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Smart Devices with Micro:Bit

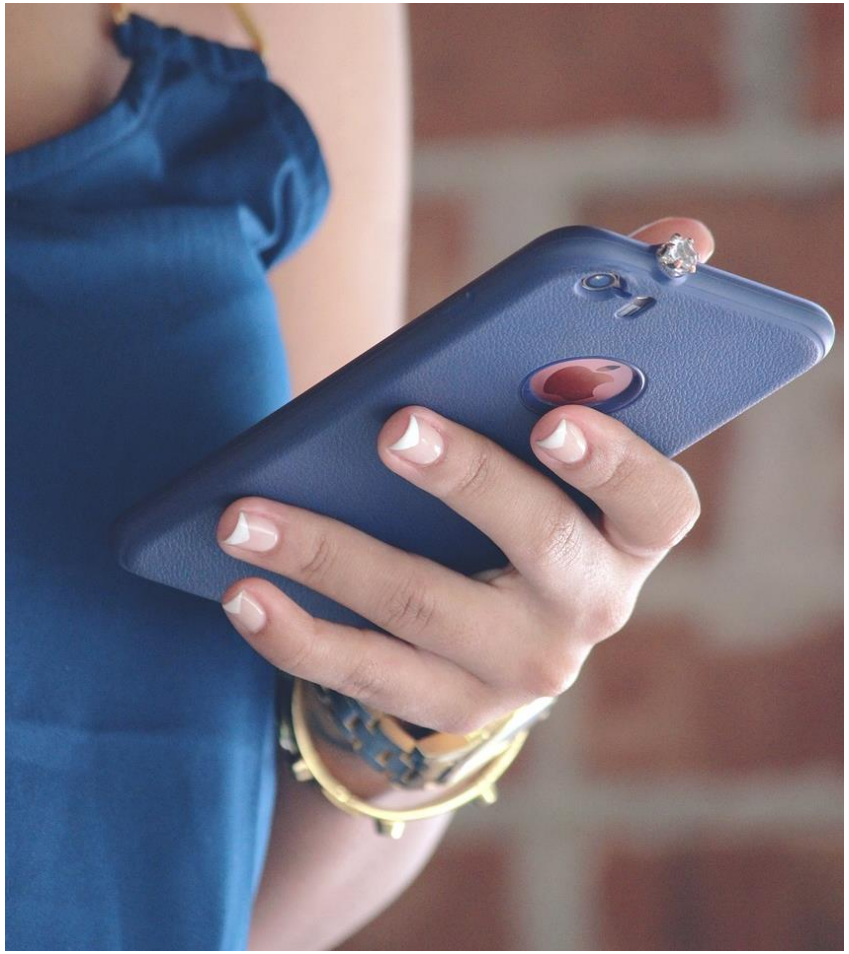
What is a smart device?

How many can you think of?

Smart Devices

Smart devices are **electronic devices** that:

- Have **electronic sensors** to observe their surroundings
- Use data from the sensors to **act autonomously** (on their own)
- **Communicate** with other devices connected to a **network**.



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DIY Smart Devices

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Intro to Micro:Bit

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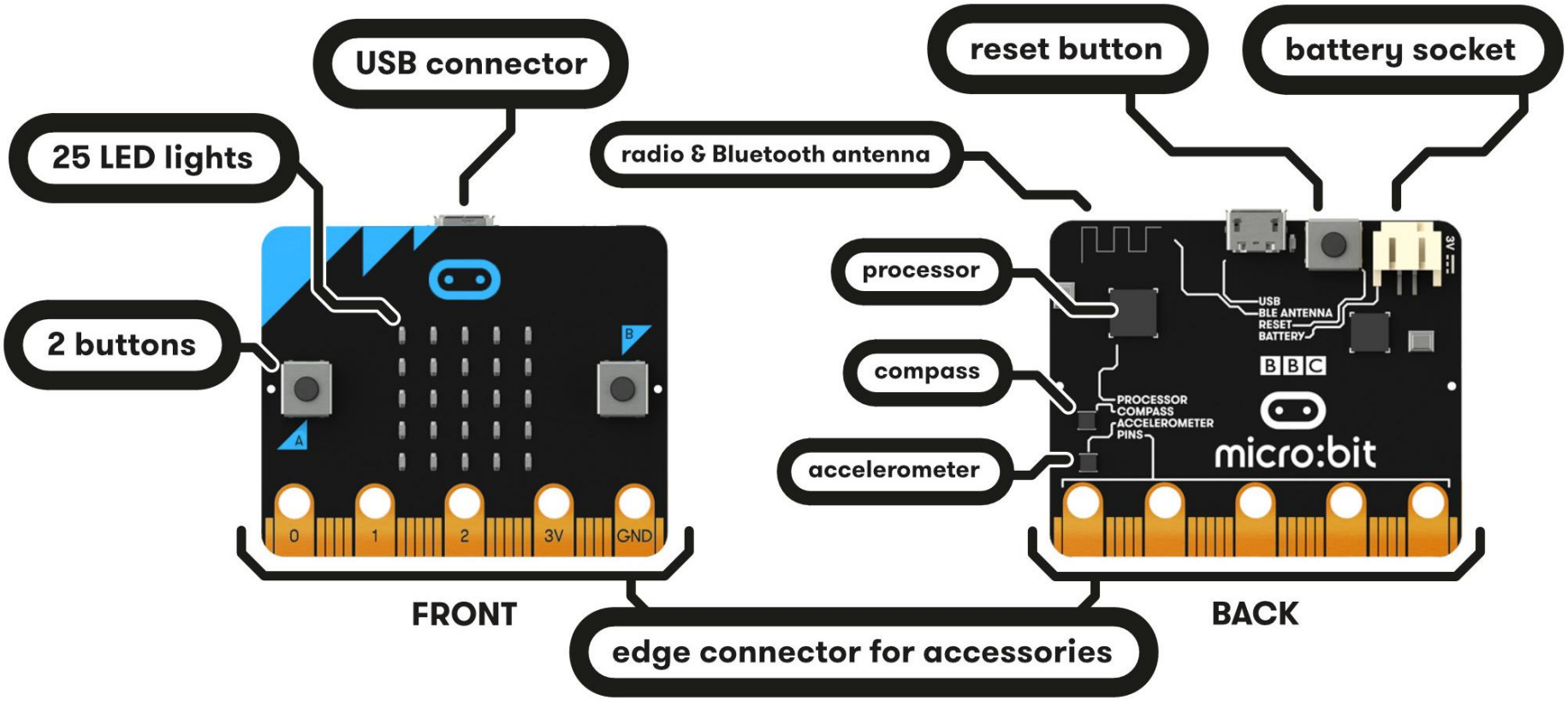
What is a micro:bit?



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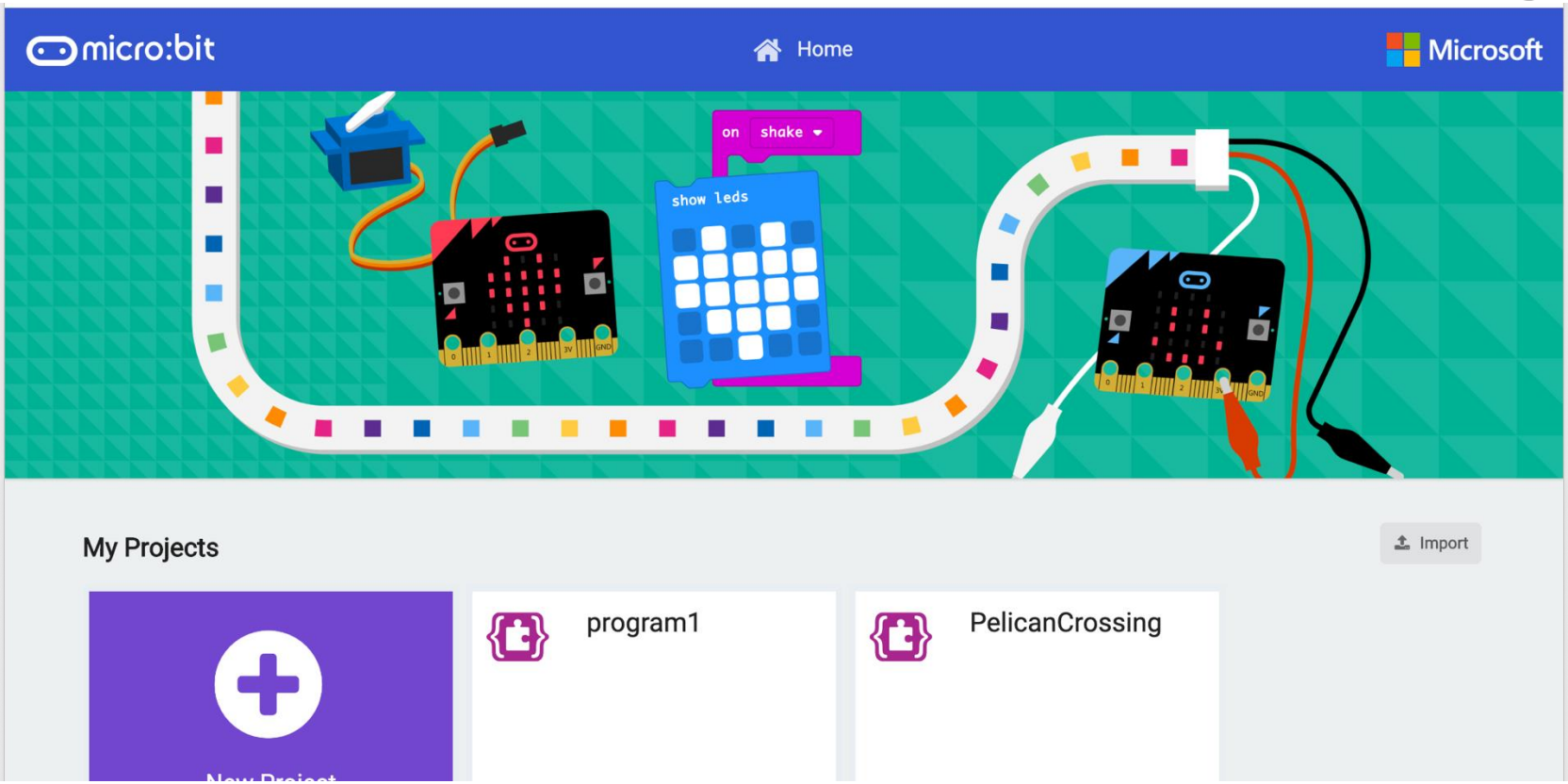
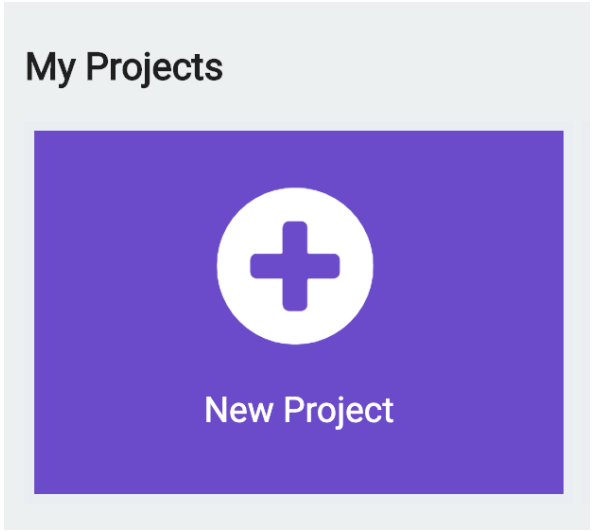
Starting with MakeCode

makecode.microbit.org

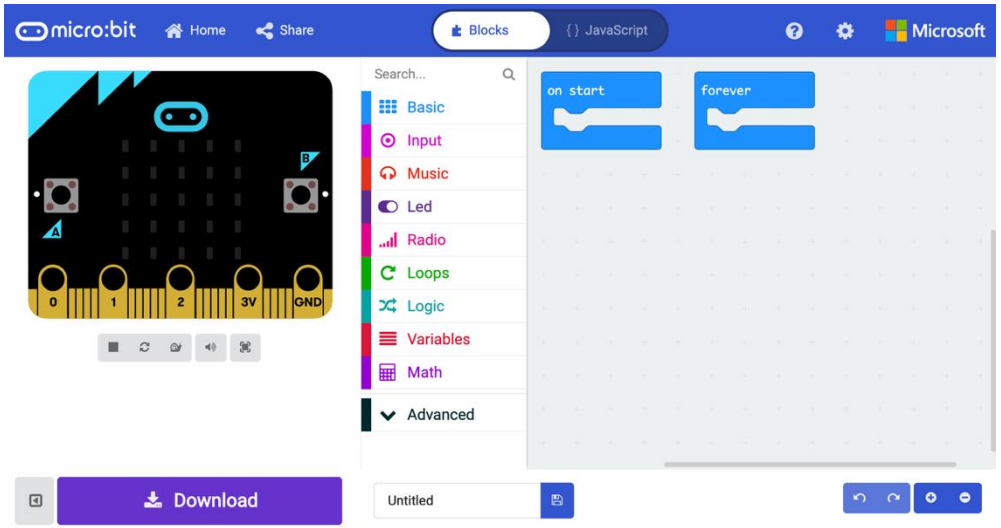


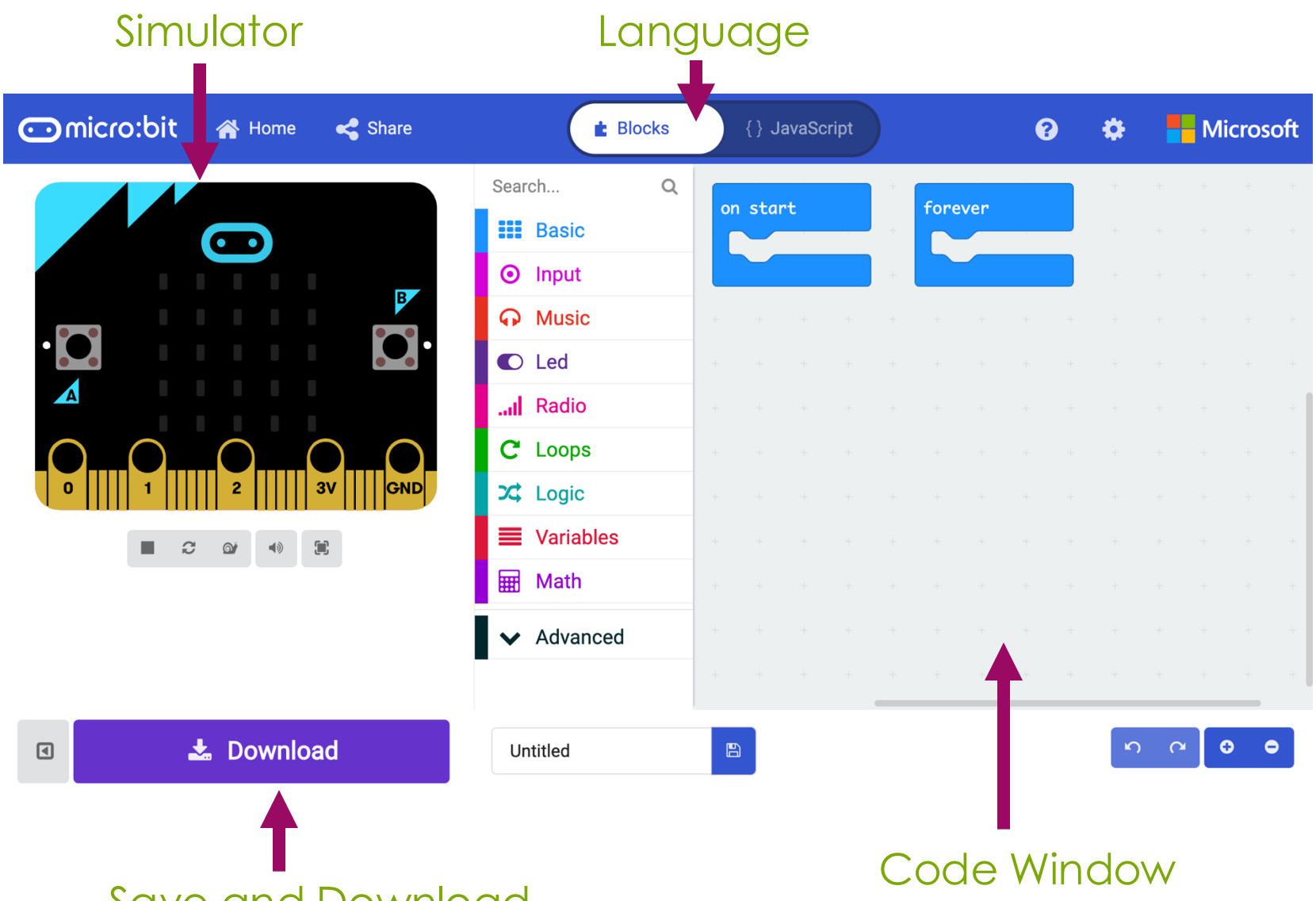
Starting with MakeCode

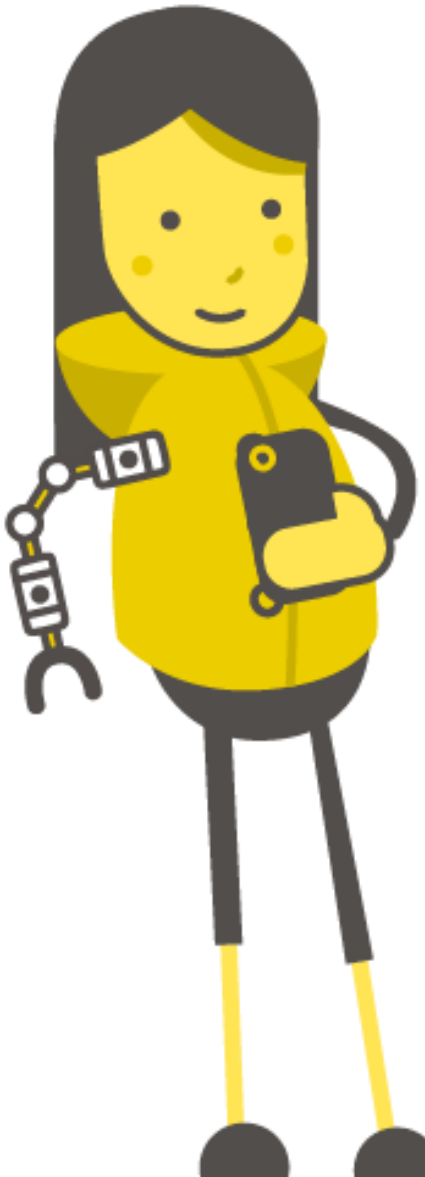
Click New Project



It should look like this!




Simulator
Language
micro:bit
Home
Share
Blocks
{ } JavaScript
Microsoft
Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
on start
forever
0
1
2
3V
GND
Download
Untitled
Save and Download
Code Window



Activity: Sense Testing

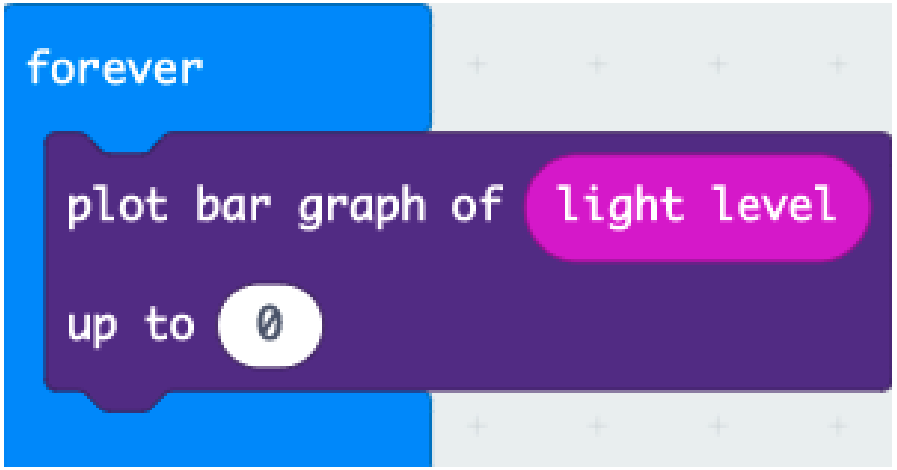
Activity: Sense Testing

Let's test our micro:bits by playing with the sensors

Copy this code:

light level is in the Input tab

plot par graph is in the Led tab

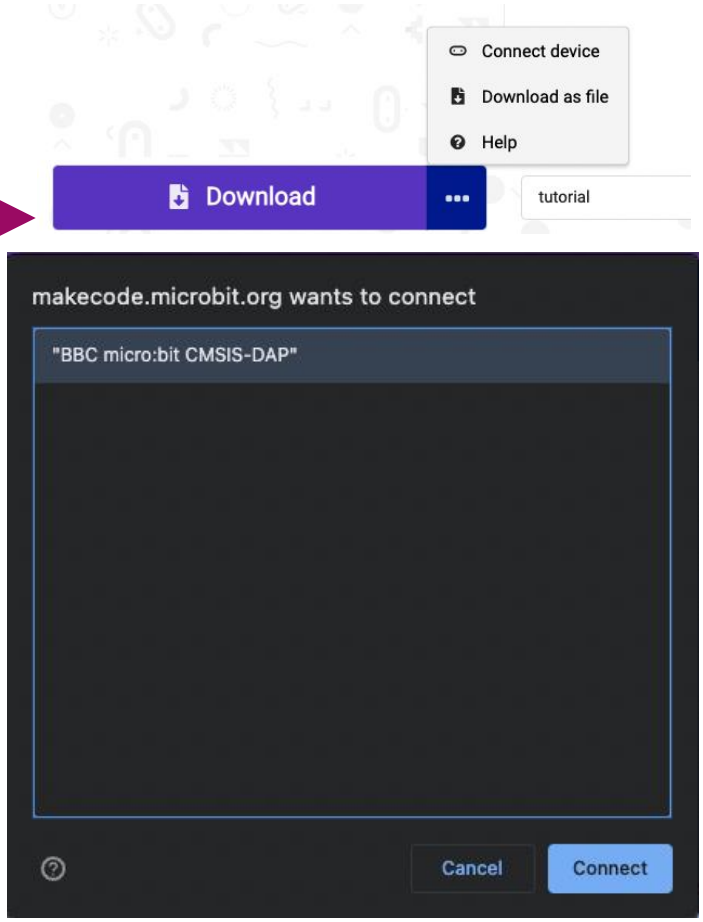


Upload the code to your Micro:Bit – what's going on?

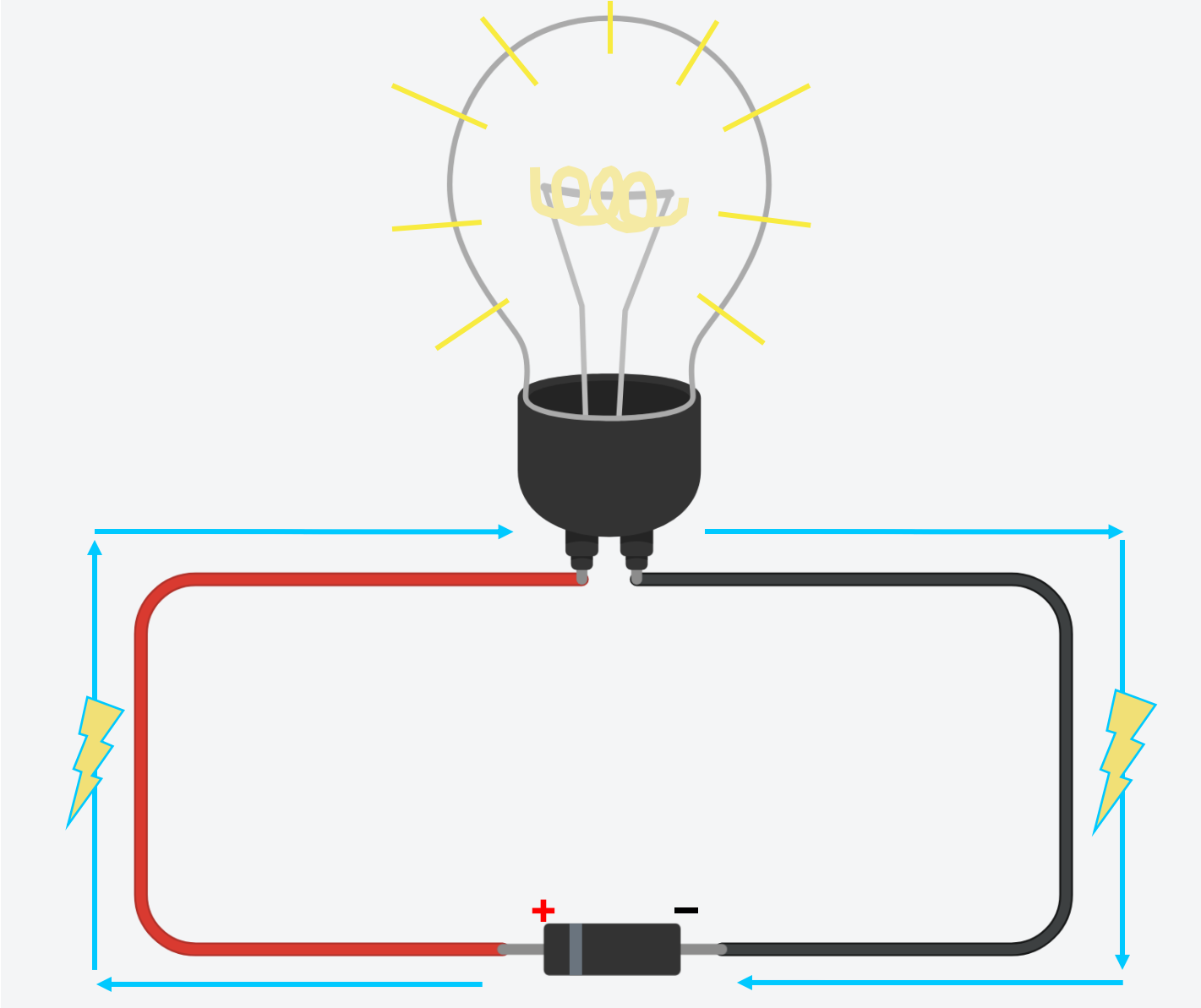
Try swapping out light level for sound level (in the Input tab)

Connecting the micro:bit

1. Plug the micro:bit into your computer
2. In the bottom left of your screen, click the 3 dots next to 'Download', then click 'Connect Device'
3. Follow the on-screen instructions until you see this popup
4. Click the name of your device (it should be the only option)
5. Click connect



Activity: Let's Build a Circuit



Electricity needs a complete loop from + to – or it cannot flow through the circuit

Let's Build a Circuit

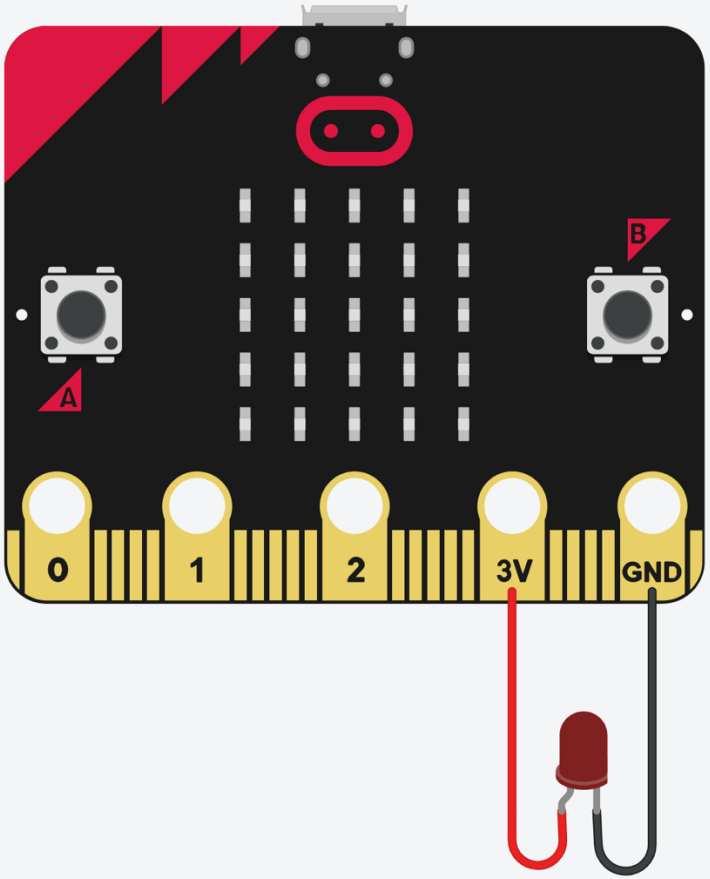
Connect your LED to the 3-Volt (**3V**) and Ground (**GND**) pins:

- **3V** → LED long leg
- **GND** → LED short leg

What happens when you turn on the micro:bit?

What happens when you swap around the legs of your LED?

What haven't we used?

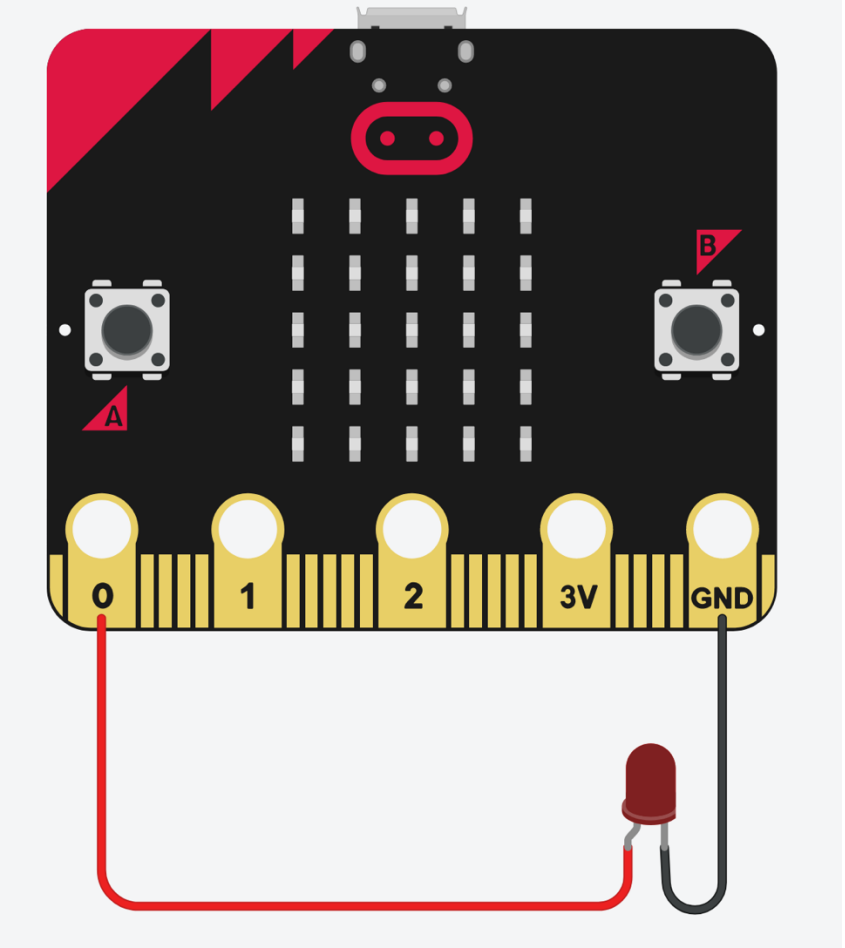


Let's Build a Circuit

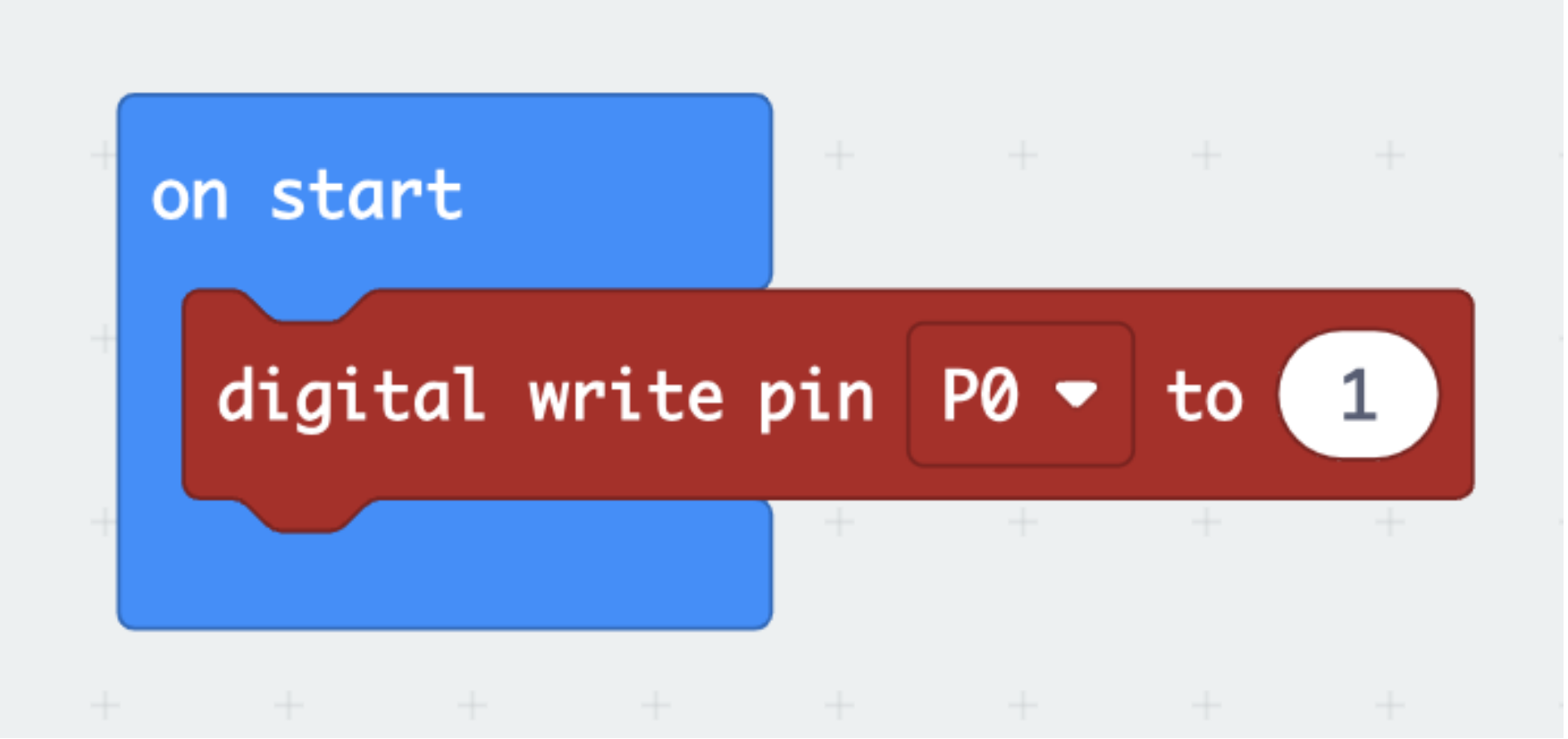
Swap the long led from the **3V** pin to pin **0**

What happens when you turn on the micro:bit?

Pin 0 is **programmable**... what might we be missing?



Let's Build a Circuit



We can program the LED to turn on with the code above!

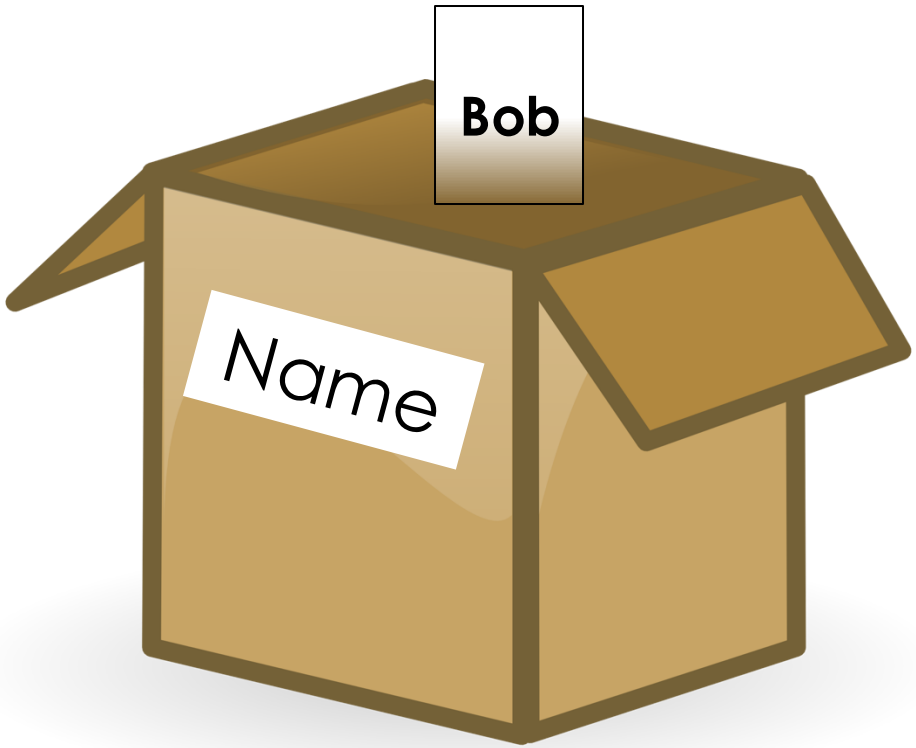
Activity: Switch It Up

What Is a Variable?

A **variable** is something that stores data in our program. It is like a box with a label on it

I can store different things in the box, but the label stays the same

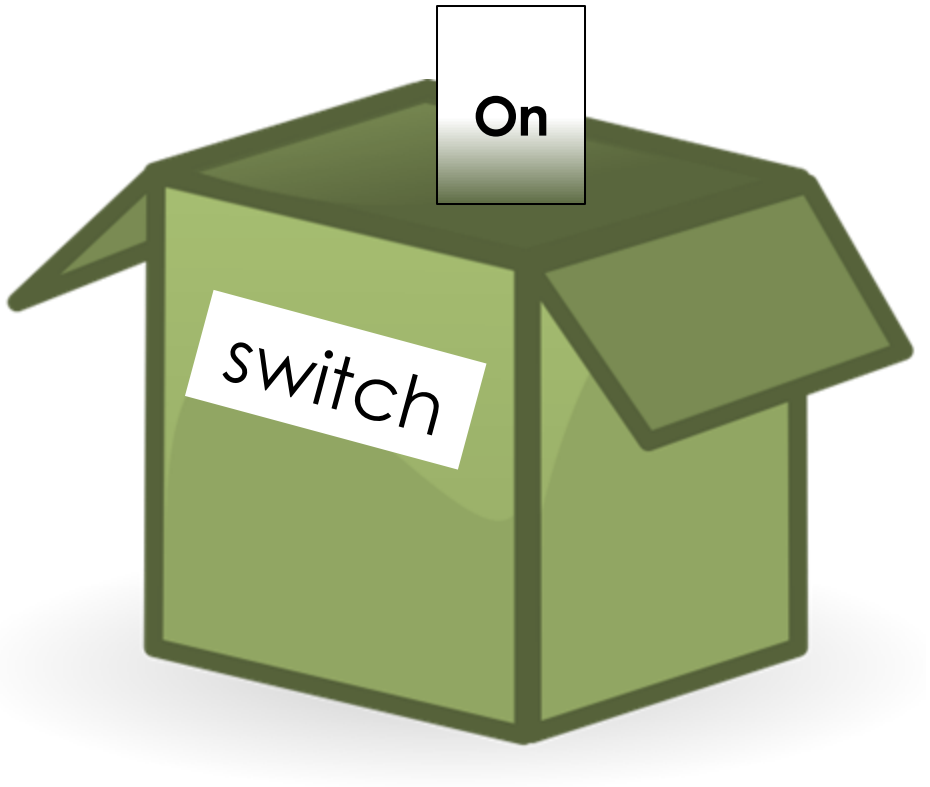
For example, I have stored the word "Bob" in my **variable** which is labelled "Name"



Switch Variable

I could have another **variable** named 'switch' which keeps track of whether our LED should be on or off

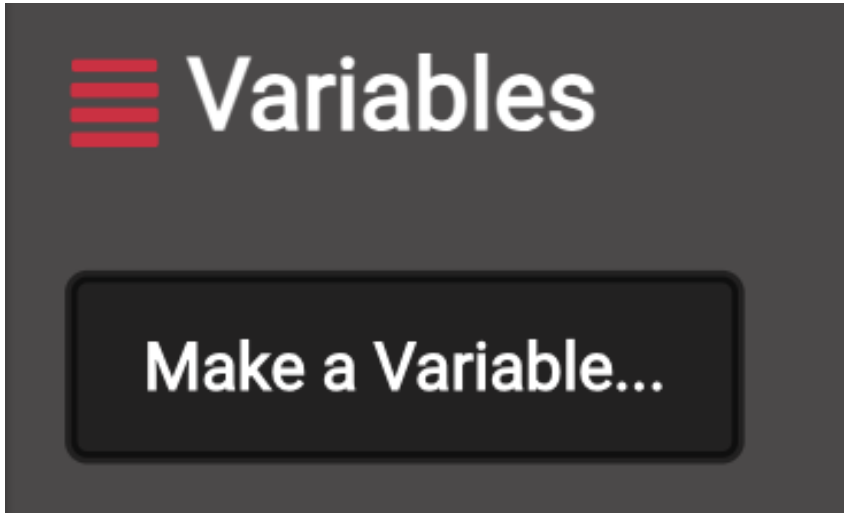
Every time we press the on/off button, our 'switch' variable will update and our micro:bit can use it to change the state of the LED

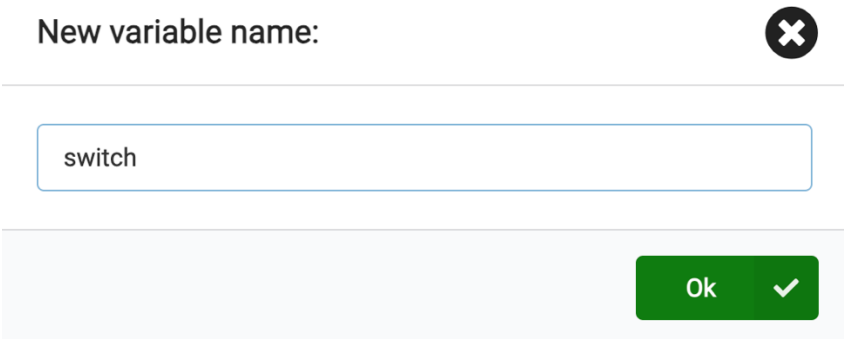


Switch It Up

Click on the variables tab and ‘Make a Variable’

Call your new variable ‘switch’





Switch It Up

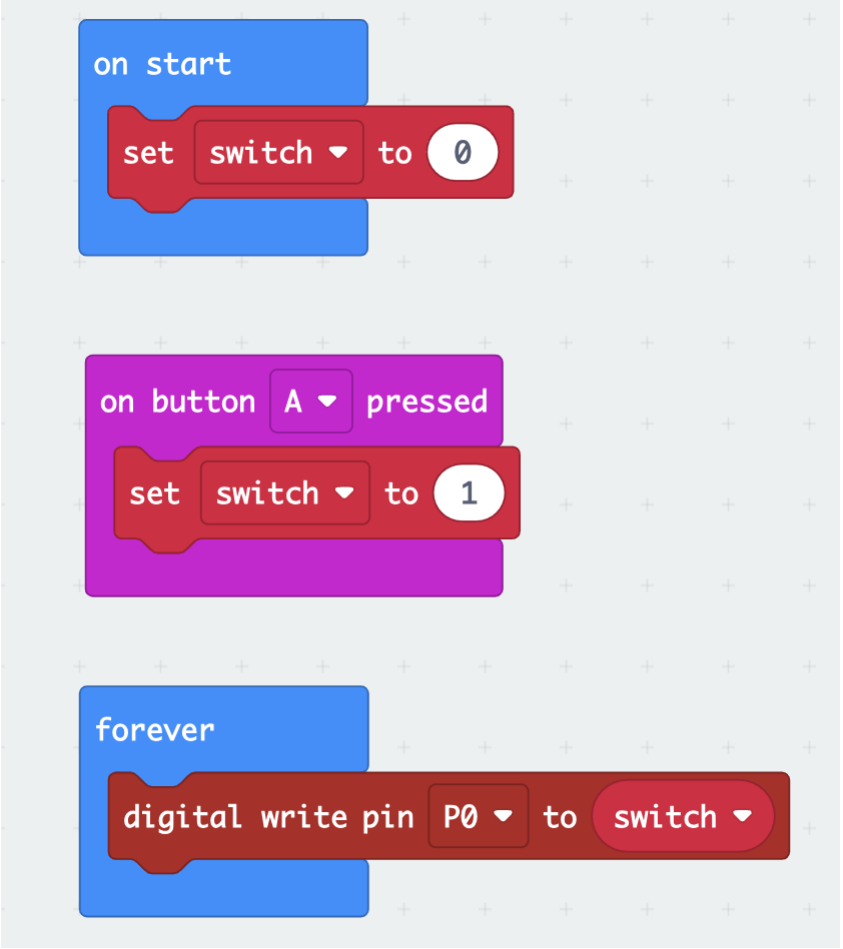
For digital devices:

0 = **off** **1** = **on**

Set your switch variable to **0** (**off**) on start

Set your switch variable to **1** (**on**) when the 'A' button is pressed

Forever set pin 0 to equal your switch variable



Conditions

- Feature of a programming language which helps us perform different actions based on different conditions.
- These conditions should always result either in Yes/No or True/False.
- Example:

  If your age is > 17 then

  You are eligible to drive (given that you have passed your tests).

  else

  You have to wait until you are eligible.

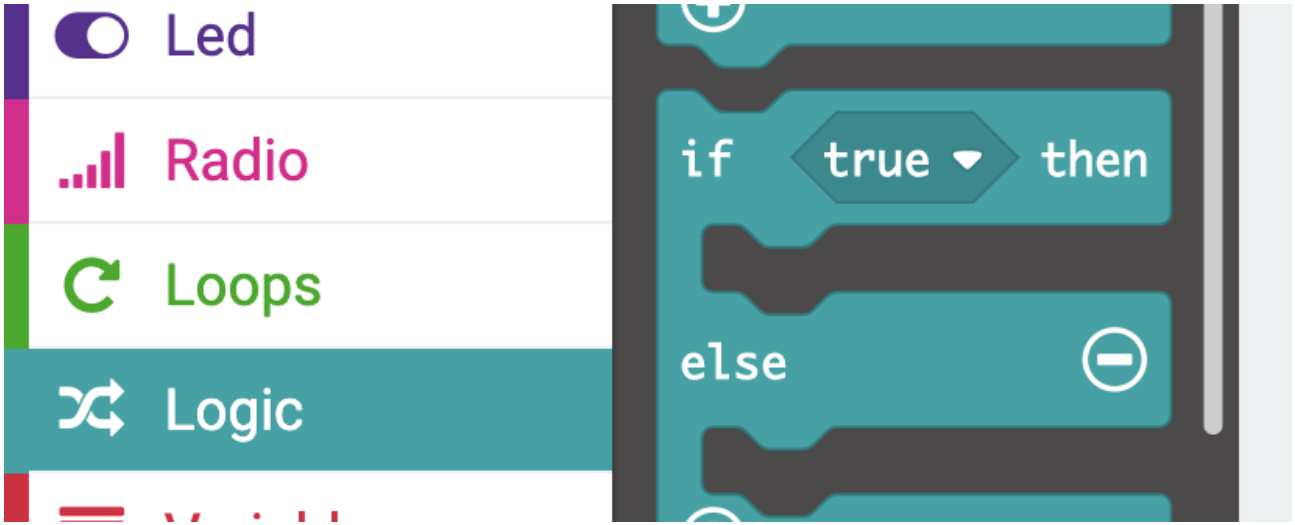
- The condition in the example above can either be true or false. Your age can either be > 17 or less than 17.
- What happens if your age is 17?

Conditional Expressions

- You can create conditions using expressions.
- These expressions use mathematical operators.

Operator	Meaning
<	Less than
>	Greater than
<= or ≤	Less than or equal to
>= or ≥	Greater than or equal to
=	Equal to
≠	Not equal to

Logic



- In Micro:bit these conditional statements are placed under Logic section.
- It has the conditionals, the comparison operators and the logical operators.

Switch It Up

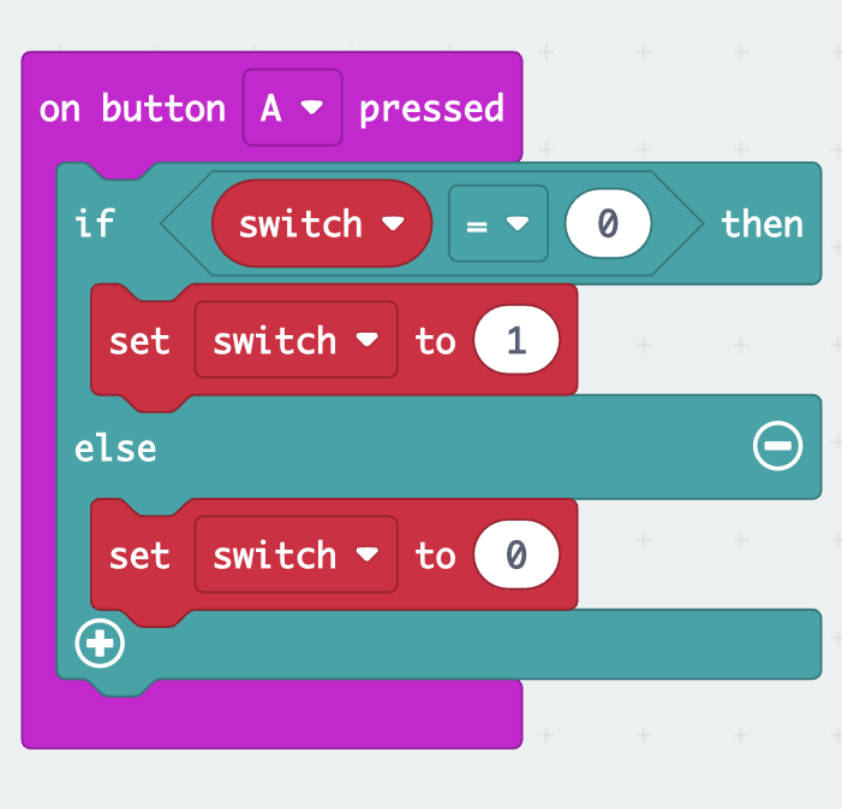
We can use an **if else** statement to update our switch variable every time the button is pressed

Create the statement:

if switch = 0

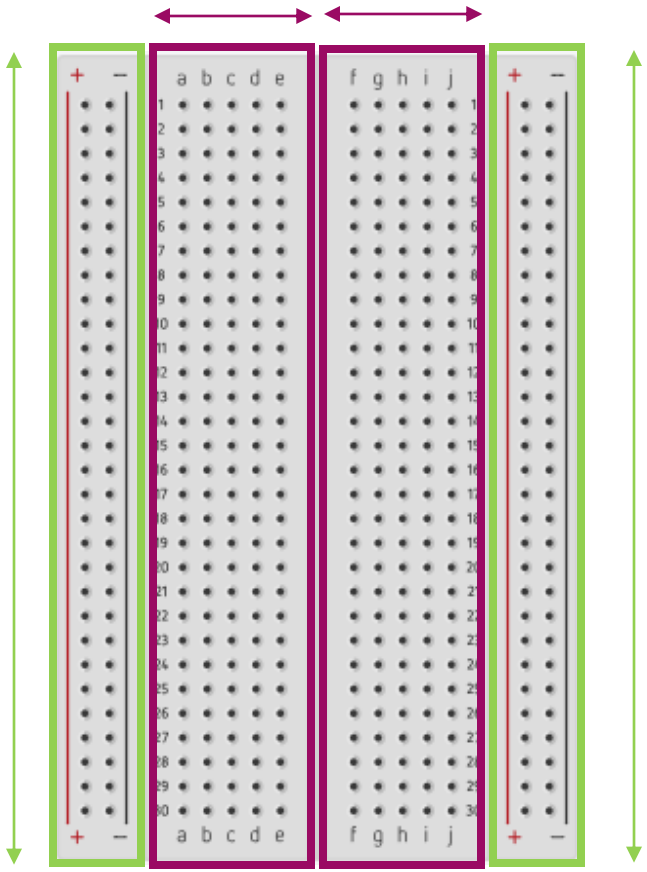
If this statement is true, we should set the switch variable to **1** when the button is pressed

Else we can set it to **0**



Activity: Improving the Circuit

Breadboard

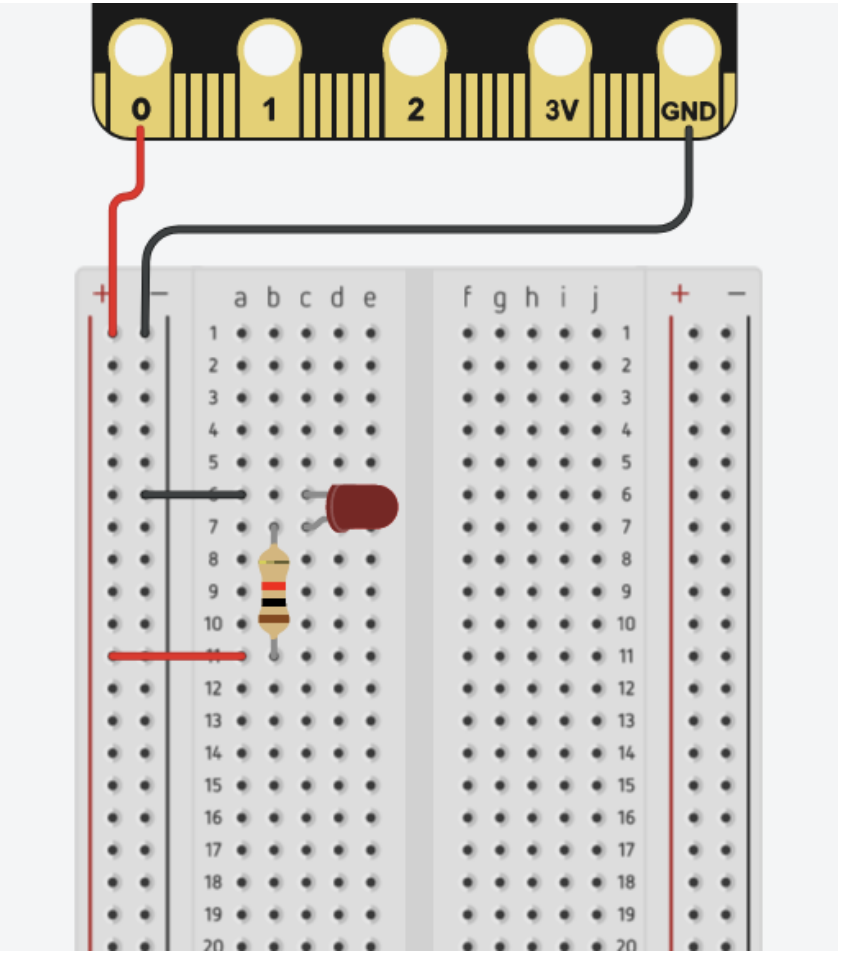


Improving the Circuit

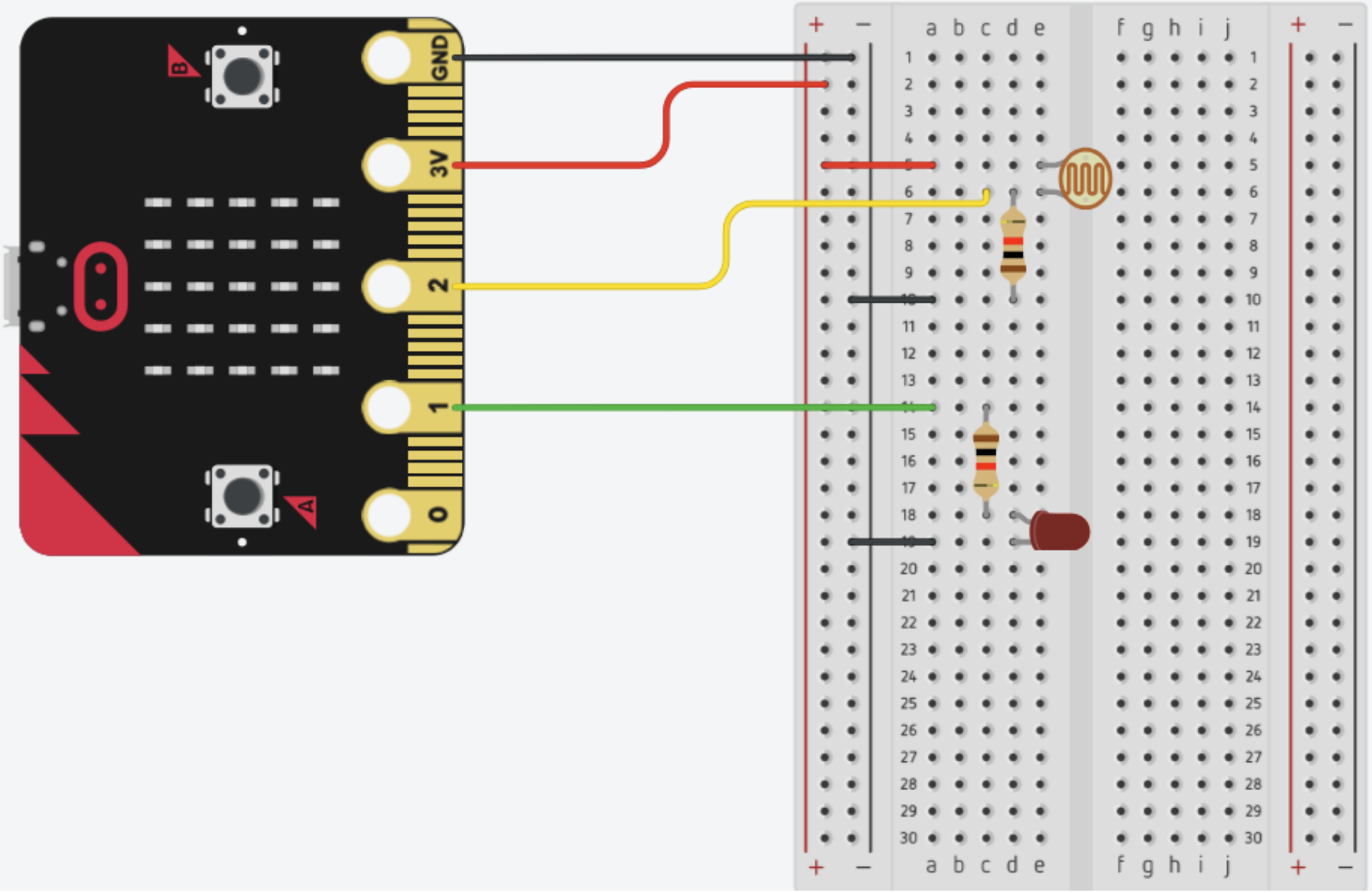
We can use a breadboard to:

- Make our circuit neater
- Add new components to our circuit
- Look after our components and stop them burning out

Follow the diagram to improve your circuit and add a resistor

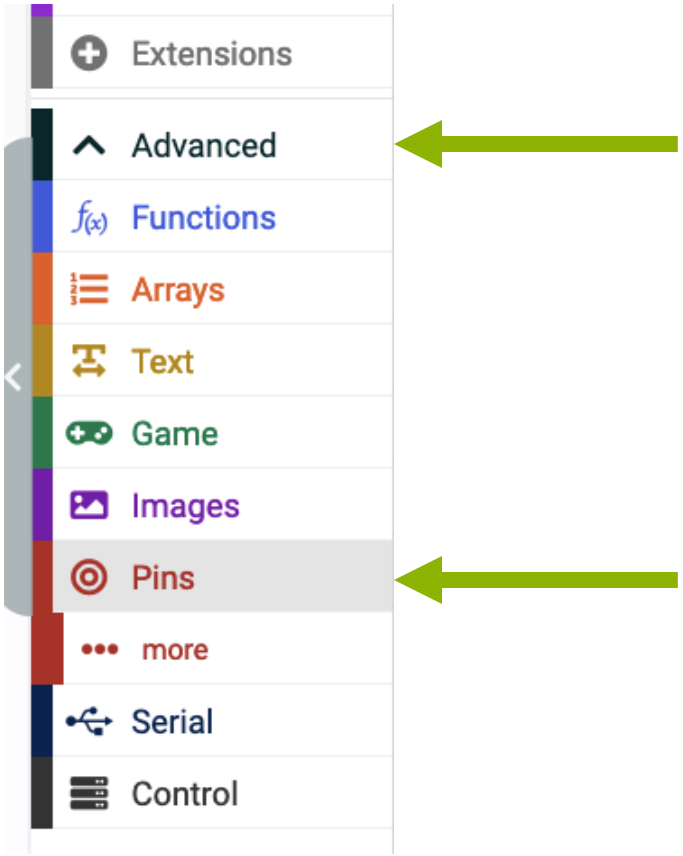


Activity: Making our Circuit Smart



Automatic Light Circuit

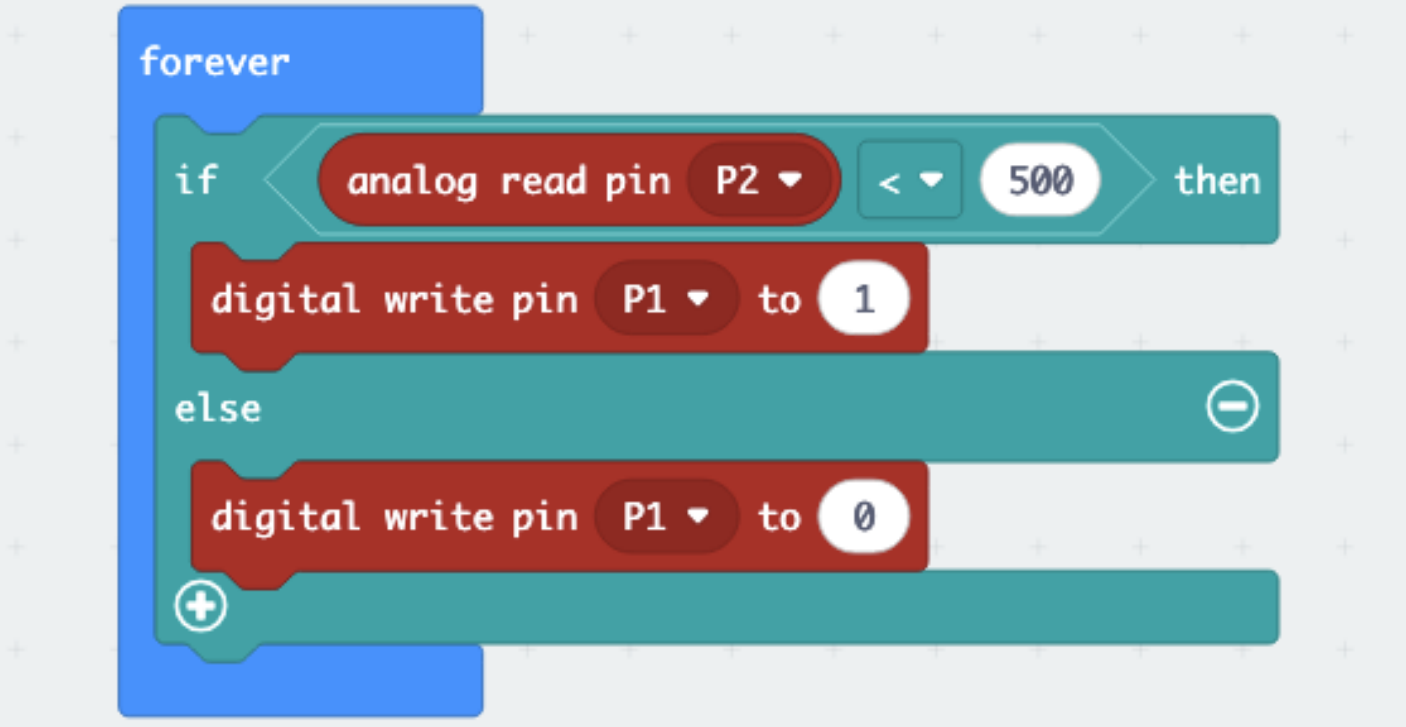
Programming Our Circuit



We will need blocks from the **Pins** tab in the **Advanced** menu

Programming Our Circuit

If the light sensor reading is low enough, the LED turns on

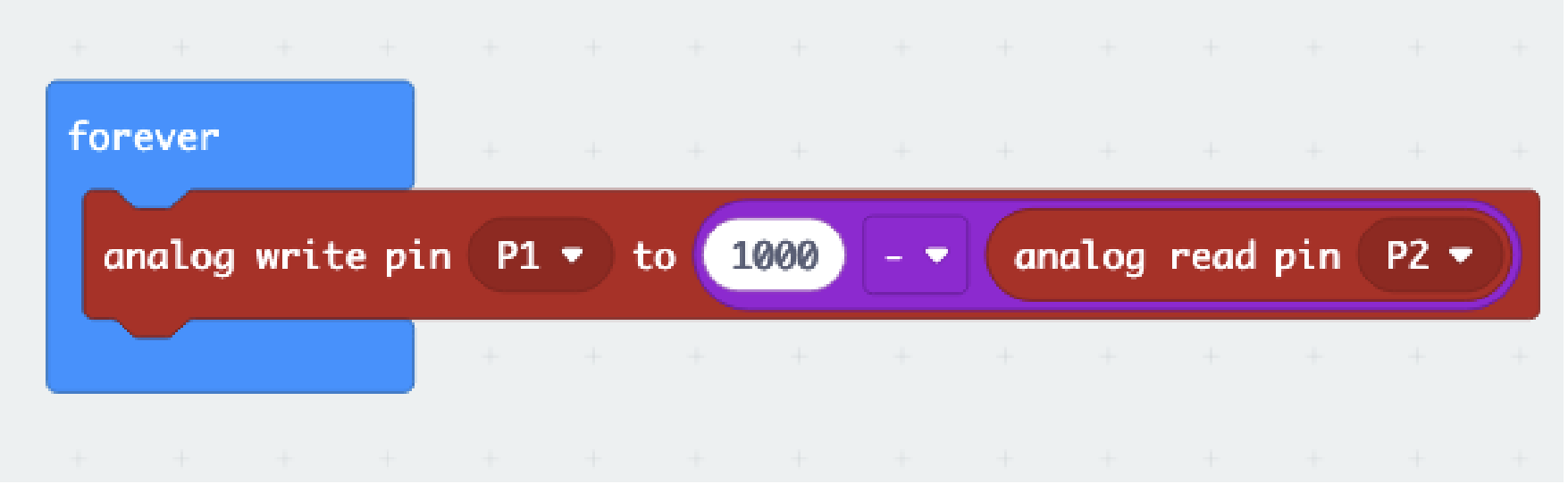


You may need to experiment to find a suitable threshold on pin 2!

Automatic Dimming

We could also try an analogue write to create a dimmer switch

We can subtract our light sensor reading from the maximum analogue value we can send to our LED to create the effect



You may need to experiment to make it work well!