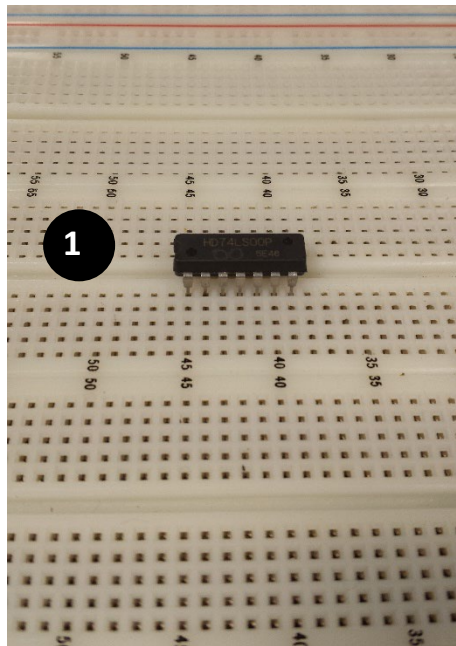


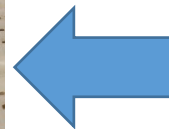
## Lab experiment 1 circuit connection guide

Different colour wires (they are the same functionally) are usually used to make circuit connections easier to trace. Students are encouraged to **follow the wire colours** suggested in this guide so that it is easier to trace 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.

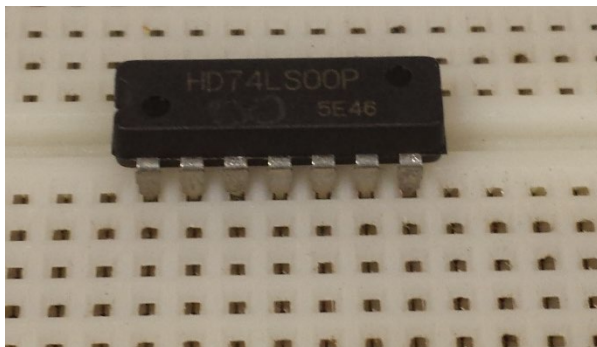


The IC must sit across a gutter

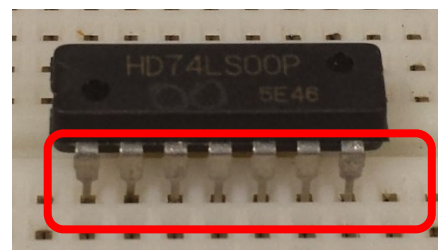


Make sure **pin 1** is at the **bottom left corner**

Pin 1



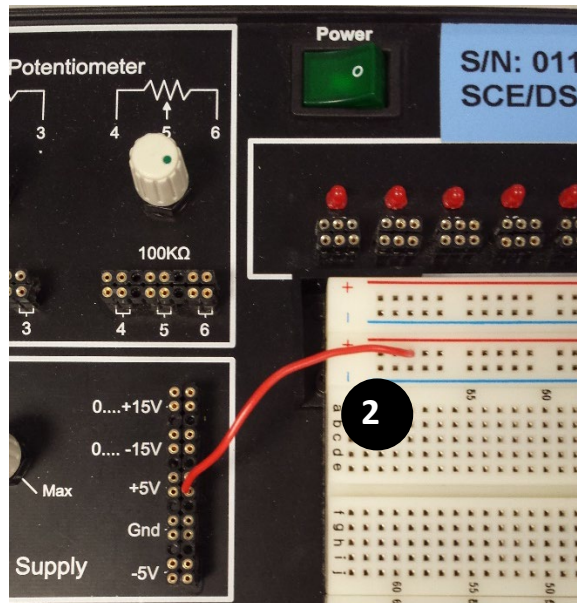
Each pin must fit firmly into a hole



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

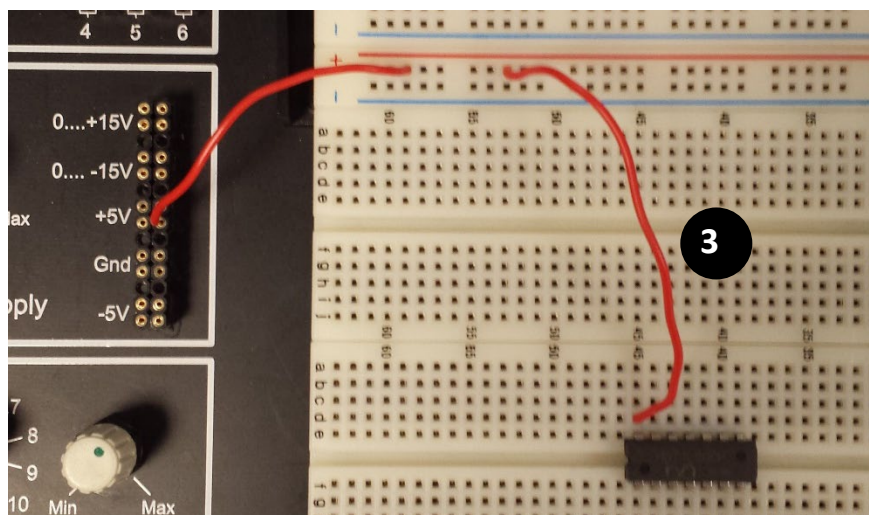
2. Make a connection from the Power supply (+5V) to the breadboard's red colour rail. **Red wire.**

Every hole on the same rail is internally connected. So it does not matter which hole is chosen for the connection.



Two separate red colour rails 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.



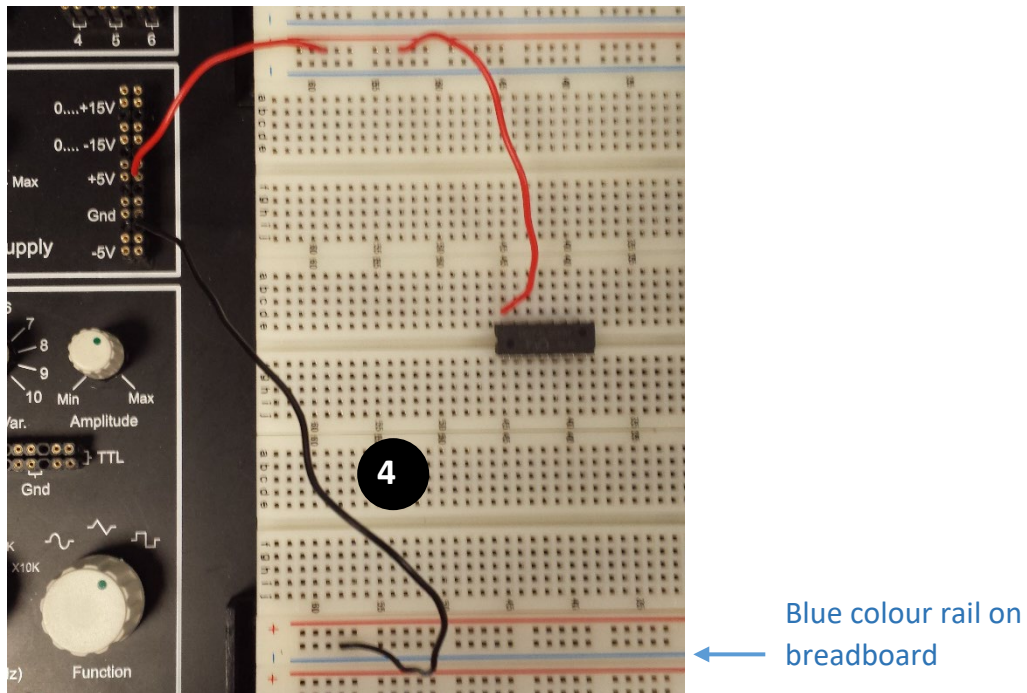
**It is IMPORTANT to connect the Vcc and Gnd of each IC correctly.**

**If you are not able to identify the pin 1 of an IC, please ask for assistance.**

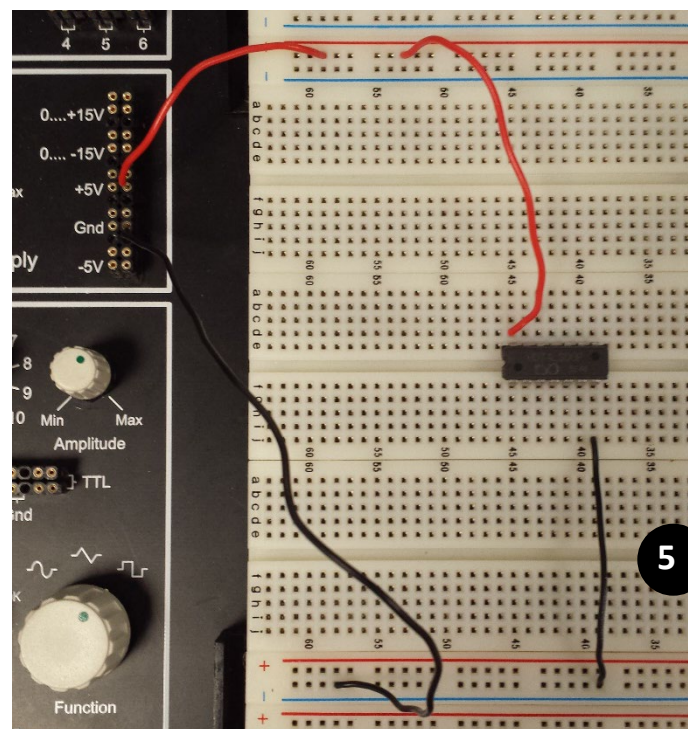
Make sure pin 1 is at the bottom left corner

Pin 1

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

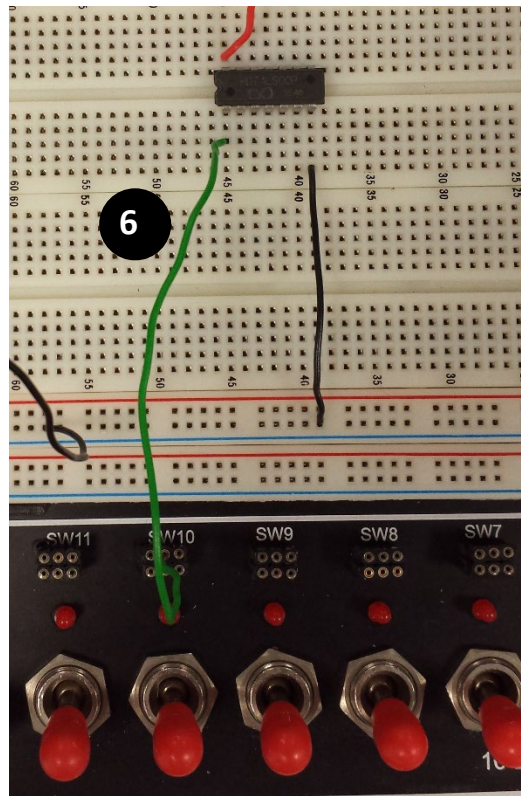


5. Make a connection from the blue colour rail to the IC's Gnd (pin 7 in this case). **Black wire.** This completes the connection from power supply to Gnd of the IC.

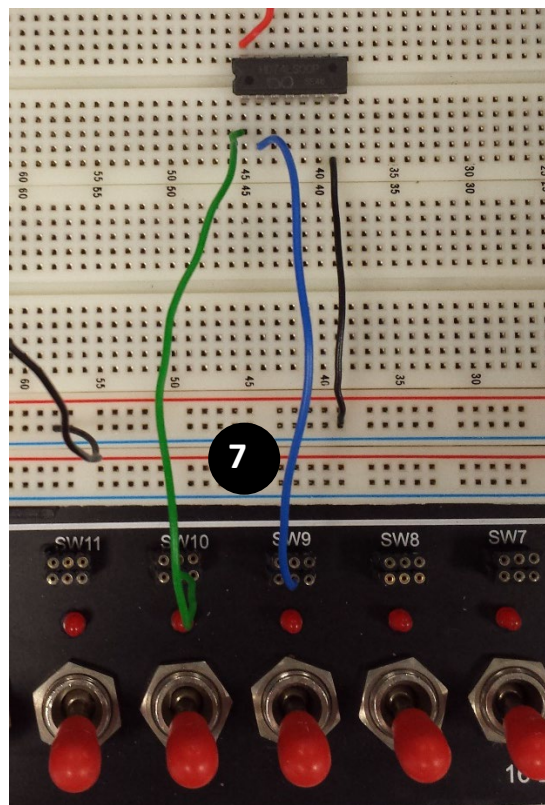




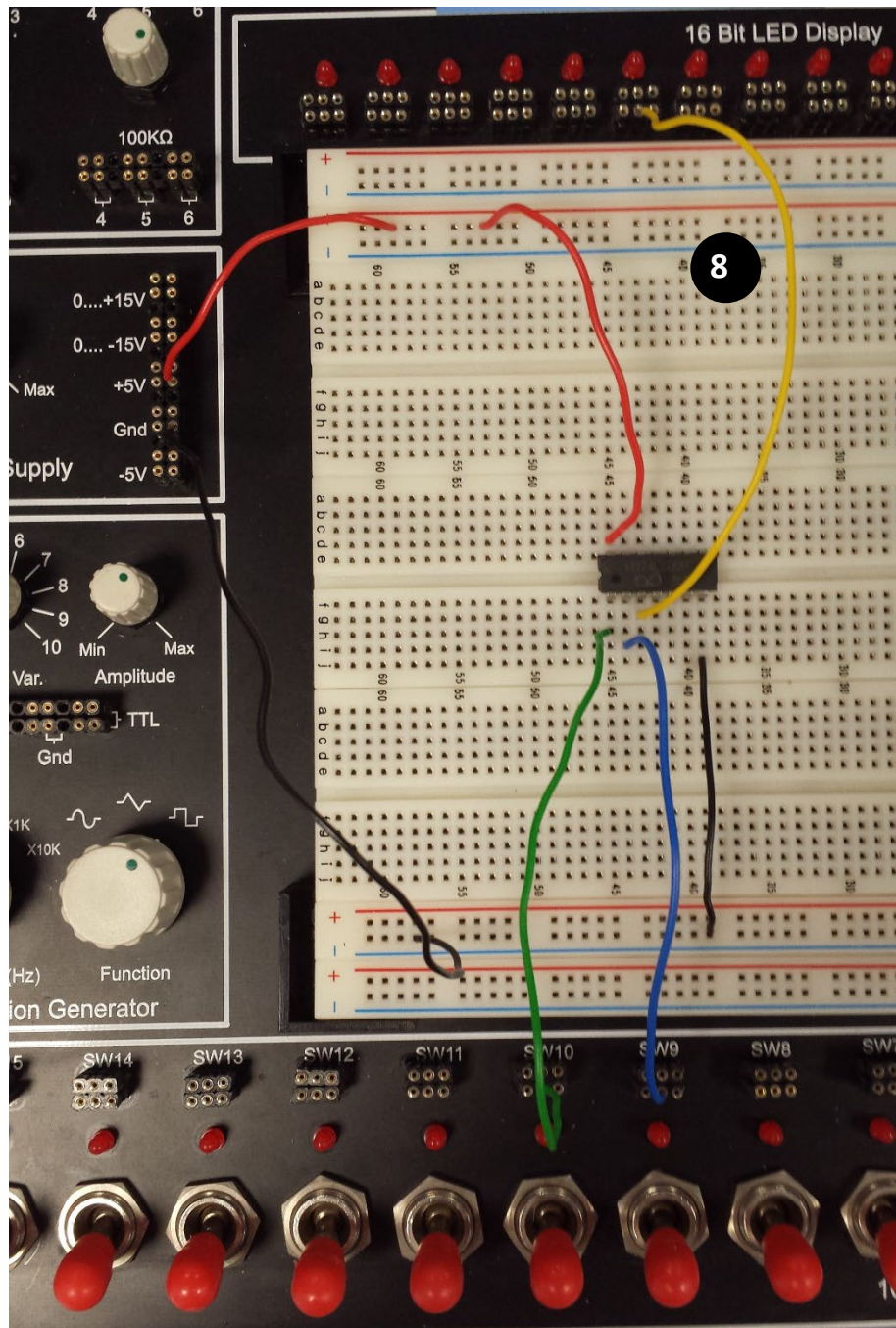
6. Make a connection from toggle switch to an input pin (pin 1 in this case). **Green** wire.



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

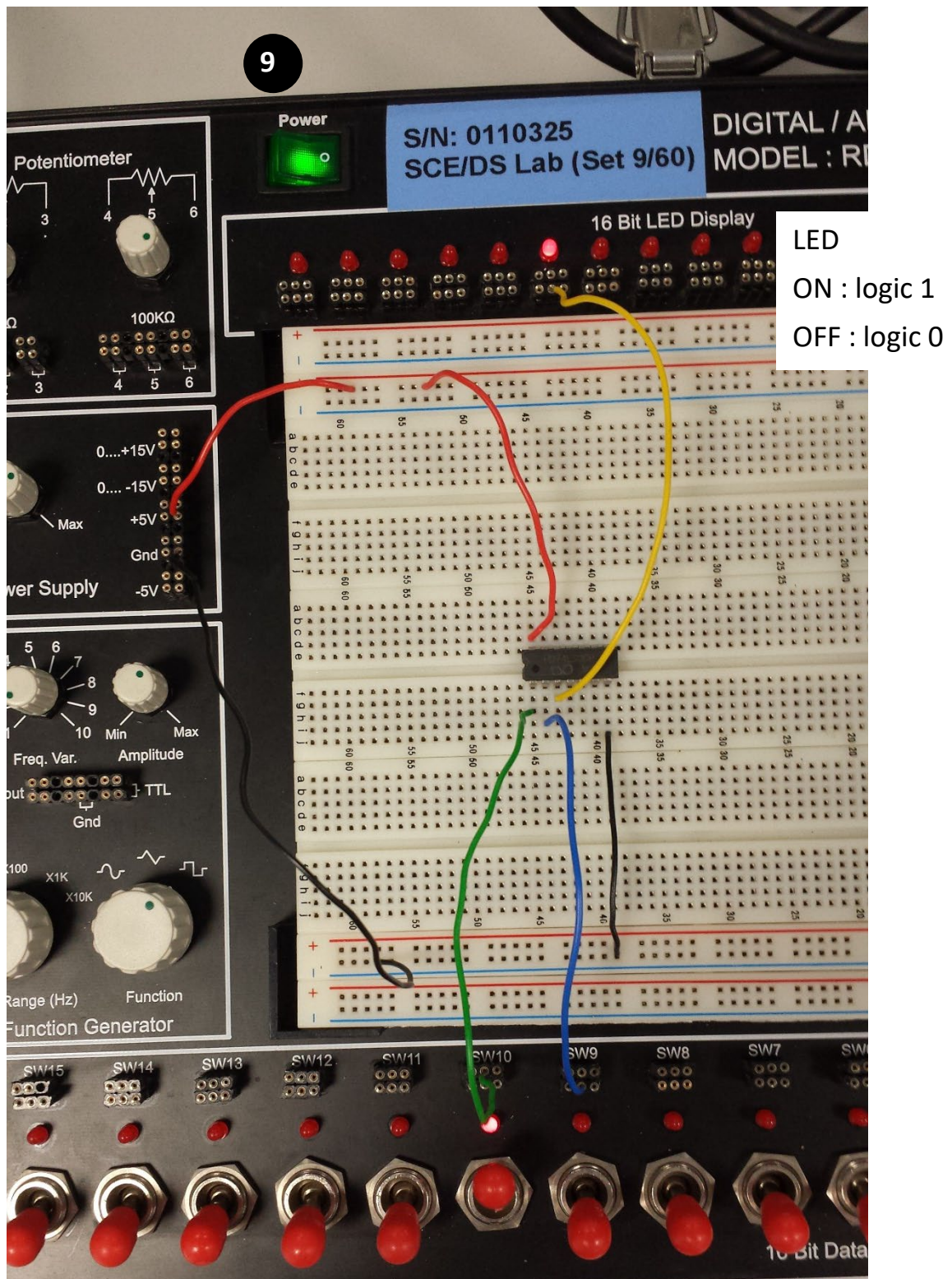


8. Make a connection from the output (pin 3 in this case) to an LED. Yellow wire. The circuit is now ready for testing.

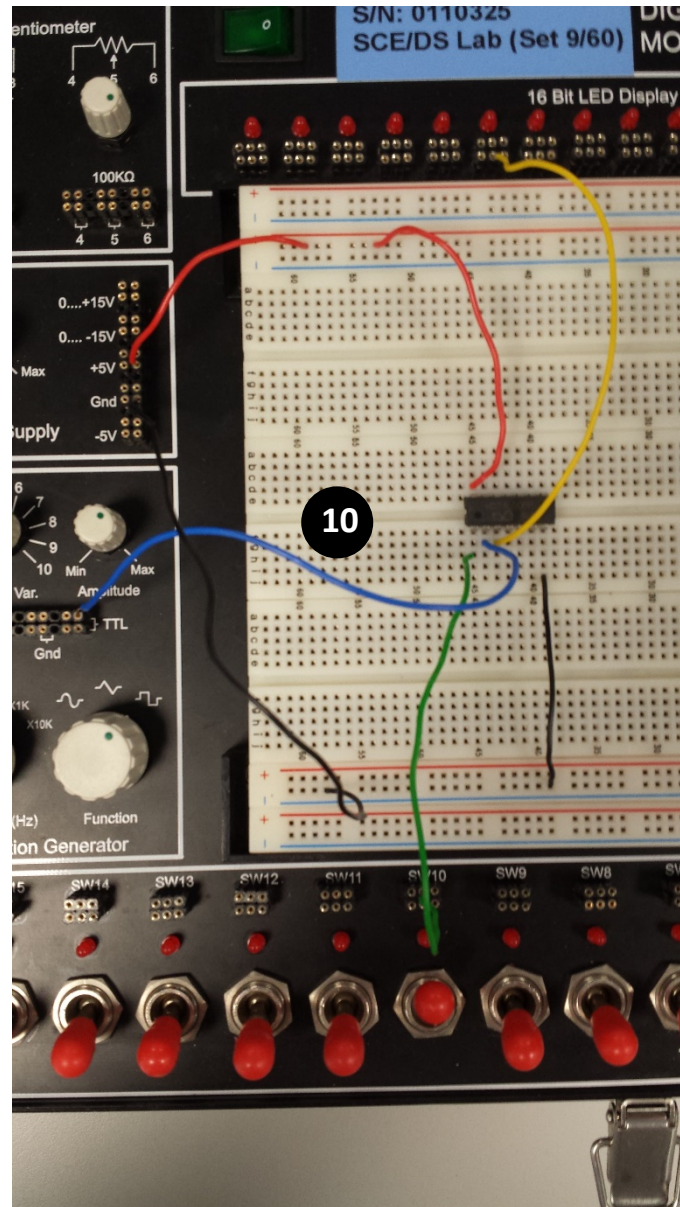




9. Turn on the power supply. Set the toggle switches to different combinations of logic values and observe the circuit output on the LED.

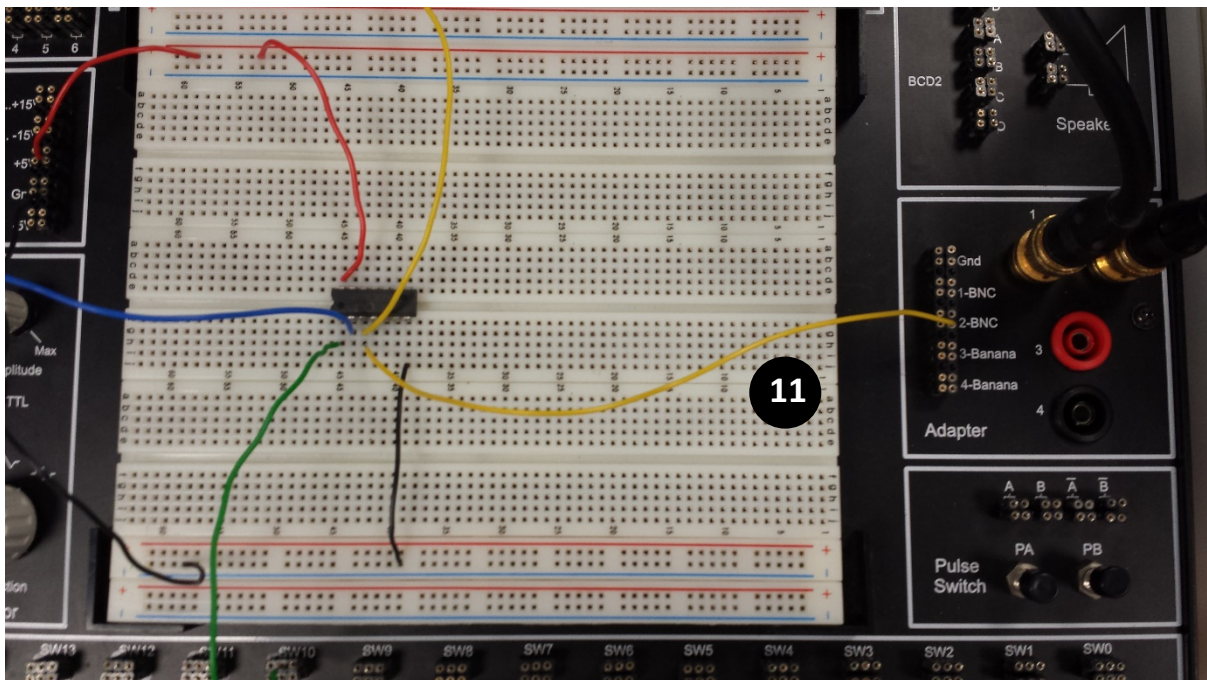


10. Disconnect the input pin 2 from the toggle switch. Instead, connect it to the TTL output of the function generator. **Blue** wire.
- Note that an input pin can only connect to one source of input: either a toggle switch (manual switching between 0 and 1) or a TTL squarewave (auto and repetitively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

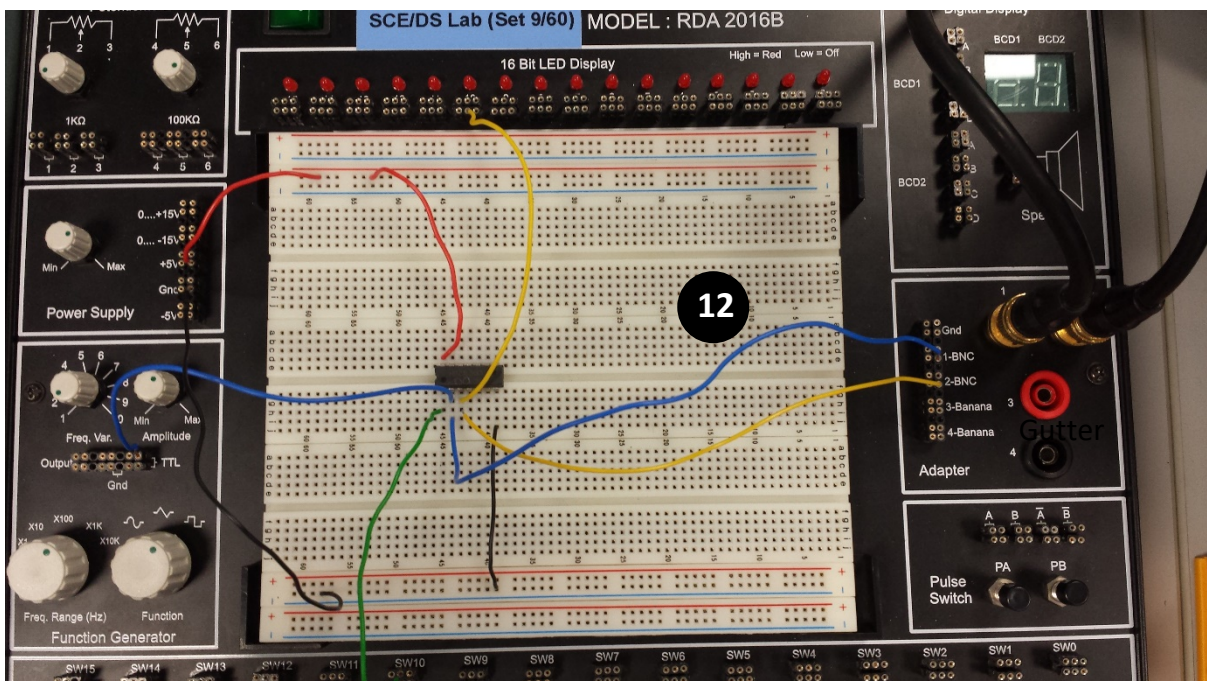




11. Make a connection from the circuit output (pin 3 in this case) to 2-BNC (Channel 2 of the oscilloscope). **Yellow** wire.

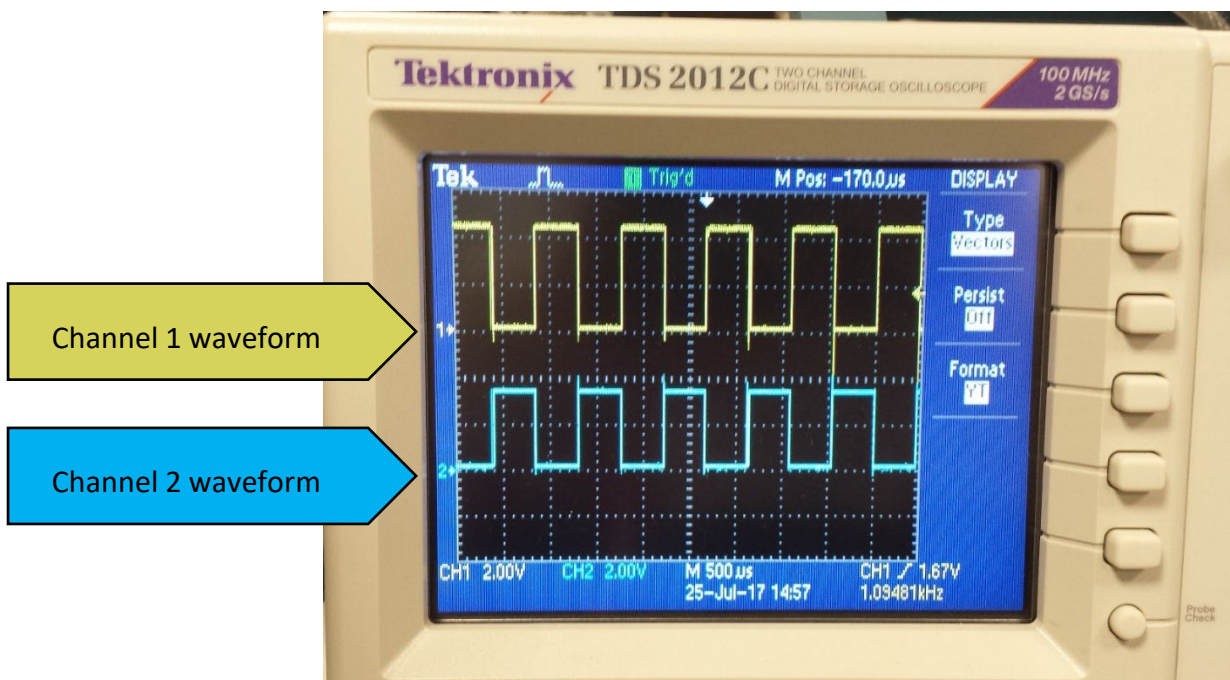
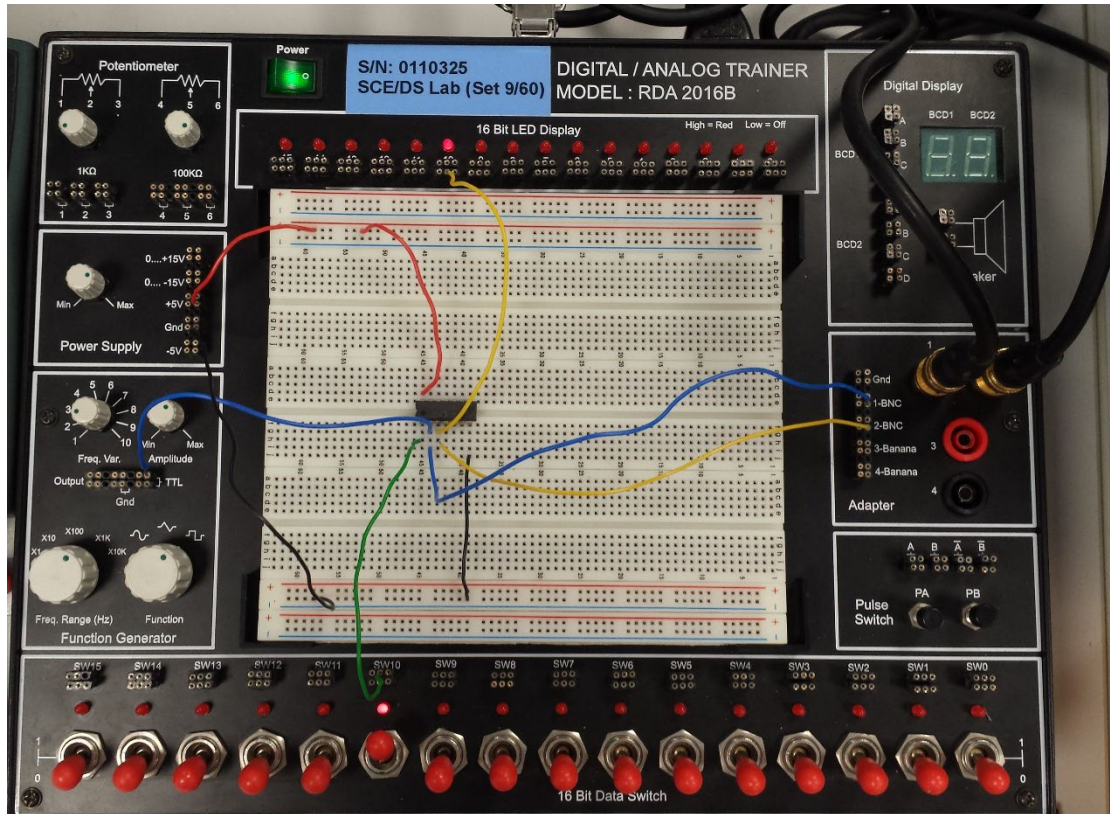


12. Make a connection from the TTL square wave (pin 2 in this case) to 1-BNC (Channel 1 of the oscilloscope). **Blue** wire.





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.



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

Use the **Freq. Var.** knob and **Freq. Range** knob to adjust the square wave frequency:

Example:  $5 \times 10$   
= 50 Hz



Hertz (Hz) is the number of cycles per second.

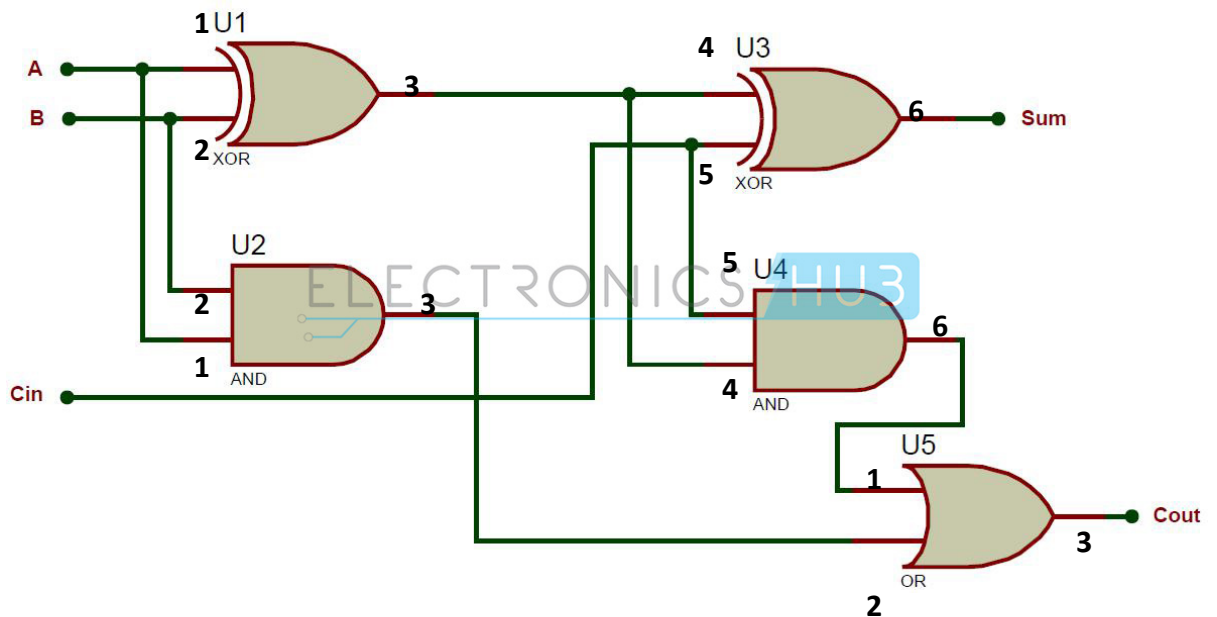


**Note:** **Not every two pins on an IC can be connected together.**

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>