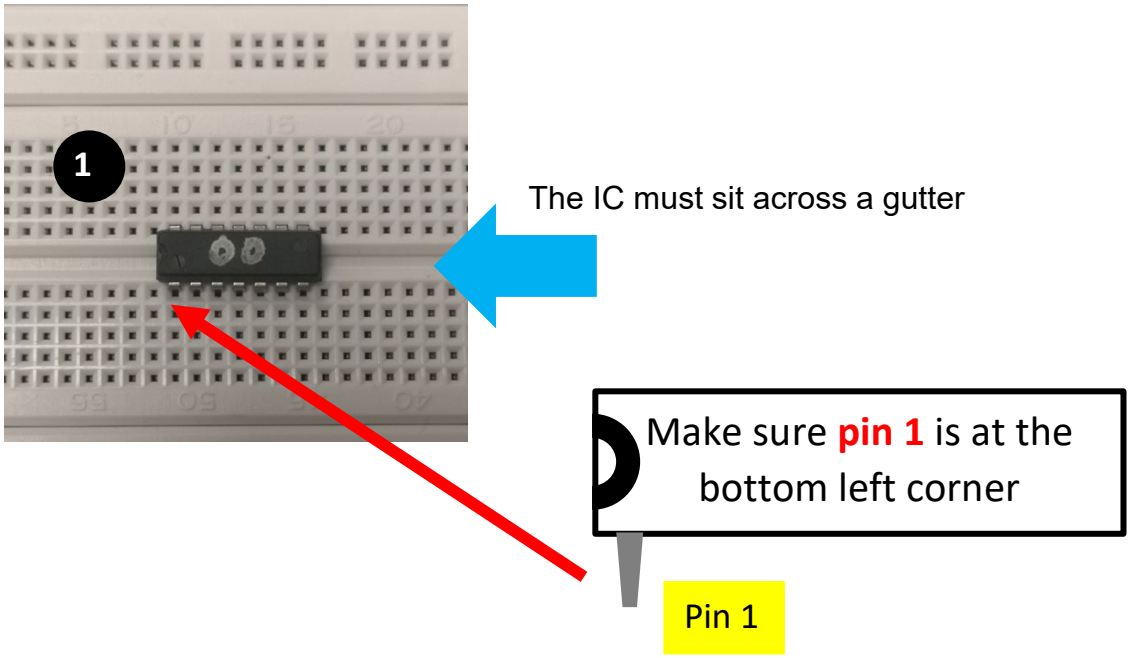
Lab 1 circuit connection guide – version B

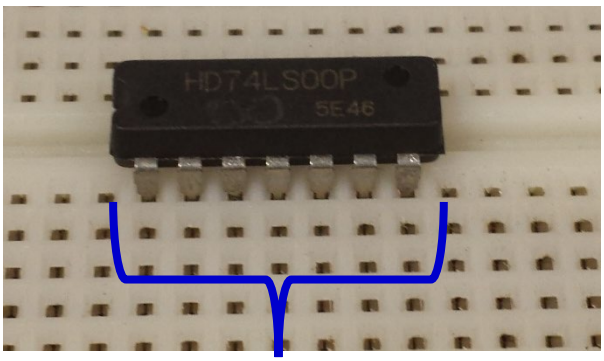
Different colour wires (they are the same functionally) are usually used to make circuit connections easier for a human-being to visually trace the connections. The circuit itself is not affected by the wire colours.

You may 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 despite your best effort.

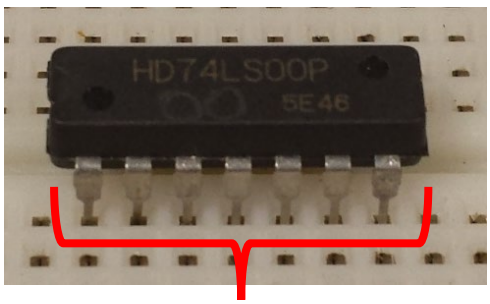
ALWAYS turn OFF the power when you are making circuit connections

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



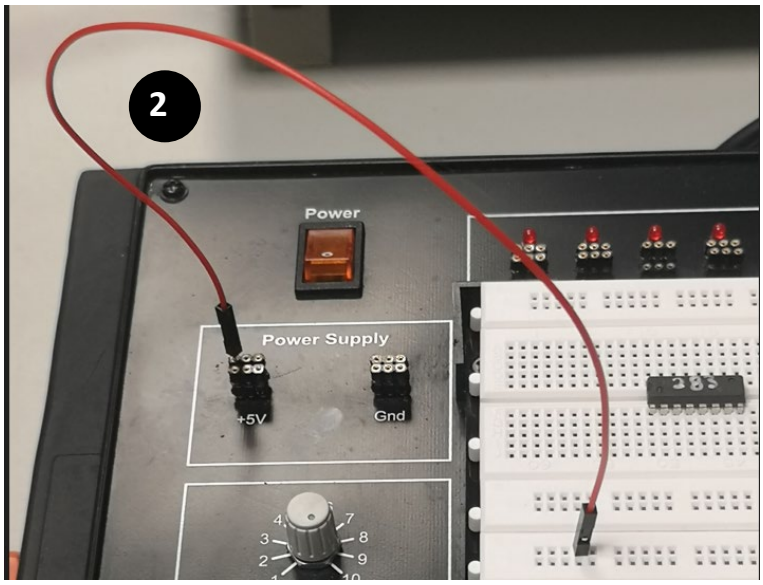


Each pin must fit firmly into a hole

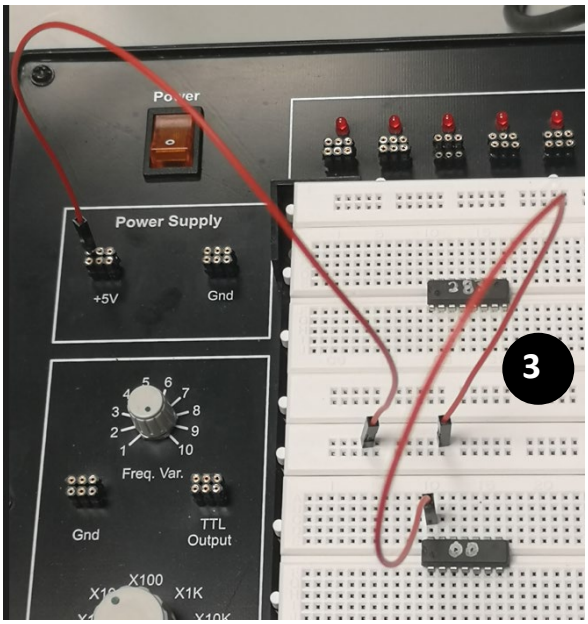


The metal pins are not fully inserted into the breadboard.
This is incorrect.

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

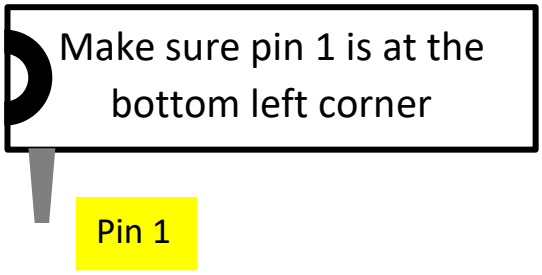


3. Make a connection from the Power rail to the IC's Vcc (pin 14 in this case). **Red** wire.
   This completes the connection of power supply to Vcc of the IC.

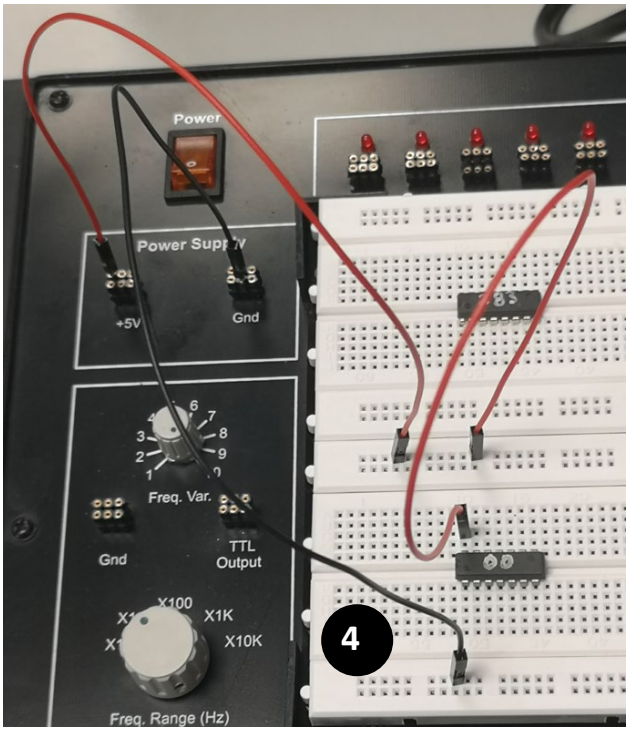


It is IMPORTANT to connect the Vcc and Gnd of each IC correctly.

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

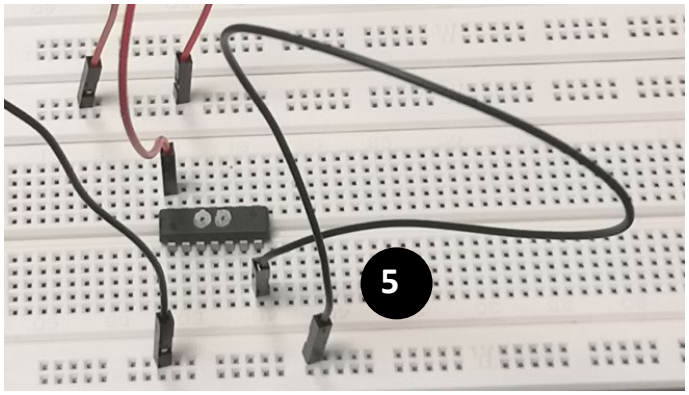


4. Make a connection from the power supply (Gnd) to a **different horizontal rail** on the breadboard. **Black** wire.



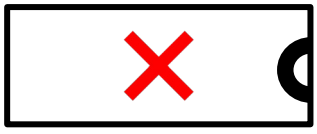
The connection to Gnd has made this the Ground rail

5. Make a connection from the Ground 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.

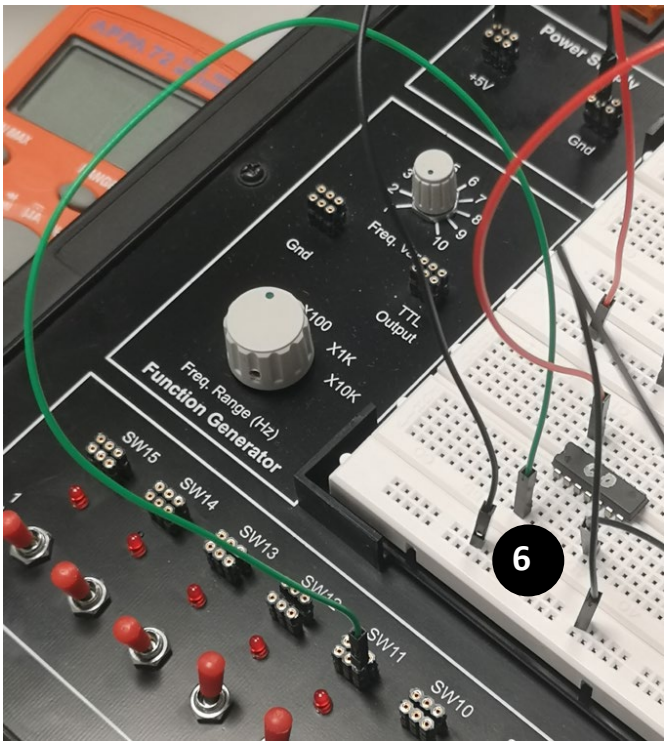


Look at the top view of your IC. Make sure the small notch is on the **left** edge.

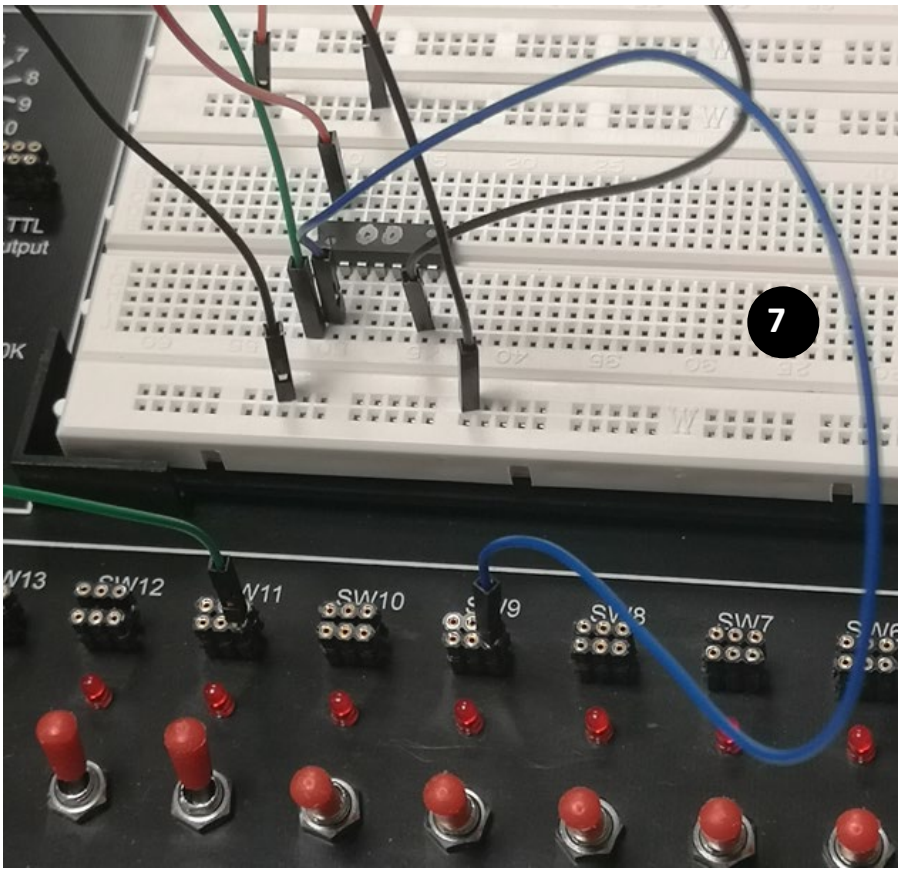
If the small notch is on the right edge instead, **you have oriented the IC wrongly.**



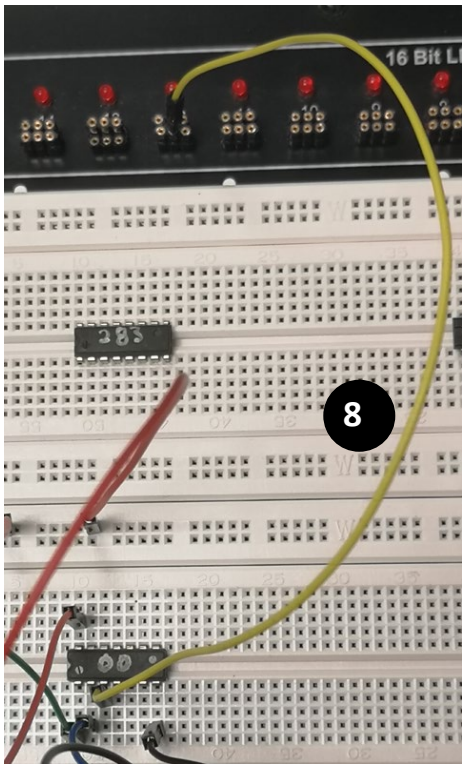
6. Connect a toggle switch to an input pin (pin 1 in this case). **Green** wire.



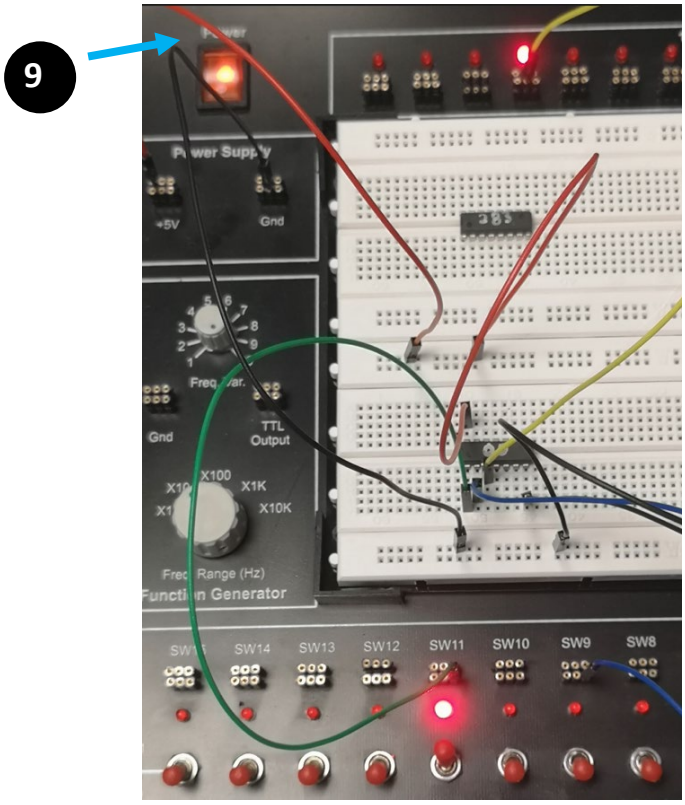
7. Connect a different toggle switch to the other input pin (pin 2 in this case). **Blue** wire.



8. Connect 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.



LED

ON : logic 1

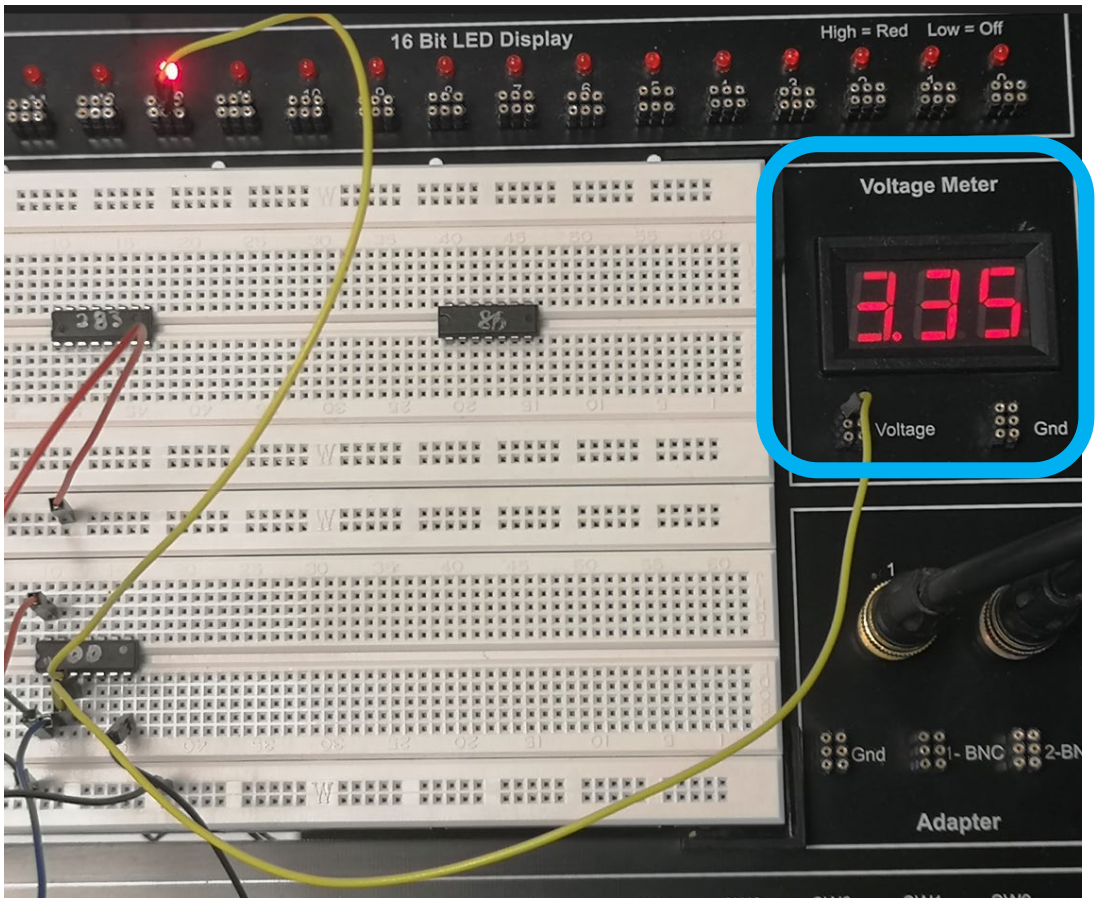
OFF : logic 0

SWITCH

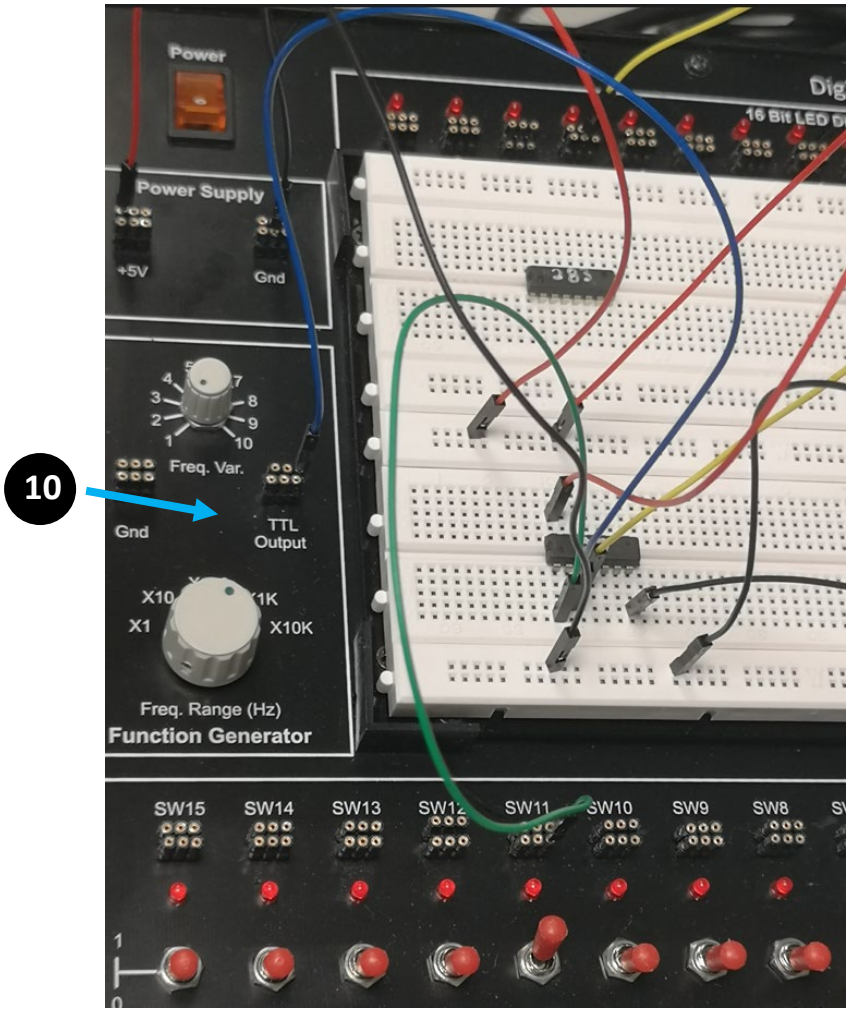
ON : logic 1

OFF : logic 0

You may also connect the output (pin 3 in this case) to the Voltage Meter to measure its voltage in Volts.

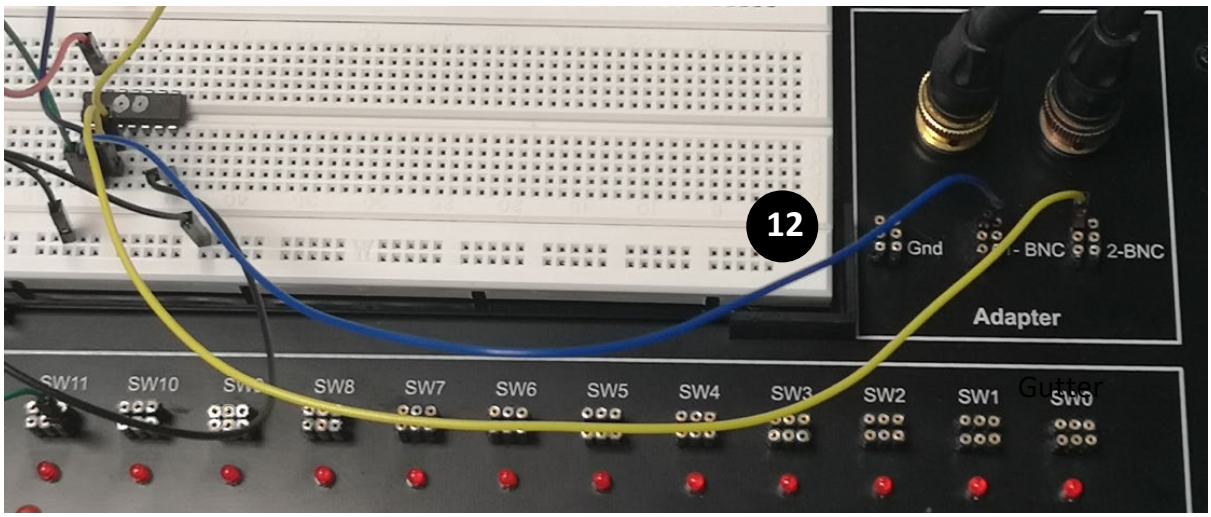


10. **Turn off the power supply.**
    Disconnect the input pin 2 from the toggle switch. Instead, connect it to the TTL output of the function generator. **Blue** wire.
    Note that an input pin can only connect to one source of input: either a toggle switch (manual switching between 0 and 1) or a TTL square wave (automatic and repetitive switching between 0 and 1 at a chosen frequency) – but not BOTH.



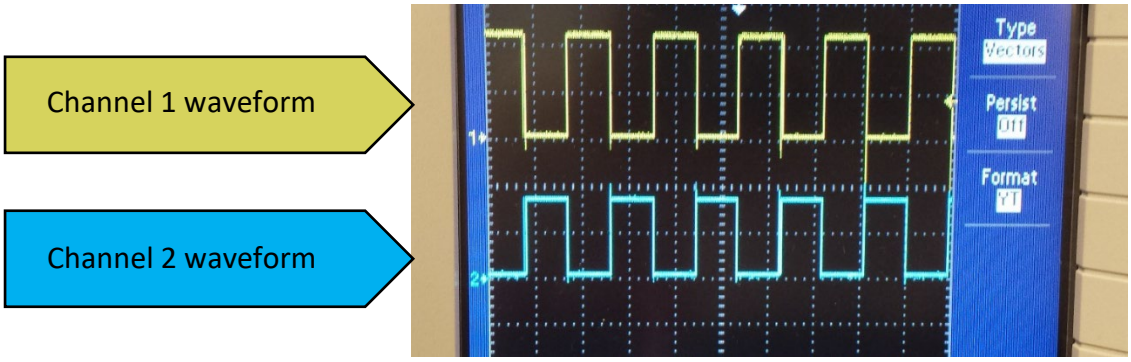
11. Connect the circuit output (pin 3 in this case) to 2-BNC (Channel 2 of the oscilloscope). **Yellow** wire.

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 (refer to **Oscilloscope Guide**).

    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 above but should look similar.

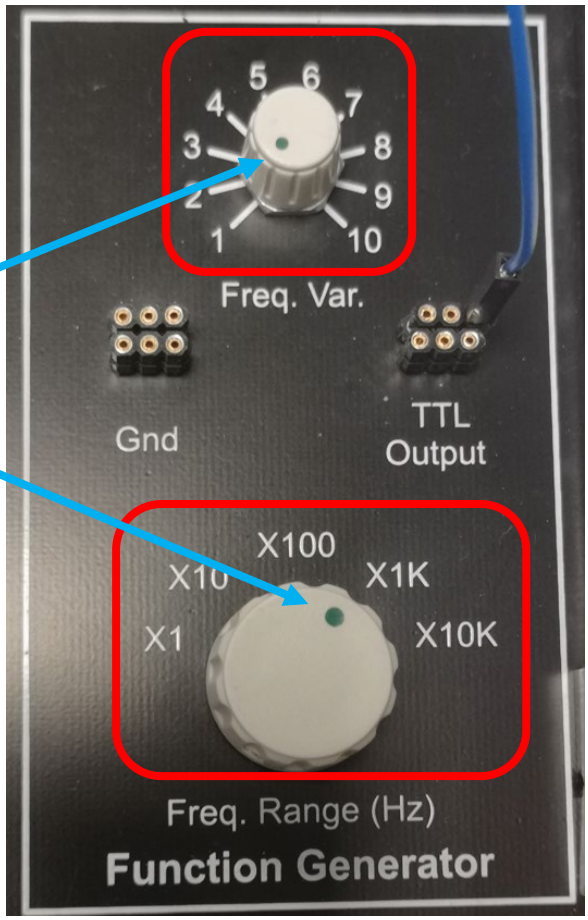
Note that two different oscilloscope models are being used in the lab. They operate in similar way. Refer to the Oscilloscope Guide.

Function Generator

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

Example: 1 x1000

= 1 kHz



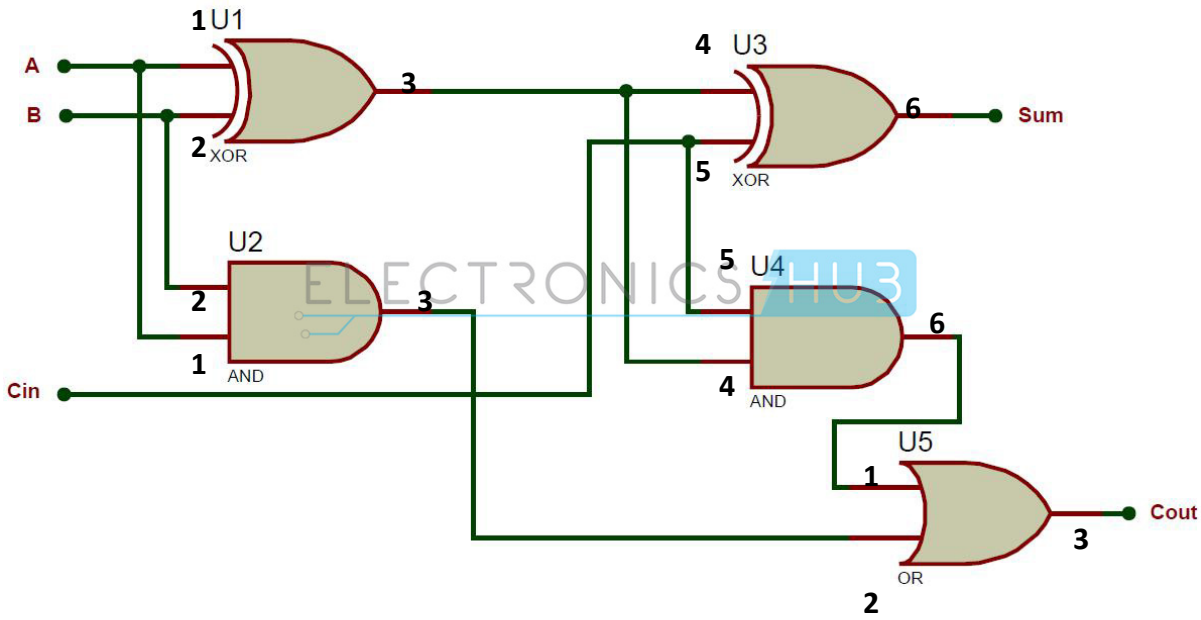
Hertz (Hz) is the number of periodic cycles per second.

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