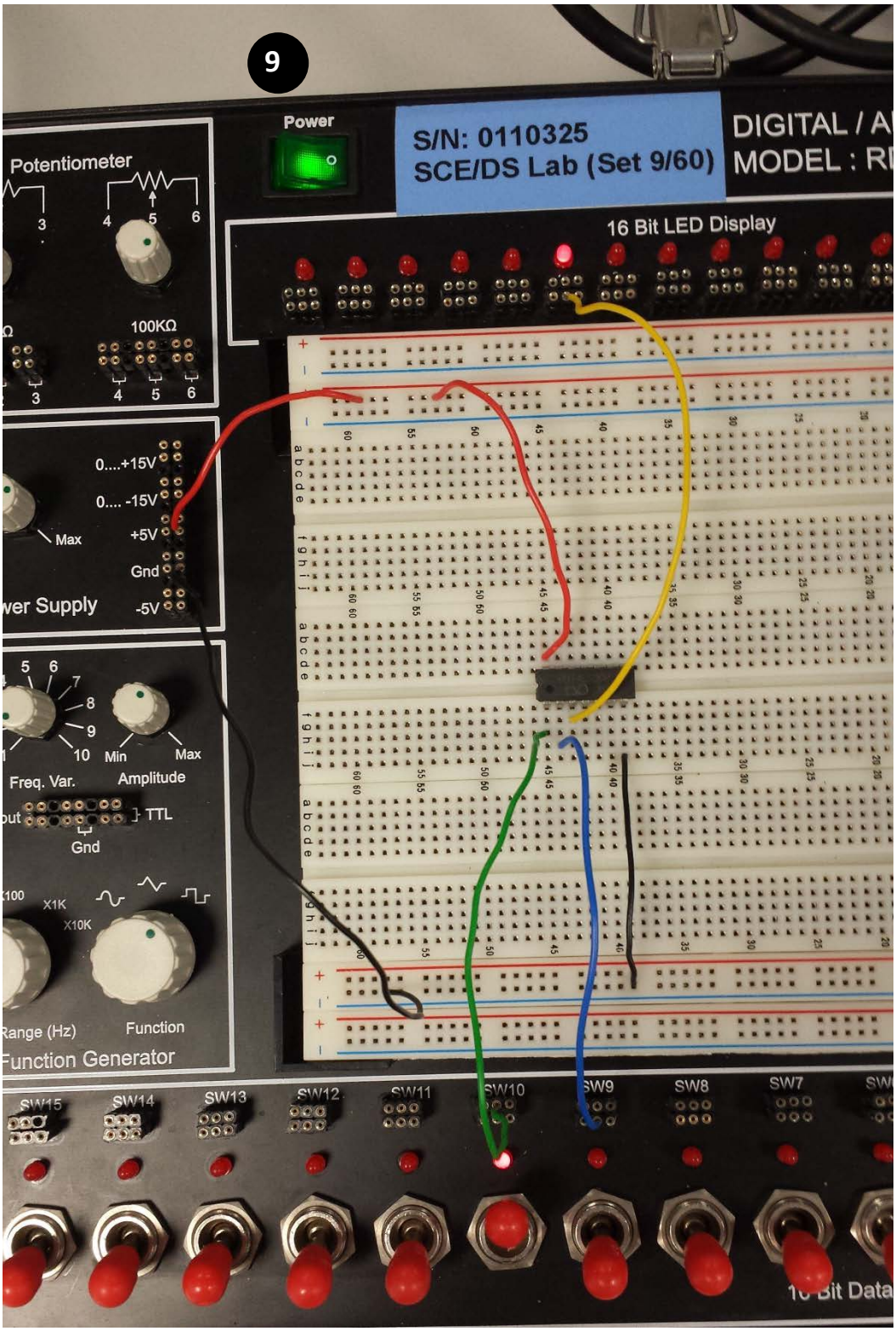
7. Make a connection from a different toggle switch to the other input pin (pin 2 in this case). **Blue** wire.



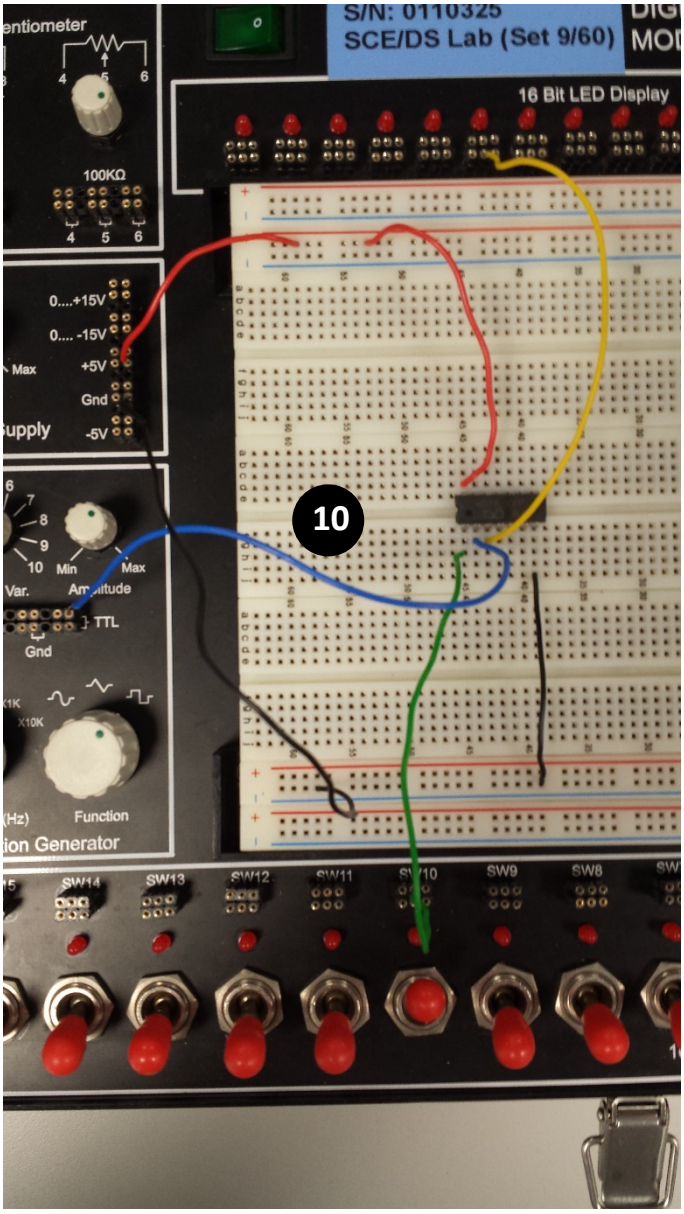
8. Make a connection from the output (pin 3 in this case) to an LED. Yellow wire. The circuit is now ready for testing.



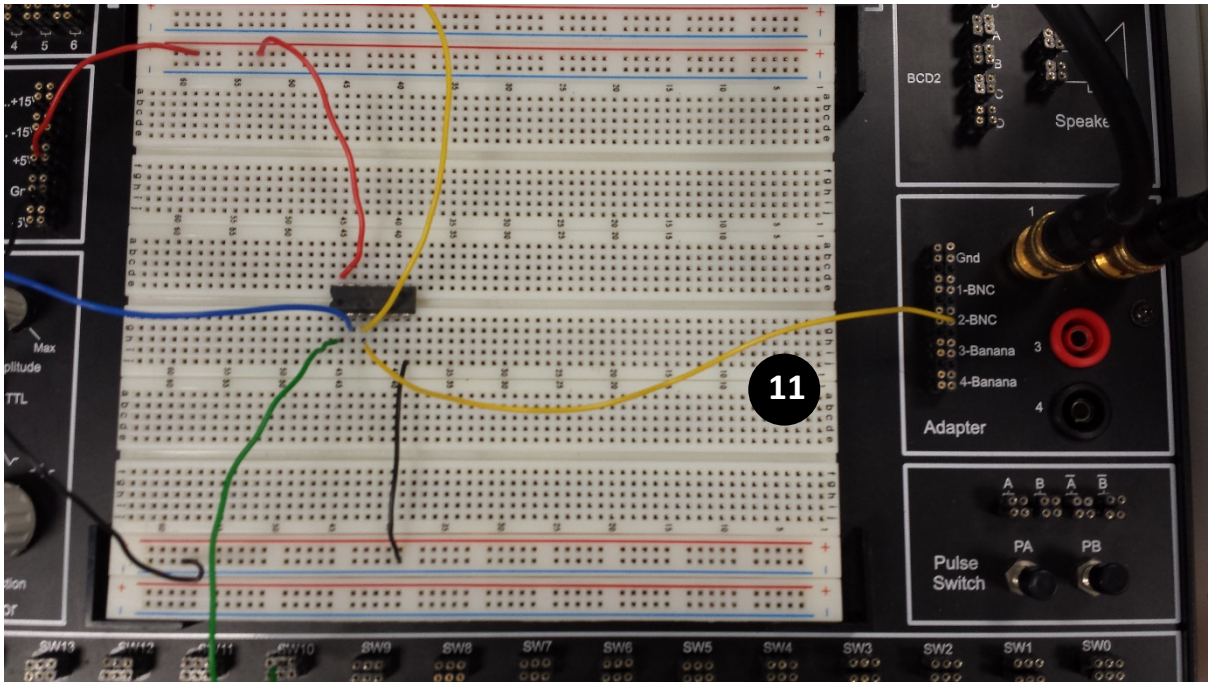
9. Turn on the power supply. Set the toggle switches to different combinations of logic values and observe the circuit output on the LED.



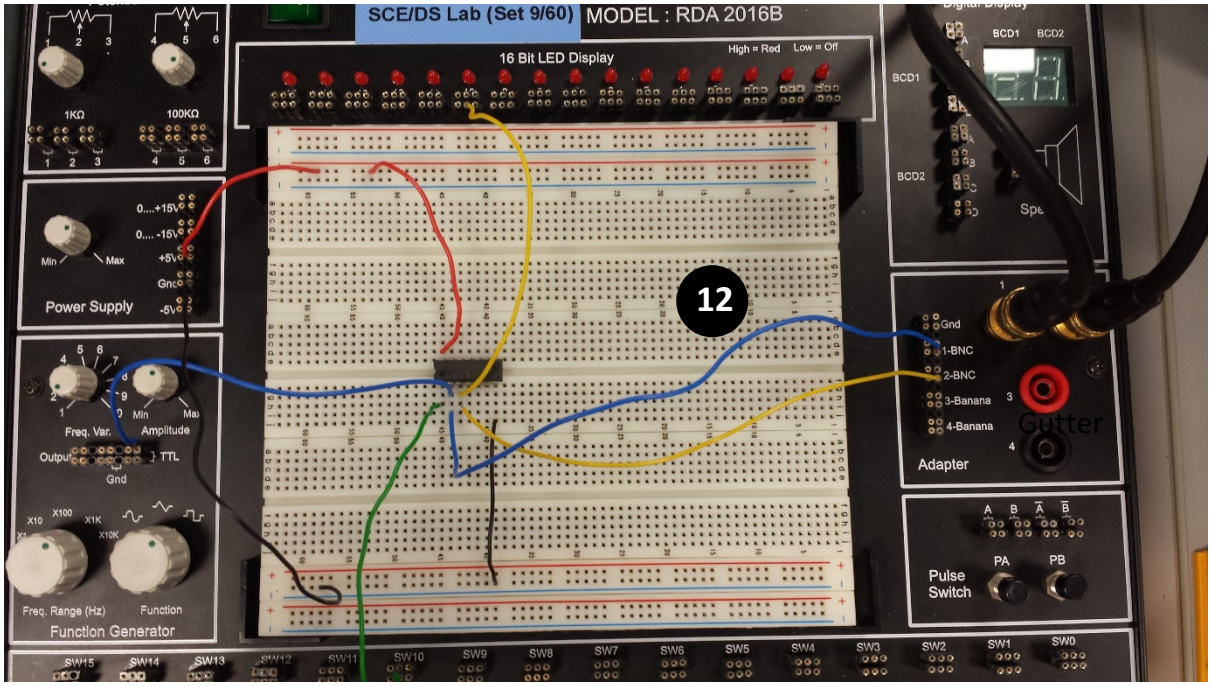
10. Disconnect the input pin 2 from the toggle switch. Instead, connect it to the TTL output of the function generator. **Blue** wire.
    Note that an input pin can only connect to one source of input: either a toggle switch (manual switching between 0 and 1) or a TTL squarewave (auto and repetitively switching between 0 and 1).



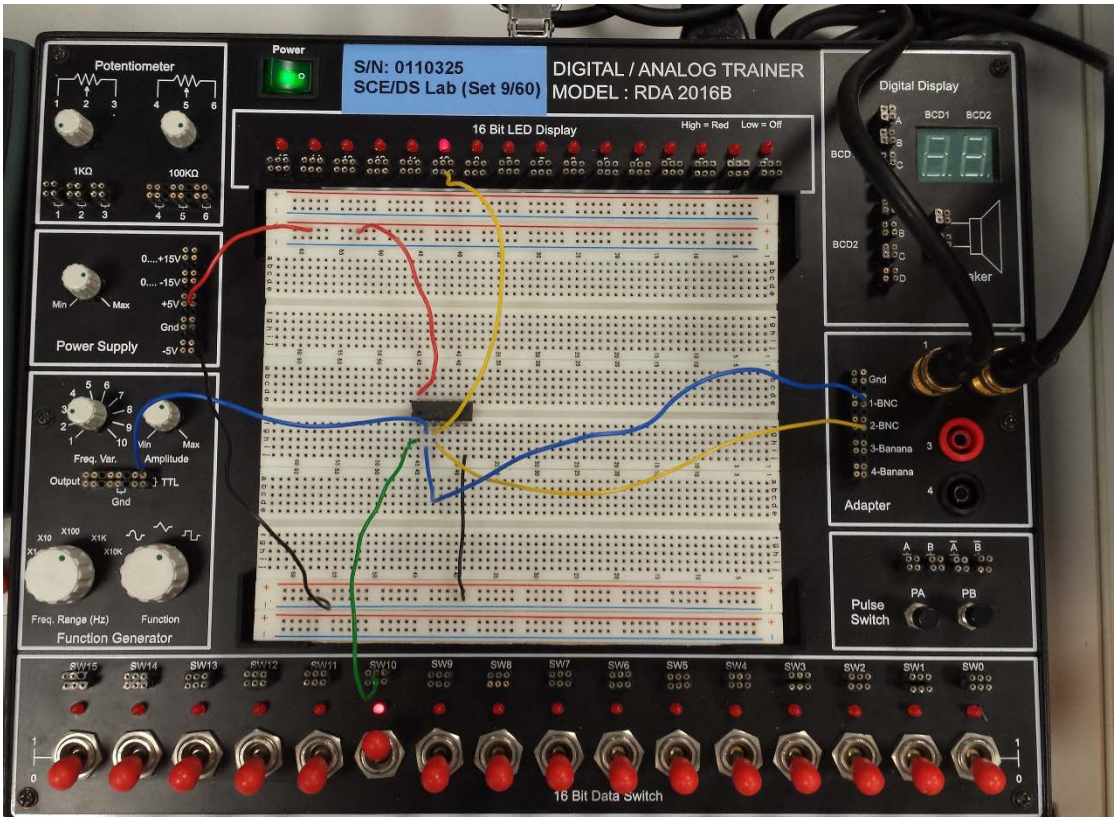
11. Make a connection from the circuit output (pin 3 in this case) to 2-BNC (Channel 2 of the oscilloscope). **Yellow** wire.

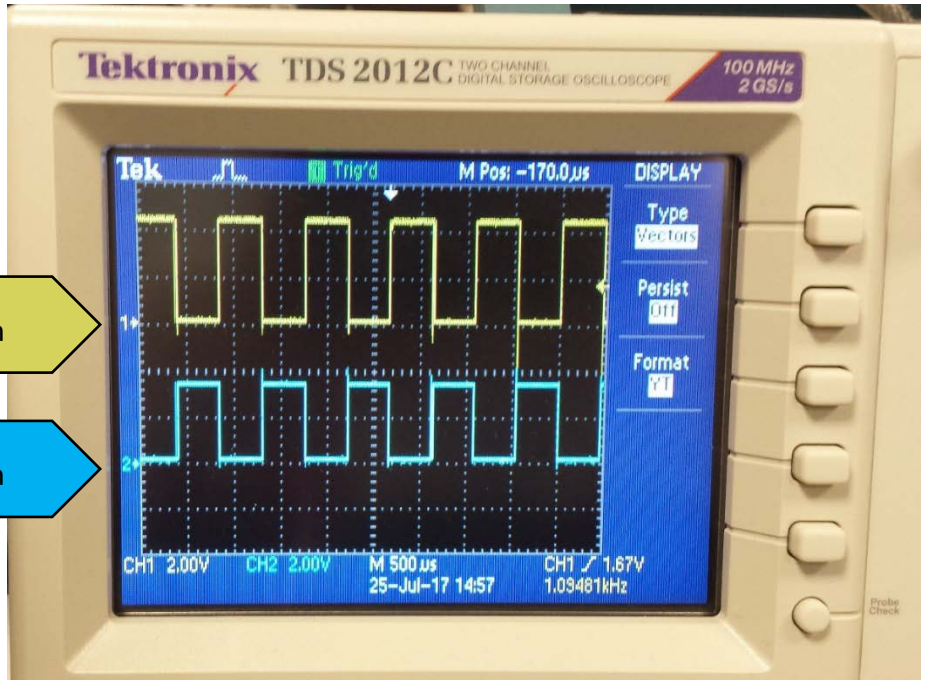


12. Make a connection from the TTL squarewave (pin 2 in this case) to 1-BNC (Channel 1 of the oscilloscope). **Blue** wire.



13. Turn on the power supply to the circuit board and turn on the oscilloscope.
    If everything is connected correctly, you should see the input and output waveforms displayed on the oscilloscope.





Channel 1 waveform

Channel 2 waveform

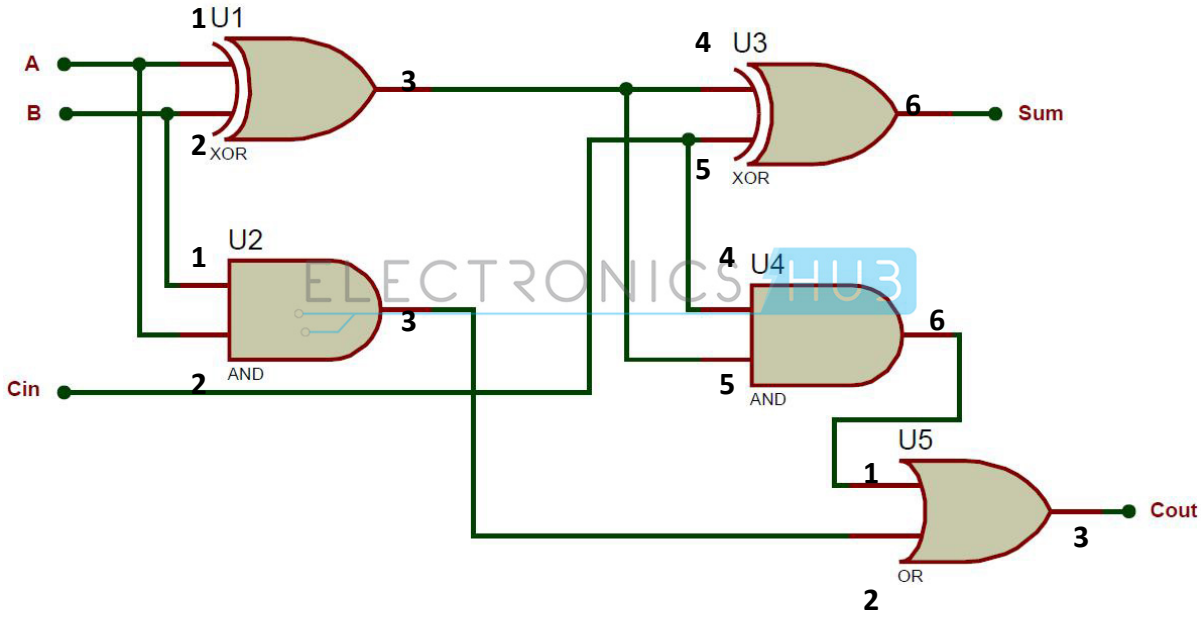
Your waveforms may not look exactly the same as these but should look similar.

Note: Not every two pins on an IC can be connected together.

An output pin can **only** be connect to an input pin. The table below shows the pairs of pins that can be connected together.

pins	Vcc	Gnd	input	output
Vcc	Yes	No	Yes	No
Gnd		Yes	Yes	No
input			Yes	Yes
output				No

Suggested circuit connection diagram for full adder



Pin 14 of each IC (XOR, AND, OR) to be connected to +5V.
Pin 7 of each IC (XOR, AND, OR) to be connected to Gnd.

Image taken from
http://www.electronicshub.org/wp-content/uploads/2014/08/Implementation-of-Full-Adder-with-2-Half-Adders.jpg

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