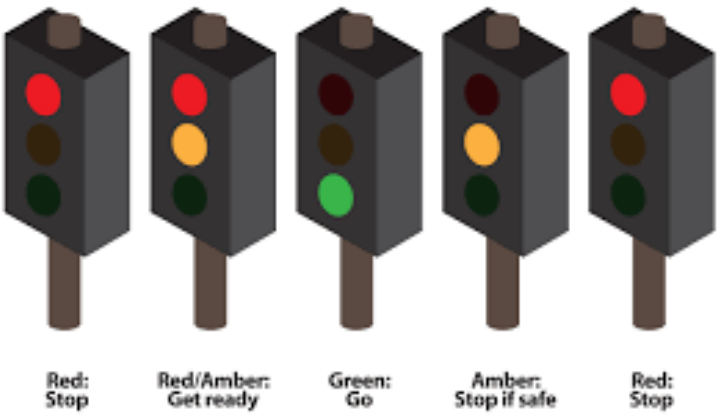
Sequencing Traffic Lights
with
Scratch3 and Raspberry Pi

This worksheet will show you how to use Scratch2 to interact with LED traffic lights and get them to change in the correct sequence as in the real world at a road junction.



The Raspberry Pi has a special version of Scratch available to use.

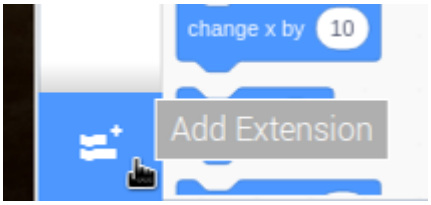
Access Scratch3 from the main menu, found at the top left of the screen. Then look under the Programming heading.

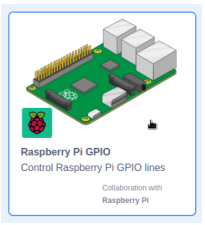
You will be provided with a small traffic light that plugs into the GPIO pins of the Raspberry Pi. GPIO stands for General Purpose Input/Output. The pins on the Raspberry Pi can have all kinds of interesting things connected to them. Devices to read about the environment, like a thermometer, or simple switches. They can also output power to an external device like a robot motor or servo controller or in this case a simple set of Light Emitting Diodes (LED). These traffic lights have all the connections premade and they will be fitted to the Raspberry Pi pins.

Start Coding

To program the LED to turn on and off you shall be using a special version of Scratch3 for the Raspberry Pi. This version allows the controlling of the pins that you have connected the LED to above.

From the Main Menu, Programming open Scratch3. The first thing to do is access the Raspberry Pi GPIO blocks at the very bottom from the Add Extension.

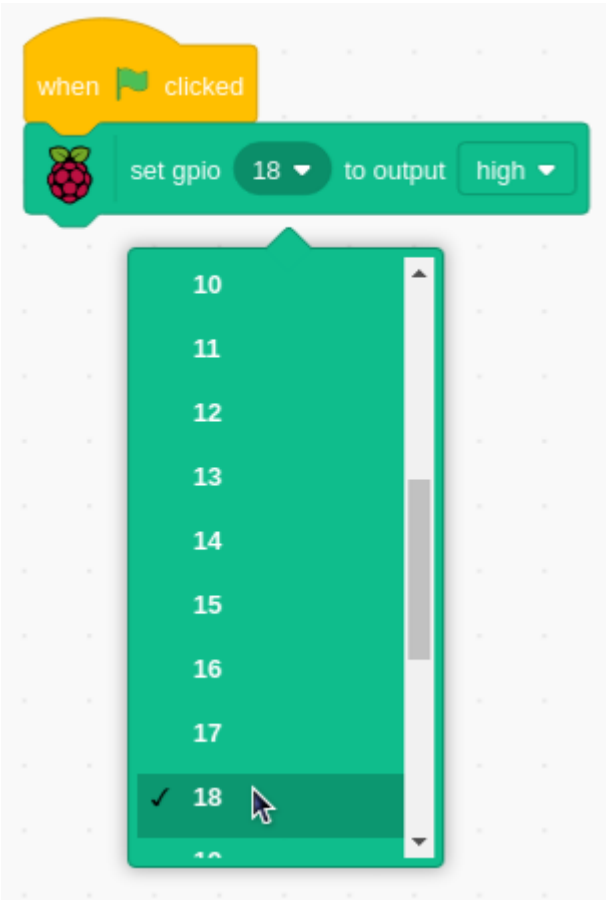




Then select the Raspberry Pi GPIO box. The new blocks will then appear on the Scratch screen.

In Scratch all the coding is done with blocks that fit together like a jigsaw puzzle. If they will not fit then Scratch is telling you that you are doing it wrong.

Each set of blocks has a different colour. Select the correct series of blocks just by looking at what colour they are.



Left click on a block to use it and drag it onto the central editing area. When a block is close enough to snap together it will be highlighted. To delete an unwanted block drag it off to the left of the screen. Right clicking on a block will bring up other block options.

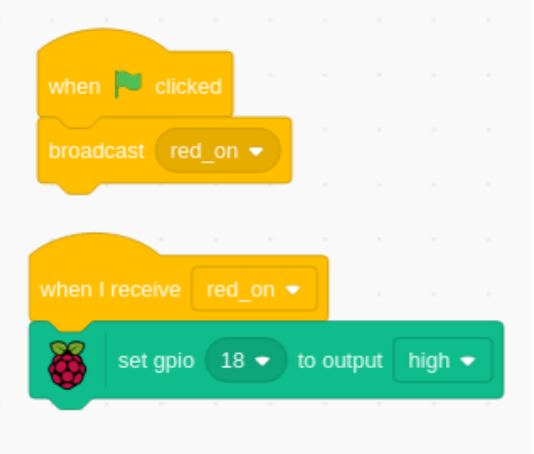
From the Events and GPIO Extension drag the blocks pictured onto the scripts area of Scratch. The first set of blocks that need to be placed are in the image. The first is the When Green Flag Clicked. Clicking the green flag or that block will start your program running.

The second block is from the GPIO extension just installed. Click on the number and the drop down selection will appear. The first LED is connected to Pin 18 on the Pi so select 18 from the list.

Then select high from the drop down list when clicking on the second selection area in the block to change the output from Low to High.

Click the Green Flag and the red stop LED should light up. Change the output to Low and click again and the LED should turn off. That's all there is to controlling an LED. High or Low on the right Pin number.

To actually control a sequence of LED requires some more blocks. A Broadcast clock sends a command out to run a sequence of events, not just one. Add the Broadcast block and a When I Receive block. Add a new message by clicking on the message area and changing it to red_on. Or maybe Stop or just Red. These names are just suitable names, not the actual code command. Use a different one if you like but you will always have to use your name not ours, red_on.

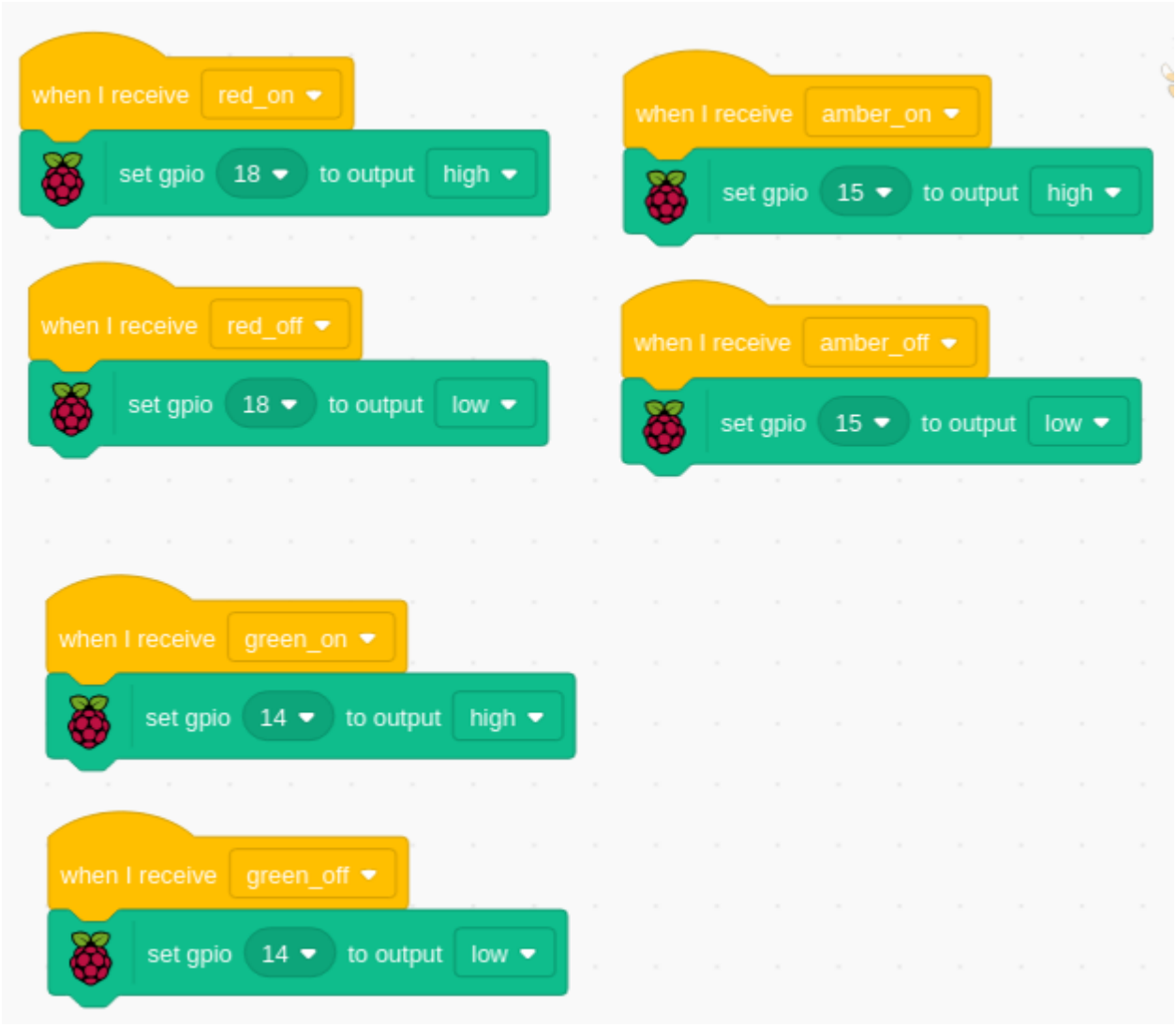


Click on the Green Flag again and the LED should turn on if the output is set to high as shown.

The next task is to add a command to turn the red LED off. This is really quite simple and just the same as the on command. Right click on the When I Receive block you already have and select Duplicate. Drag the new copy down under the original and change the message to red_off (or to whatever you are using yourself) and set the output to Low.

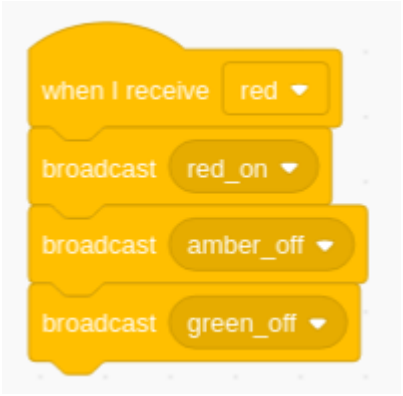
So now you have the blocks ready to control the red Stop LED. Can you do the same When I Receive blocks for the Amber and Green LED? Their Pin numbers are 15 for amber and 14 for green. Use the Duplicate again to do this quicker.

The answer is on the next page if you get stuck.



All of these blocks can be moved to the side of the editing area as they will not be needed any more. Do not delete them because they are needed. Make some space in the middle of the editing area for some new blocks.

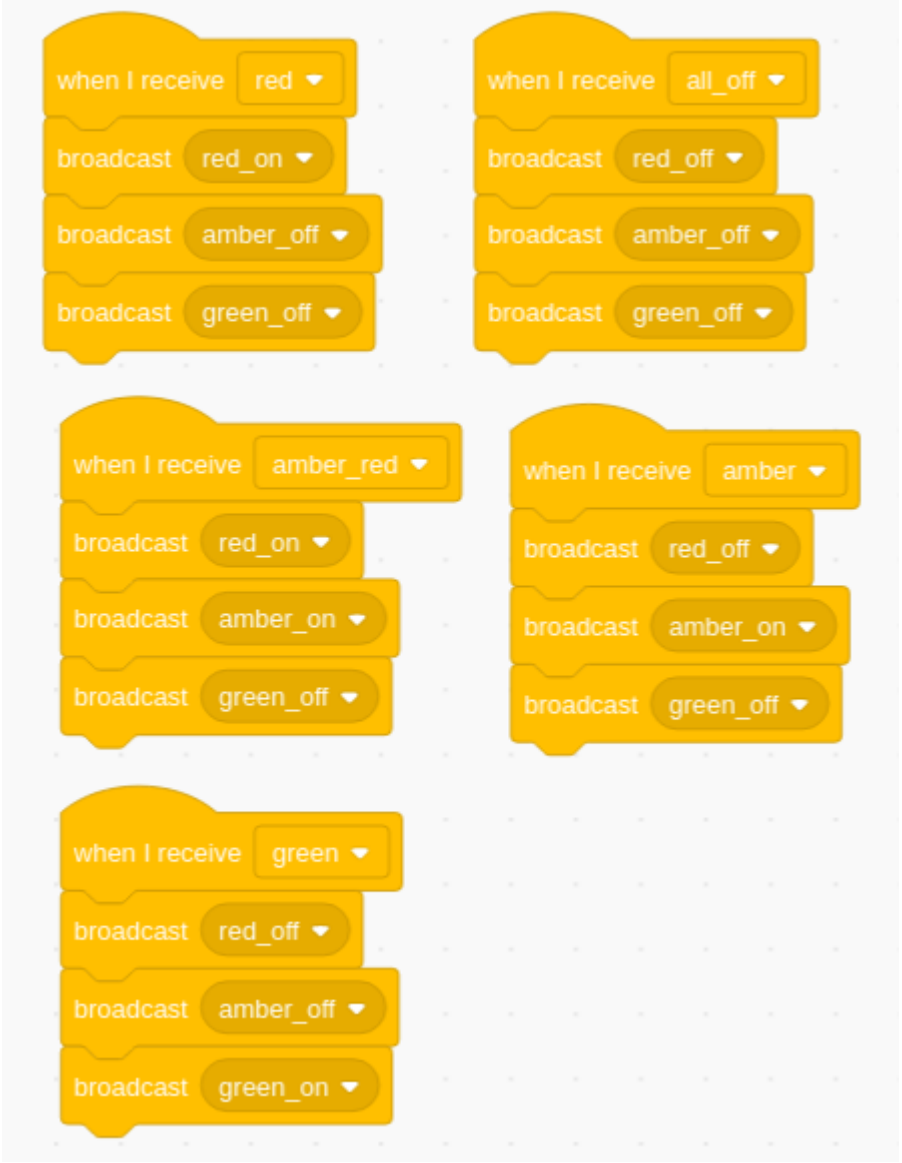
Into this new space add a new When I Receive block with new broadcasts to turn the correct LED on or off.



When this block receives a call RED. There is a call to turn the red LED on but to turn off the others. This makes sure that only the red LED will be on.

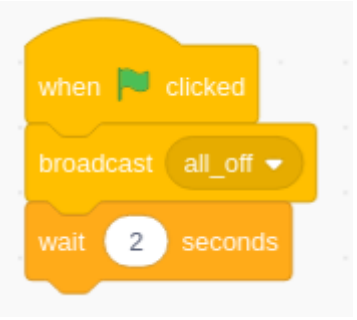
Using the picture on the first page can you create the same blocks for the other parts of the sequence? And also one to turn all the LED off?

Answer is on the next page if you get stuck.



Building the Sequence

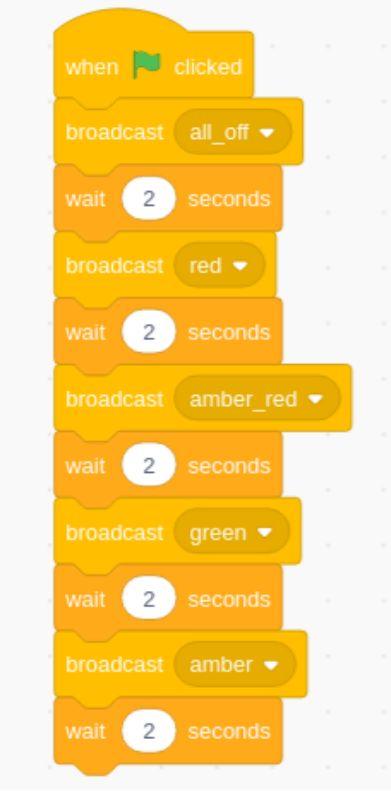
Everything is now in place to create the full sequence of lighting.



Start with all of them off followed by a few seconds wait. This is just to make it all nice and neat with all the lights off at the very start.

Then add other broadcasts under the 2 second wait with a 1 second wait in between each one to build the whole sequence. Red, red & amber, green and finally amber only. Can you do this?

The answer is on the next page again.

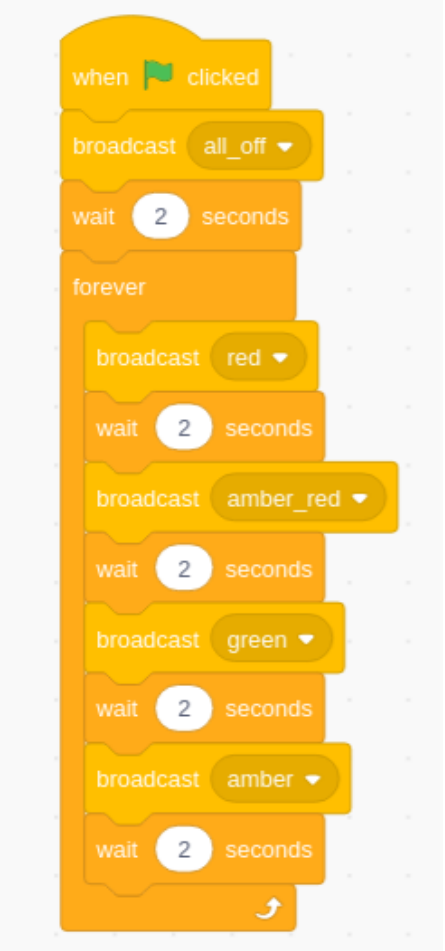


This is the whole sequence.

First, all of the LED are turned off. Then the red LED lights up for a second followed by the amber LED also switching on. Then after another second both of those are turned off and the green one is switched on. Then finally the green is turned off and the amber is switched on by itself.

Now, real traffic lights are working all day and all night. Again and again and again the lights come on. Do you know how to make yours do this?

Again the answer is below.



So there it is. You are now controlling the traffic lights.

An Extra Challenge

Can you work out how to make the amber light flash four times for half a second instead of just staying on? If you were at a pedestrian crossing the amber light would need to do this. No answers this time.

An Extra Extra Challenge

How about creating your own sequence of the LED that has nothing to do with traffic lights? Get them flashing in any sequence you like to any timing you like.