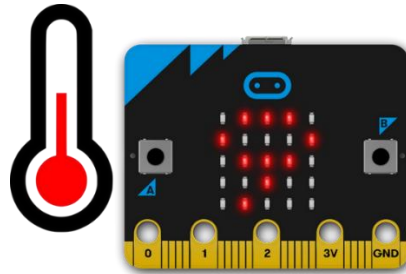# Activity:
Temperature Indicator #2 (Thermometer)

Description:

Build a program that will convert the temperature from Celsius to Fahrenheit, therefore the temperature will be displayed in Fahrenheit once button A is pressed on the microcontroller. The temperature is read using a built-in temperature sensor.
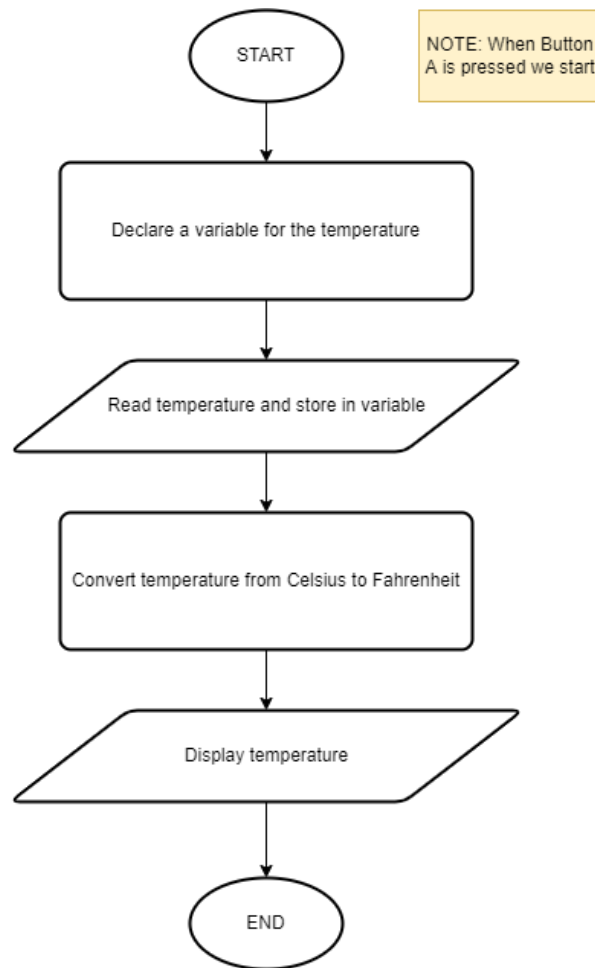
Vocabulary and Concepts:

Variable: An element, feature, or factor that is liable to change; in a programming language, a symbolic representation of some state or property of the program.

Sensor: An input device that reads or measures a physical property and converts it to a numerical value.

Temperature Sensor: a sensor that measures the temperature in degrees Celsius (scientific units)

Flowchart: A flowchart is a way of representing the step-by-step process (algorithm) of you program. For this program, the flowchart is

```
        ( START )          ┌─────────────────┐
                           │ NOTE: When Button│
                           │ A is pressed we  │
                           │ start            │
                           └─────────────────┘
     ┌──────────────────────────────┐
     │ Declare a variable for the   │
     │ temperature                  │
     └──────────────────────────────┘

      / Read temperature and store in variable /

     ┌──────────────────────────────┐
     │ Convert temperature from     │
     │ Celsius to Fahrenheit        │
     └──────────────────────────────┘

      / Display temperature /

        ( END )
```

There is always a circle informing you where the algorithm starts. The arrows walk you through to the next steps. The program should take an input pressed button. Next, output the temperature. Finally, the program should end.

Let's Start Programming!

Step 1: Accessing the Project Editor Page

You must be connected to the Internet and you may use any modern browser such as Edge, Firefox, Chrome, or Safari.

Start the micro:bit coding tool by using a web browser to connect to microbit.org/code. Once the webpage is loaded, scroll down to see the MakeCode Editor Section. Click the "Let's Code" button. This will take us to a new page where you will click the "+ New Project" box. It will take a moment to load and start.

The coding tool we are using is called the **Javascript Blocks Editor**. Here is what it looks like when it is ready:
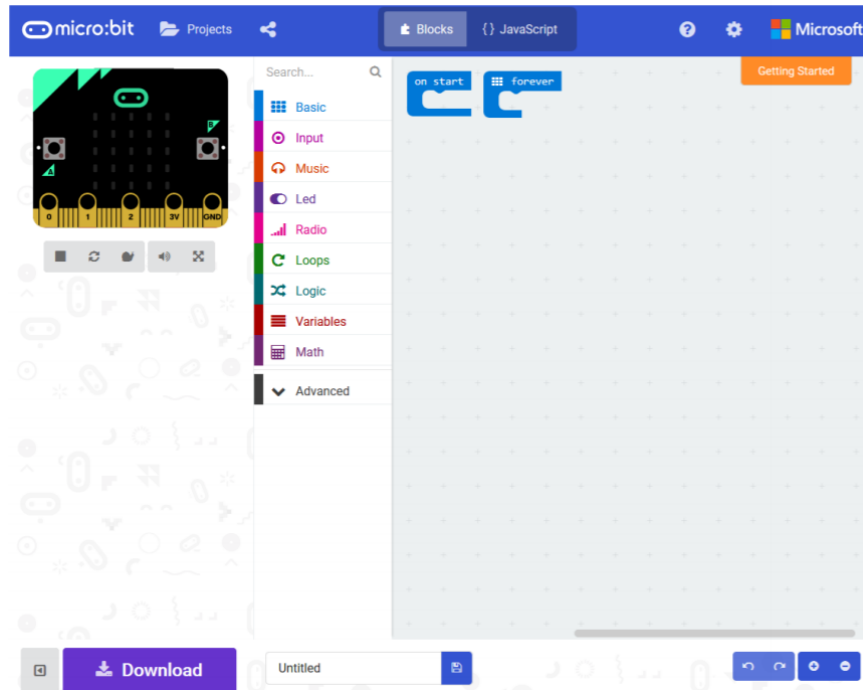

Step 2: Features of the Editing Tool

In the upper left hand corner is the micro:bit emulator. You can test your program here before you download it to the micro:bit. In the middle of the screen is the blocks chooser. The blocks are grouped into categories like Basic, Input, and Variables. The right side of the screen is where you will create your program by arranging blocks. Notice that two blocks are automatically inserted. The "on start" block contains any code that needs to happen one time only when the micro:bit is turned on. The "forever" block contains the remainder of your program. Other controls in the editor are for downloading your program, switching between blocks and Javascript, help, settings, and saving your projects. Let's code!

Step 3: Getting Started

First, grab the on button pressed block and drag it to the editor. Next, create a variable by going to the variables tab and selecting "Make a Variable". The variable name will be called "temp_in_C" because the temperature in Celsius will be stored in that variable which leads to setting the variable. Next, set the variable by going to the variables tab and grabbing the set block and select the "temp_in_C" variable to temperature (C) by grabbing the temperature block from input tab. Next, show the number from basic tab and place the temp_in_c variable within that block. Now, convert the temperature from Celsius to Fahrenheit by using the following formula, F = (C*1.8)+32. The formula can be created with the math tab and creating a new variable called, "temp_in_F". set "temp_in_F" to temp_in_C *1.8 +32. Finally, create an arrow with the show leds and show it in Fahrenheit by doing show number with "tenp_in_F" variable. An example is shown below in the visual.
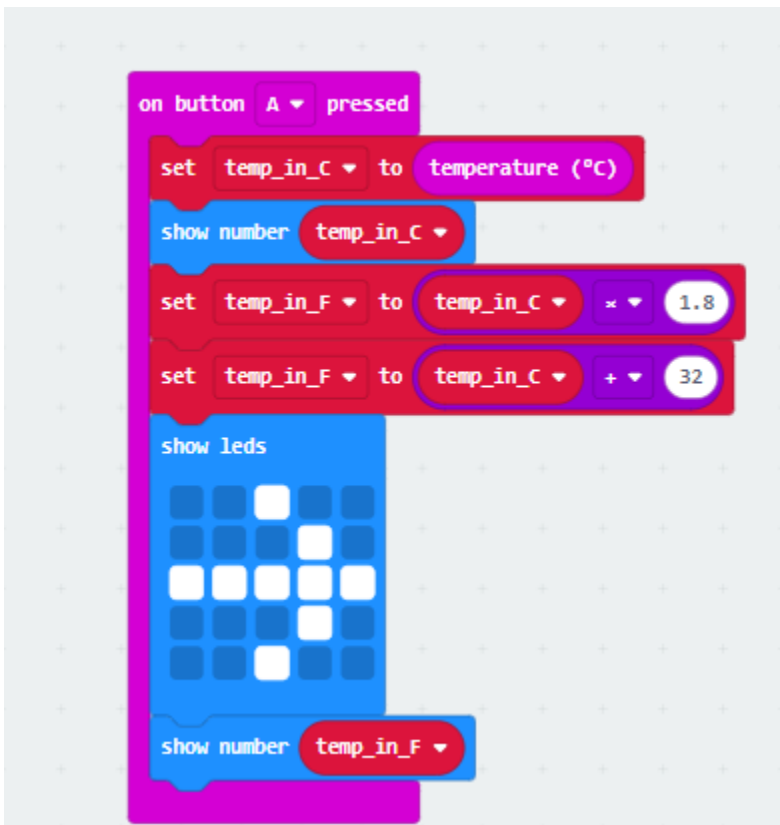
Step 4: Selection Changes

Certain changes can be made within the "on button pressed" block by choosing between A, B, or A+B which means we can determine if we would like to change the temperature when button A is pressed on the microbit, button B, or Both buttons with A+B.

## Step 5: Test your Program using the Emulator

Once you have completed assembling your blocks, then press the button A on the emulator. If your program is working correctly, then it is time to download it to the micro:bit. Before we download it, let's give our program a name. Click on the word "Untitled" in the textbook on the bottom left side of the editor.
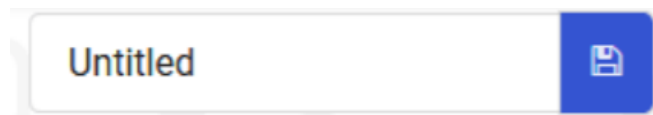
Name your program "Temperature Indicator2". You do NOT need to click the disk icon to change the name—pressing the disk icon will save your program by downloading it to your computer.
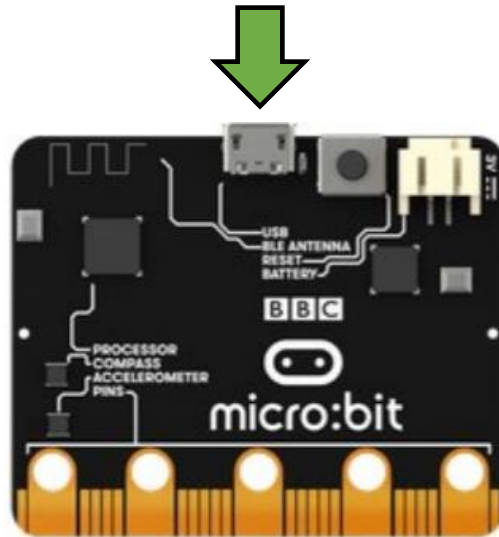
Step 6: Download the Program

Now we need to download the completed program. Click the "Download" button and save the program on your computer. Be sure to note where you have saved the program.
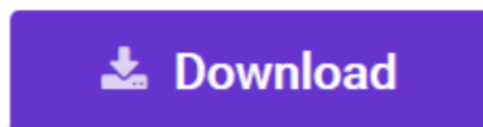
Step 7: Connect to your micro:bit

Next, connect your micro:bit to your computer with the USB cable. The following is where the USB cable needs to attach to the micro:bit.
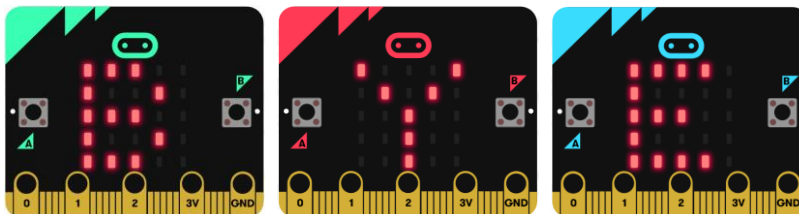

Step 8: Running the Program on the micro:bit

If you are using Windows, click the Start icon at the bottom left of your screen. Open the File Explorer (you can search for File Explorer if not displayed on your Start menu) and find your downloaded program. Right click on the program and select "Send To". Then select "Microbit". If you are using a Mac, drag and drop the program onto the MICROBIT device from the Finder. This will install your program on the micro:bit. The yellow LED on the back of the micro:bit will blink while your program is being installed. Your program will run once the selected button is pressed.

Congratulations!

You have created your Thermometer program!!

References
Online Thermometer tutorial: https://microbit.org/projects/make-it-code-it/thermometer/
Flowchart tool: https://www.draw.io/