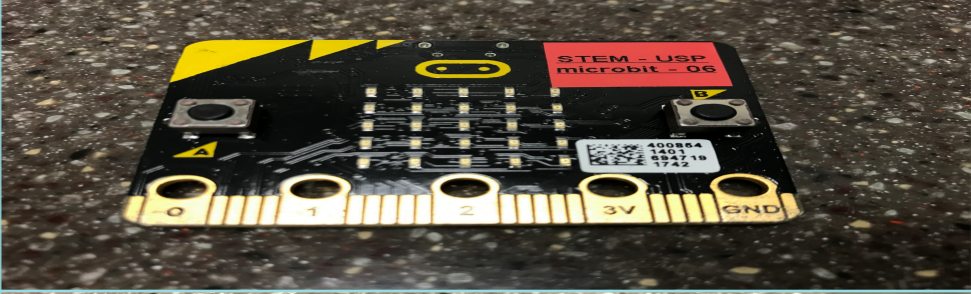
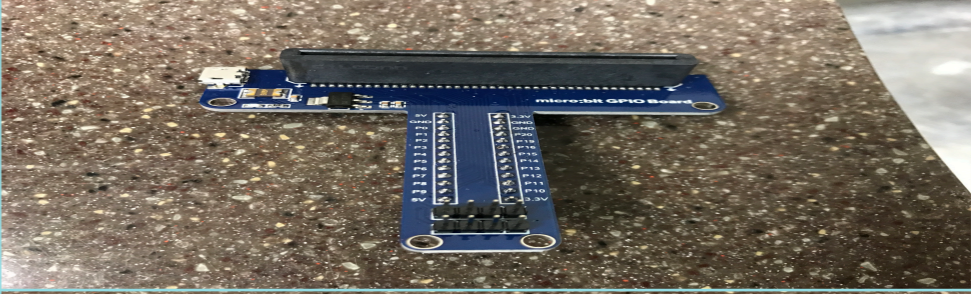
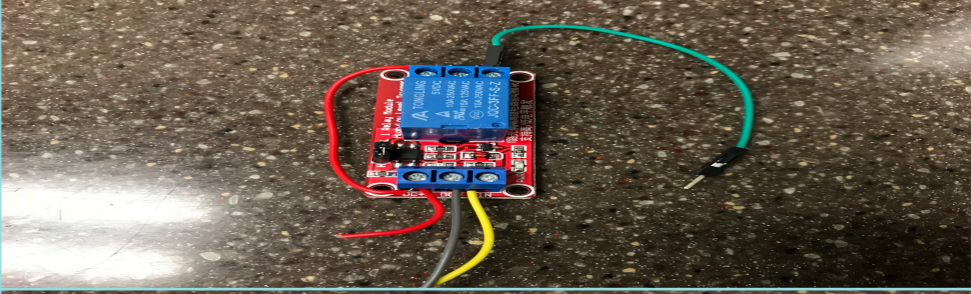
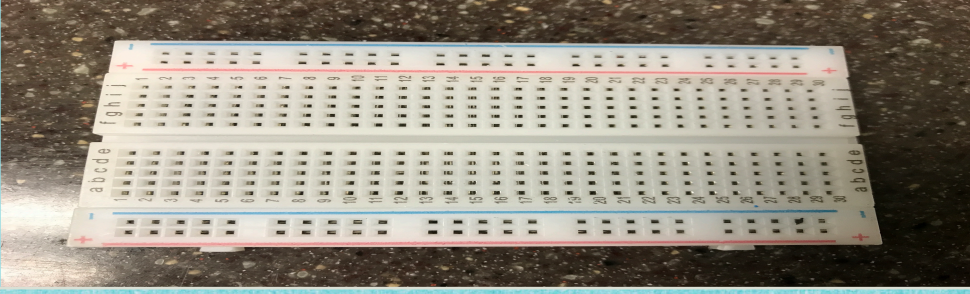

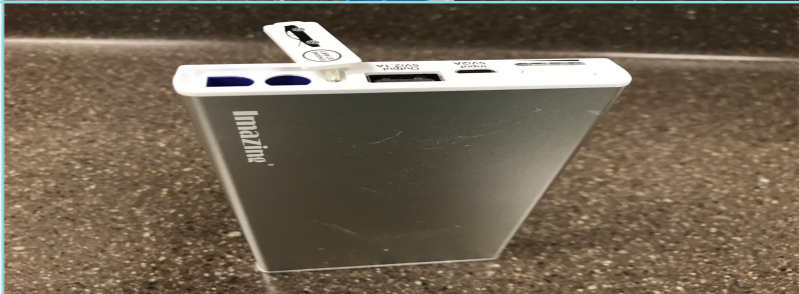




*Micro:bit Beverage  
Warmer for the Elderly*

Component	Quantity	Photo
Microbit	1	
Edge Connector	1	
Relay	2	
Breadboard	1	

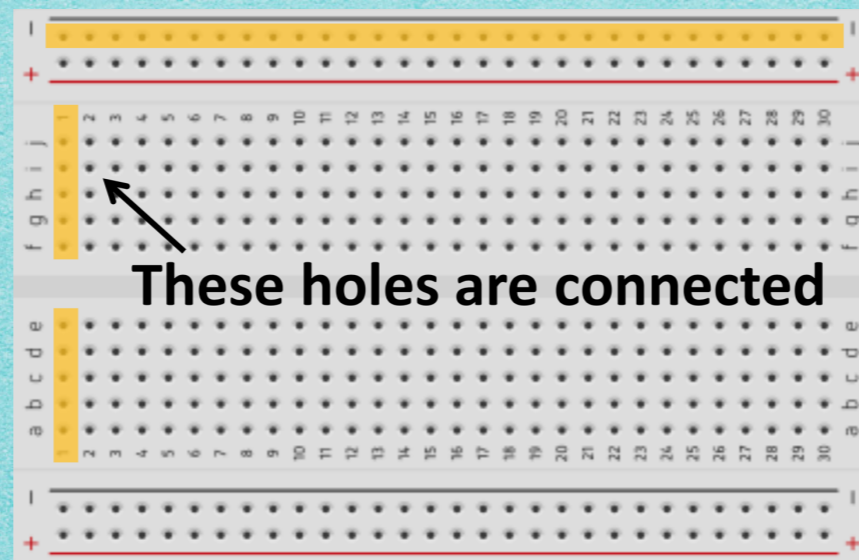
## Major Electrical Components

Component	Quantity	Photo
Fan	1	
12V Portable Car Battery Charger	1	
Heater	1	
TMP 36 (temperature sensor)	1	

## Major Electrical Components

# Breadboard

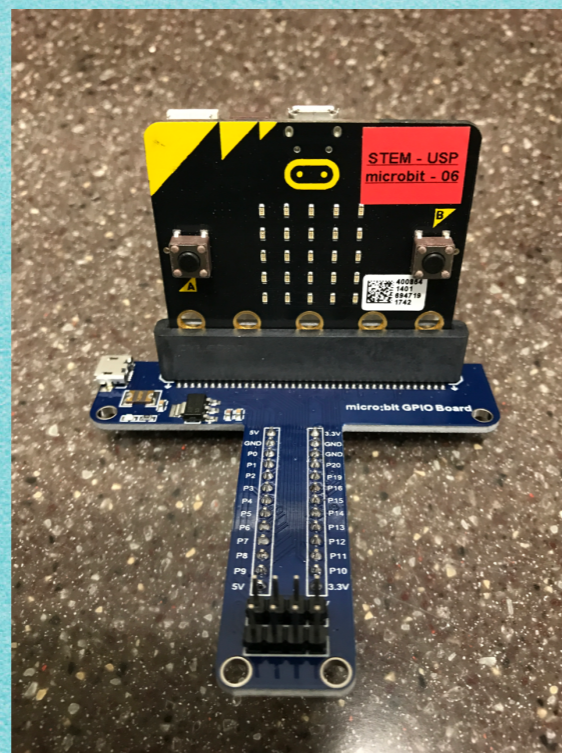
- ▶ Holes highlighted in **the same row/column are connected**



# Temperature Sensor (TMP 36)

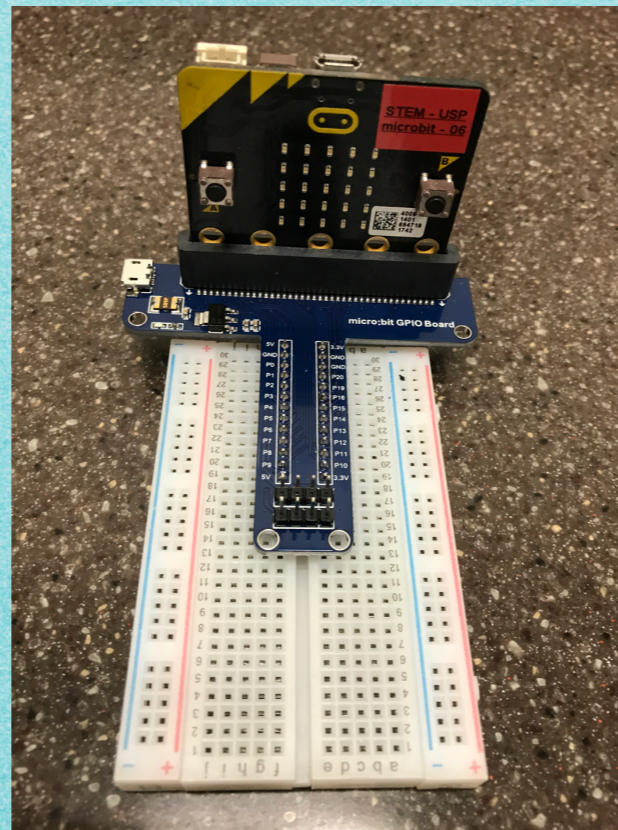
- ▶ We can use **TMP 36** to measure **temperature**

Step 1: insert **microbit** to **edge connector**



# Temperature Sensor (TMP 36)

Step 2: Insert the **edge connector** to **breadboard**



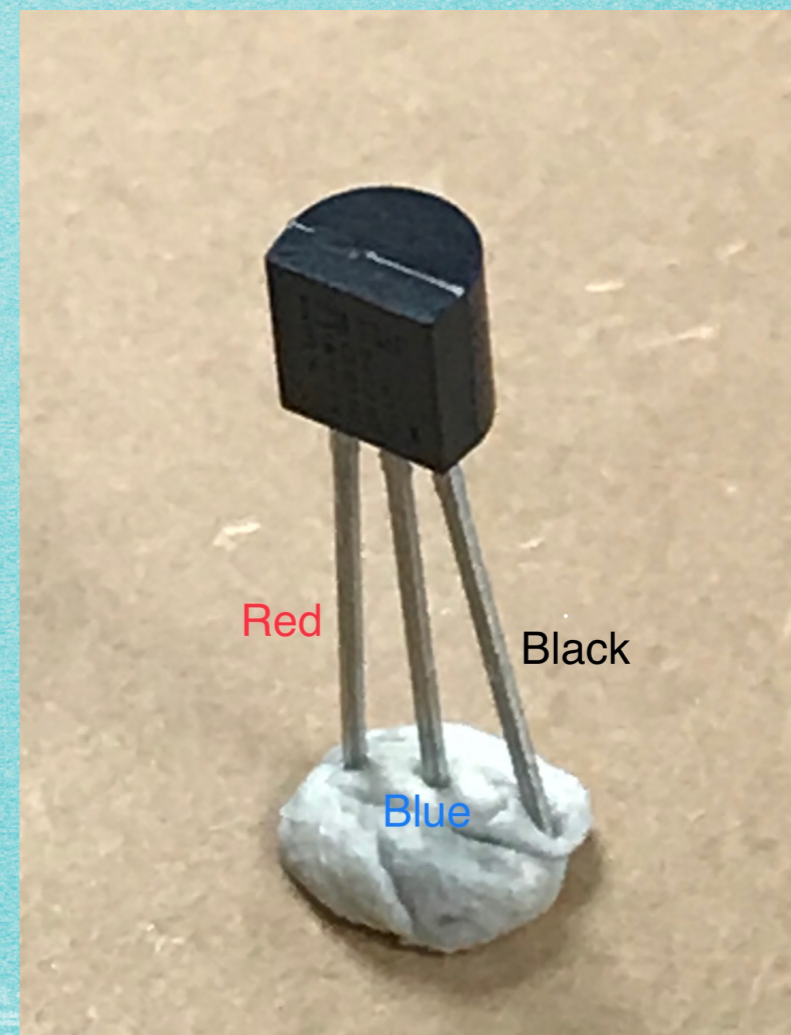
# Temperature Sensor (TMP 36)

Step 3: On the flat side of TMP 36, connect the following wires as shown

**Red -> left**

**Blue -> middle**

**Black -> right**



# Temperature Sensor (TMP 36)

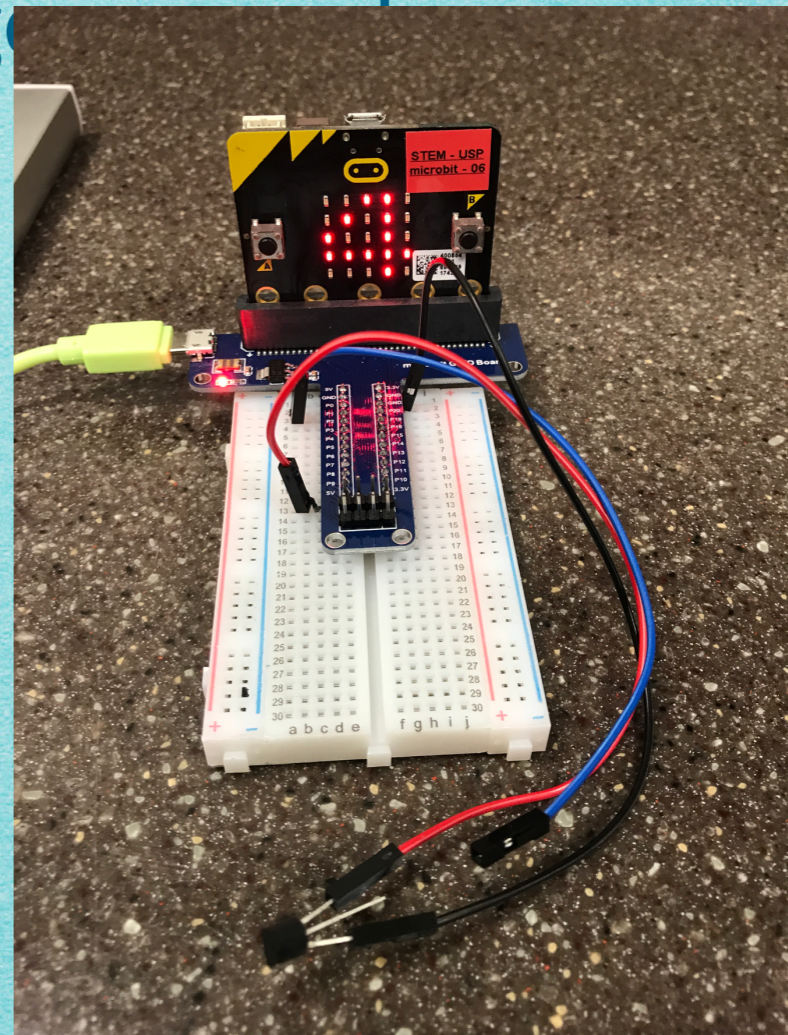
Step 4: Connect TMP 36 to edge  
follows:

**Red -> 5V**

**Blue -> pin 0**

**Black -> GND**

**Caution: TMP 36 will burn if the  
wires are not connected correctly**





# Codes for Temperature Sensor (TMP 36)

go to <http://microbit.org/code/>, and choose **let's code**, we arrive at the coding area:

**Micro:bit simulator, testing the written codes**

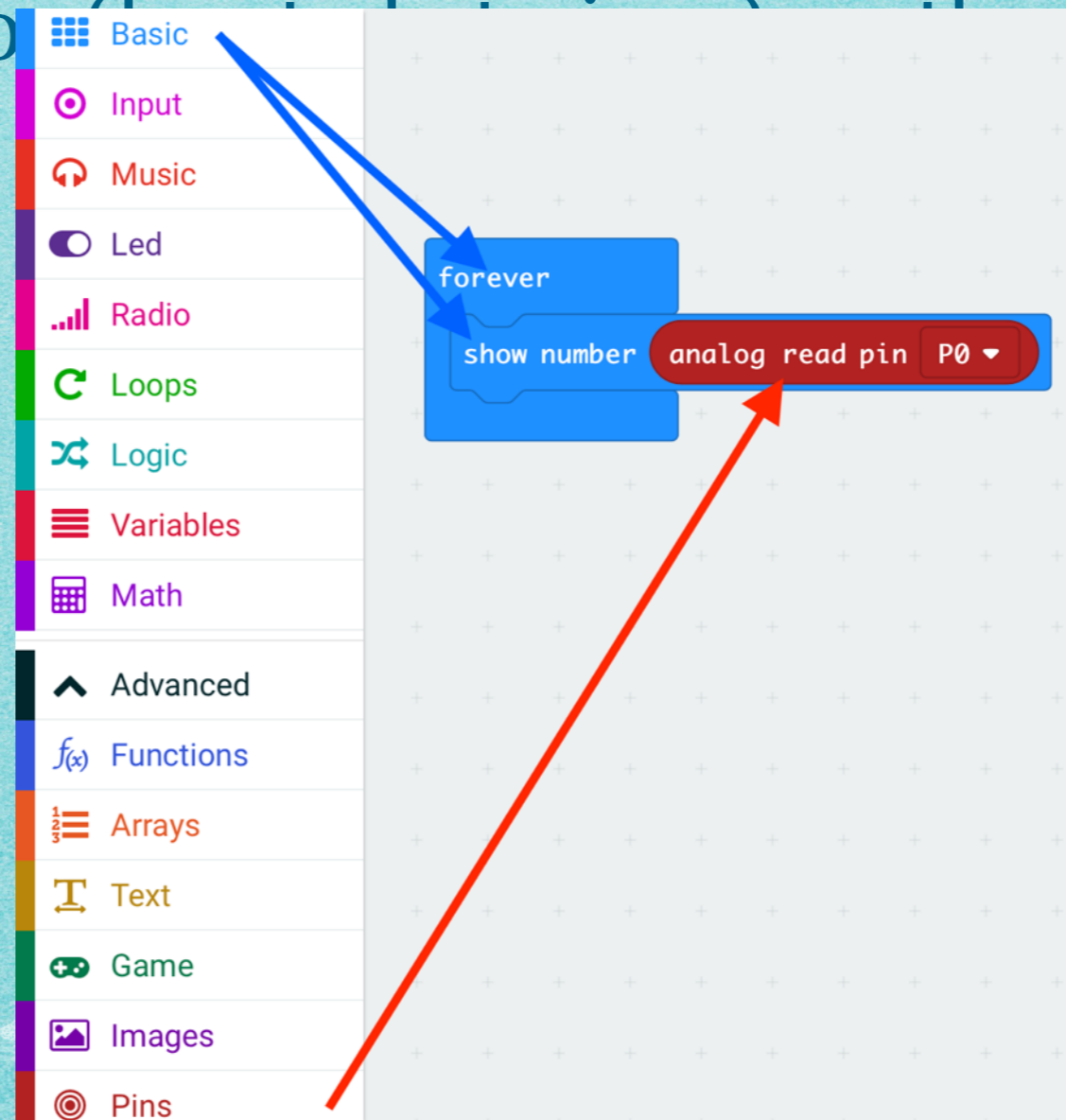
**Categories of coding blocks**

**Coding area**

**Download the code to run on micro:bit**

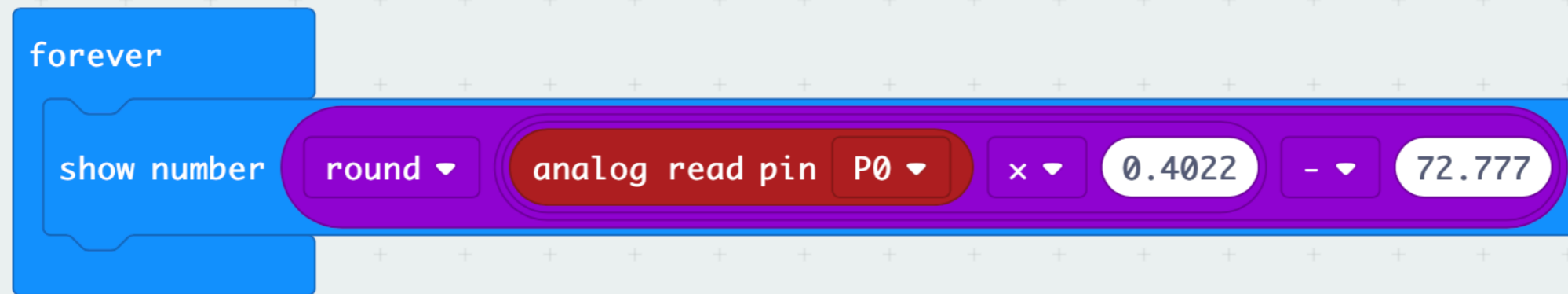
# Codes for Temperature Sensor (TMP 36)

Step 5: The following codes output the reading of temperature sensor (TMP 36) on microbit



# Codes for Temperature Sensor (TMP 36)

Step 6: Calibrate the temperature sensor, and convert the readings of the sensor to temperature values in Celsius



```
forever loop containing:  
  show number  
  round  
  analog read pin P0  
  multiply by 0.4022  
  subtract 72.777
```

The image shows a Scratch code block for a temperature sensor. It is a 'forever' loop containing a 'show number' block followed by a mathematical expression:  $\text{round}(\text{analog read pin P0} \times 0.4022 - 72.777)$ . The 'analog read pin' block is set to 'P0'. The multiplication factor is 0.4022 and the subtraction value is 72.777.

# Relay

- ▶ High voltage devices could be controlled by Microbits using relays

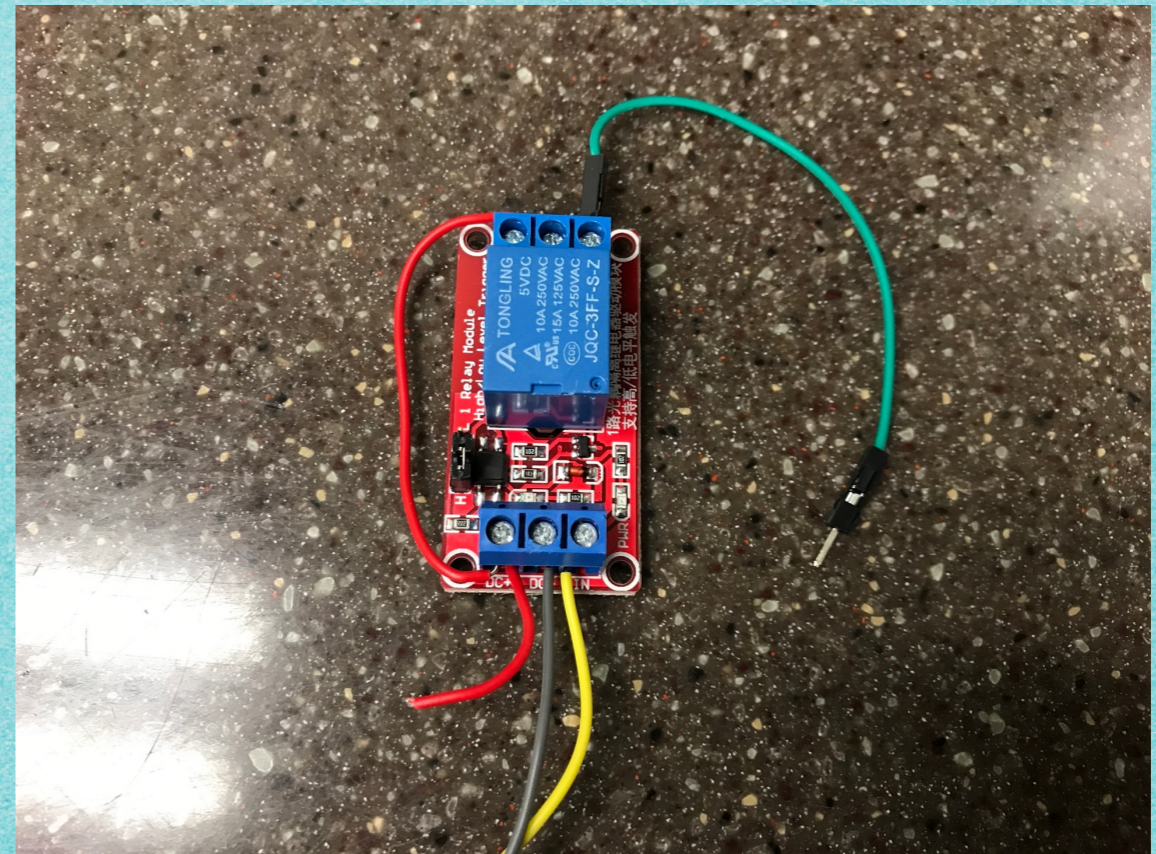
Step 1: Connect wires to relay as shown

DC+ -> COM, **red** wire

DC- -> **grey** wire

IN -> **yellow** wire

NO -> **green** wire



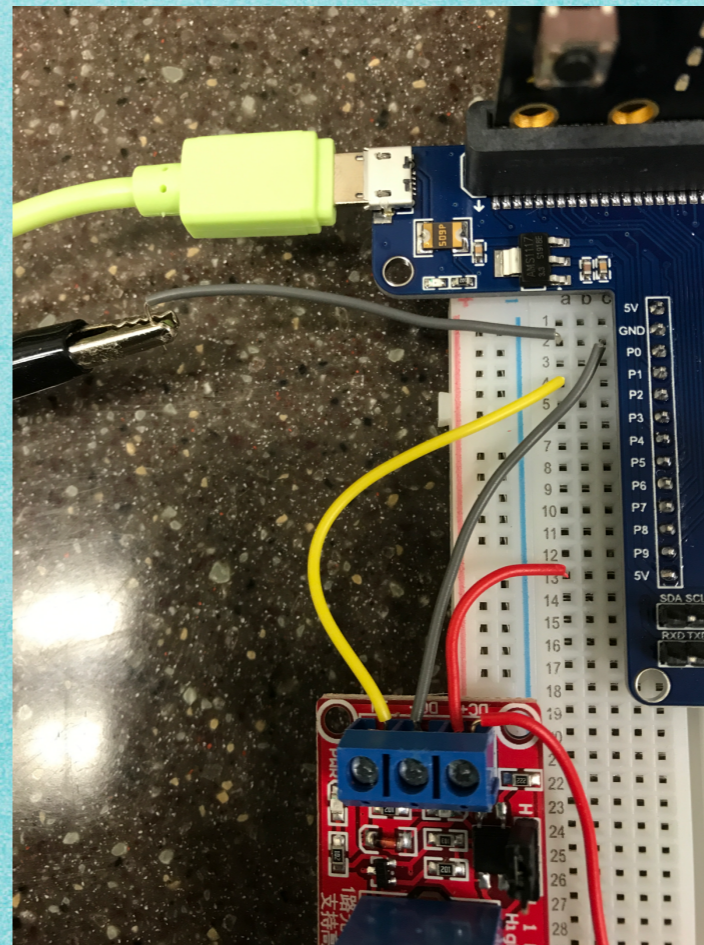
# Control Fan with Relay

Step 2: Connect **relay** to **breadboard** as shown:

**Red** -> **5V**

**Yellow** -> **pin 1**

**Grey** -> **GND**

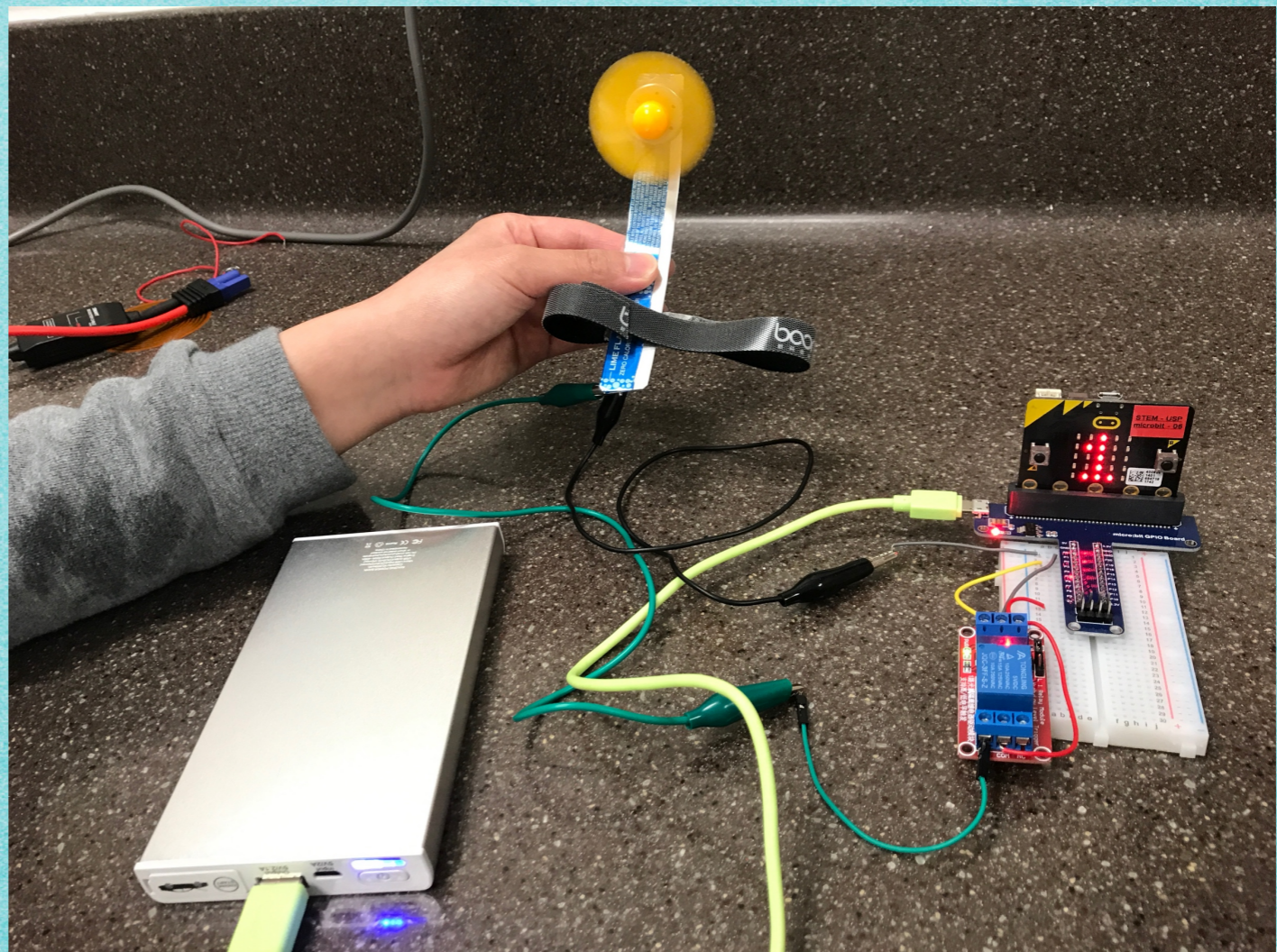


# Control Fan with Relay

Step 3: Connect **relay** to **fan** as shown:

Green -> Fan

GND -> Fan



# Control Fan with Relay

Step 4: The following codes control the relay by pin 1

Check whether the fan works

on button **A** pressed

digital write pin **P1** to **0**

show number **0**

on button **B** pressed

digital write pin **P1** to **1**

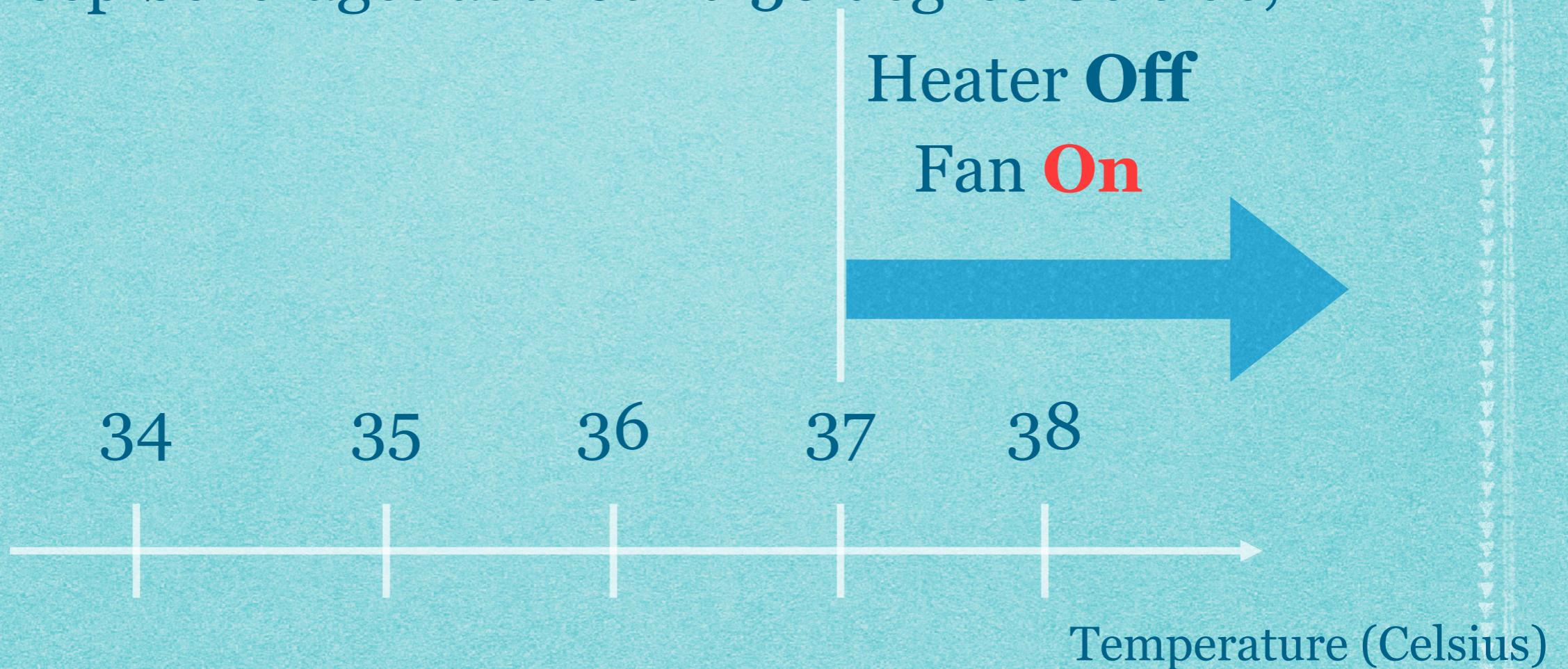
show number **1**

# Codes for Fan with Relay

To keep beverages at around 36 degree Celsius,

Heater **Off**

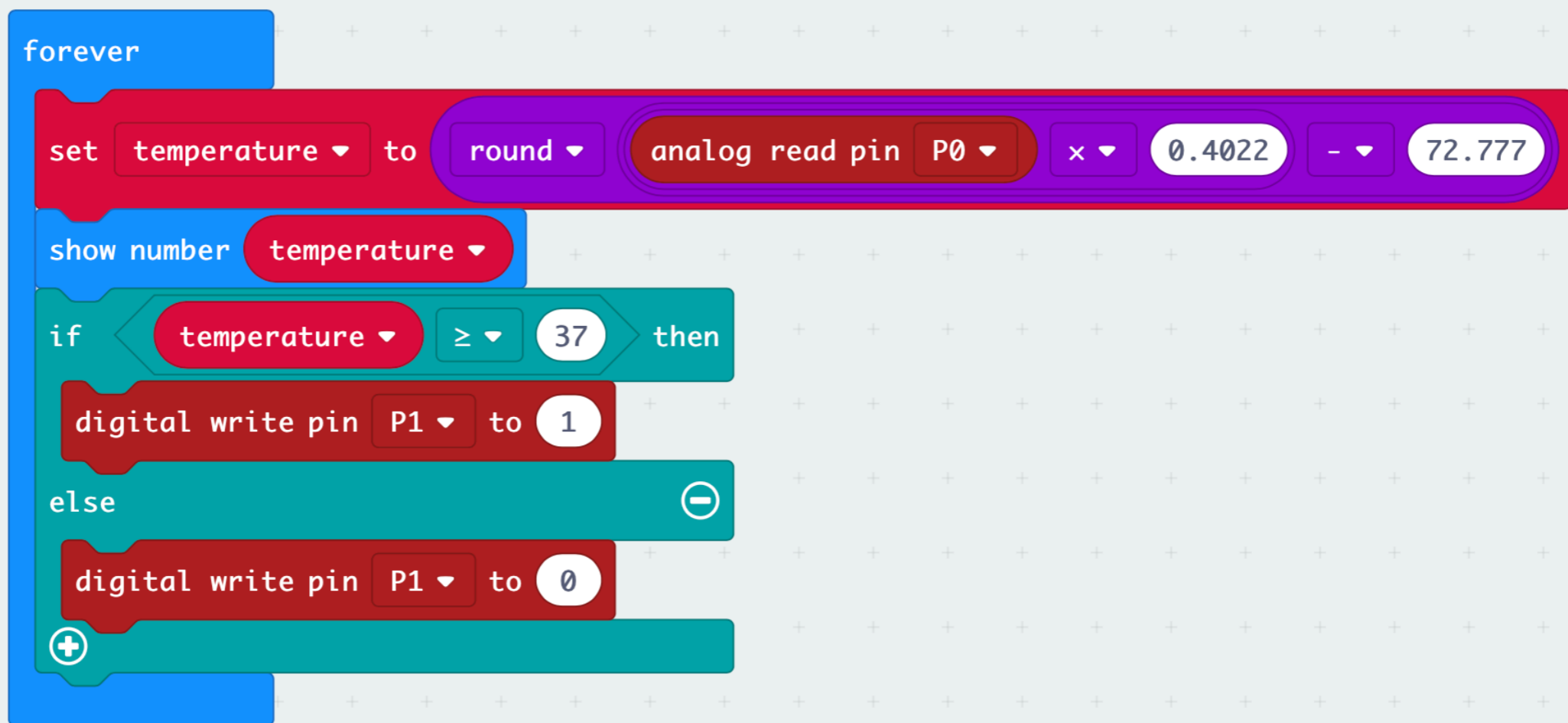
Fan **On**





# Codes for Fan with Relay

Step 5: The following codes switch on fan if temperature  $\geq 37$  degrees at pin 1



```
forever
  set temperature to round(analog read pin P0 * 0.4022 - 72.777)
  show number temperature
  if temperature >= 37 then
    digital write pin P1 to 1
  else
    digital write pin P1 to 0
```

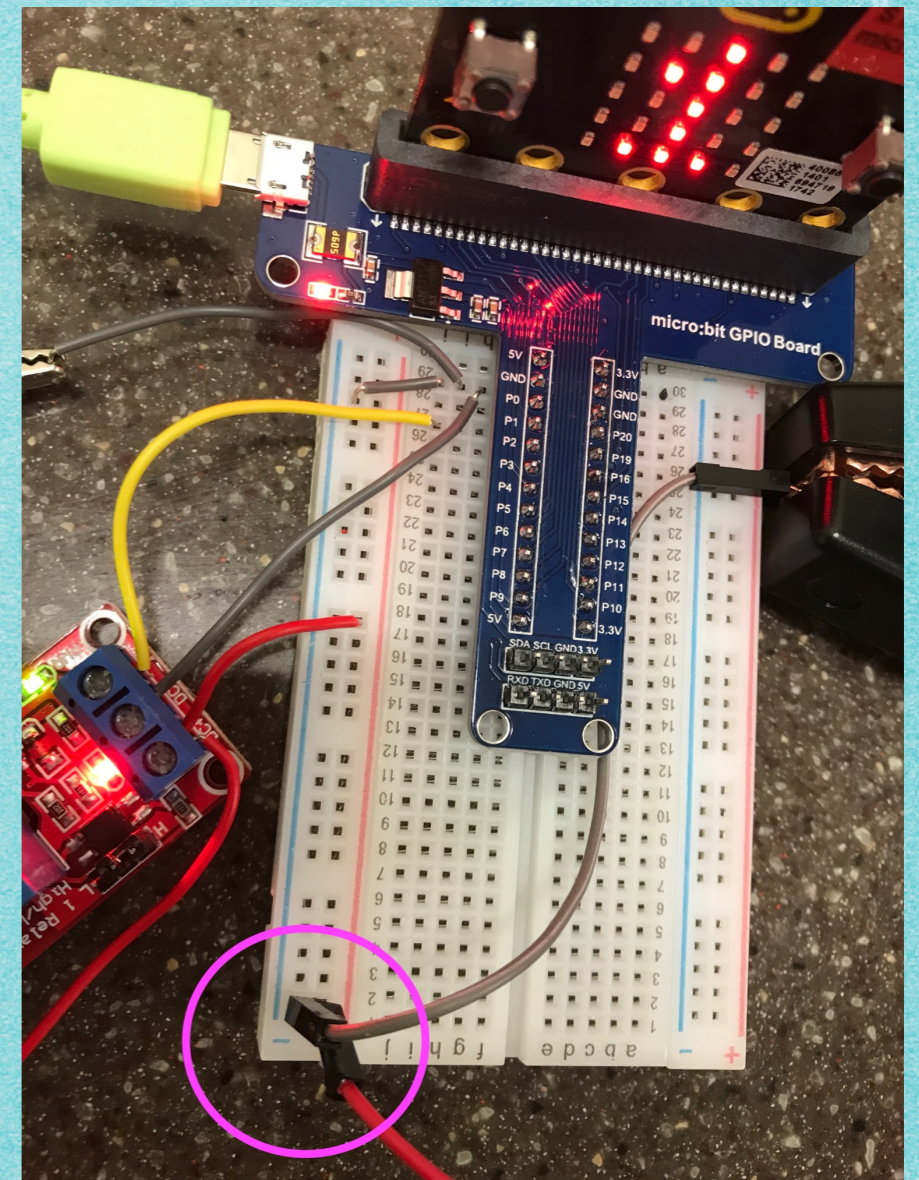
The image shows a Scratch code block for a fan relay. It starts with a 'forever' loop. Inside the loop, the first block is 'set temperature to round(analog read pin P0 \* 0.4022 - 72.777)'. The second block is 'show number temperature'. The third block is an 'if' statement: 'if temperature >= 37 then'. Inside the 'if' block, there are two 'digital write pin P1 to' blocks: one with the value '1' and one with the value '0', separated by an 'else' block. The 'if' block has a minus sign (-) on its right side, and the 'else' block has a plus sign (+) on its right side.

# Control Heater with Relay

Step 1: Connect **12V Portable Car Battery Charger** to **breadboard** as shown

**Red line on breadboard -> (+) of battery**

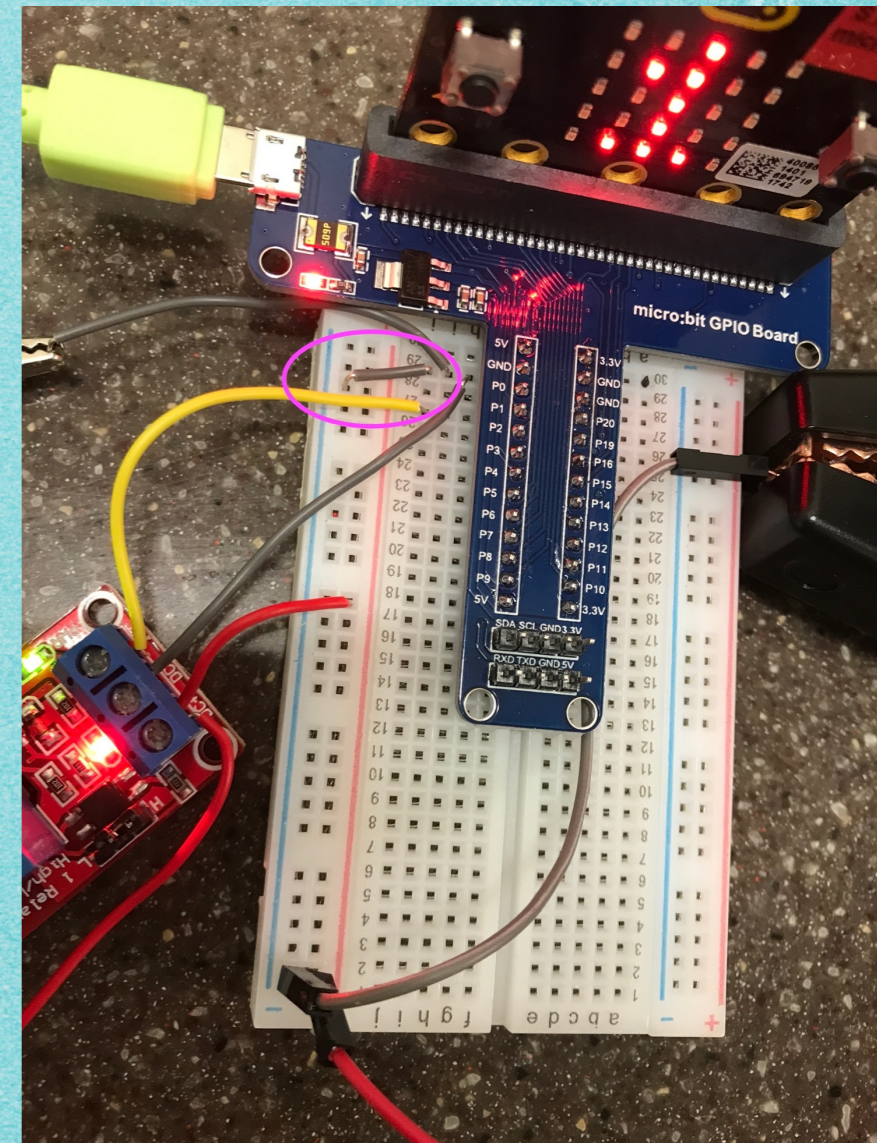
**Blue line on breadboard -> (-) of battery**



# Control Heater with Relay

Step 2: Connect **common ground** as shown

GND (edge connector)  
-> GND (blue line on  
breadboard)



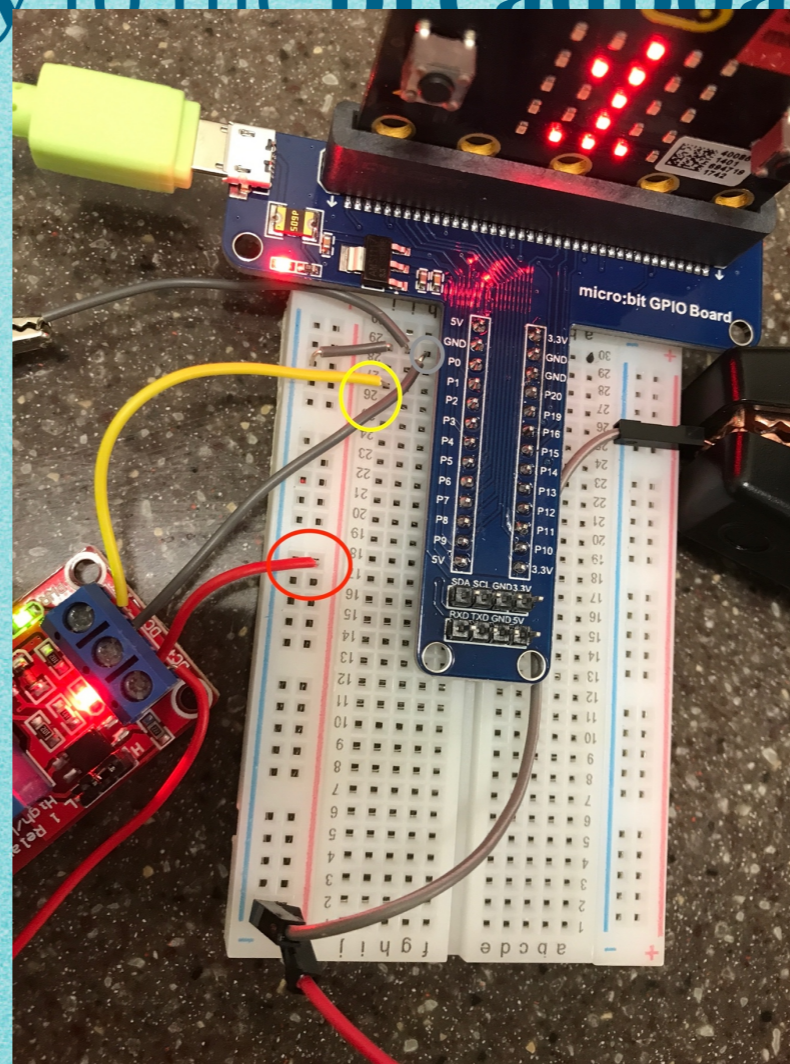
# Control Heater with Relay

Step 3: Connect **relay** to the **breadboard**

**Red** -> **12V**

**Yellow** -> **pin 2**

**Grey** -> **GND**

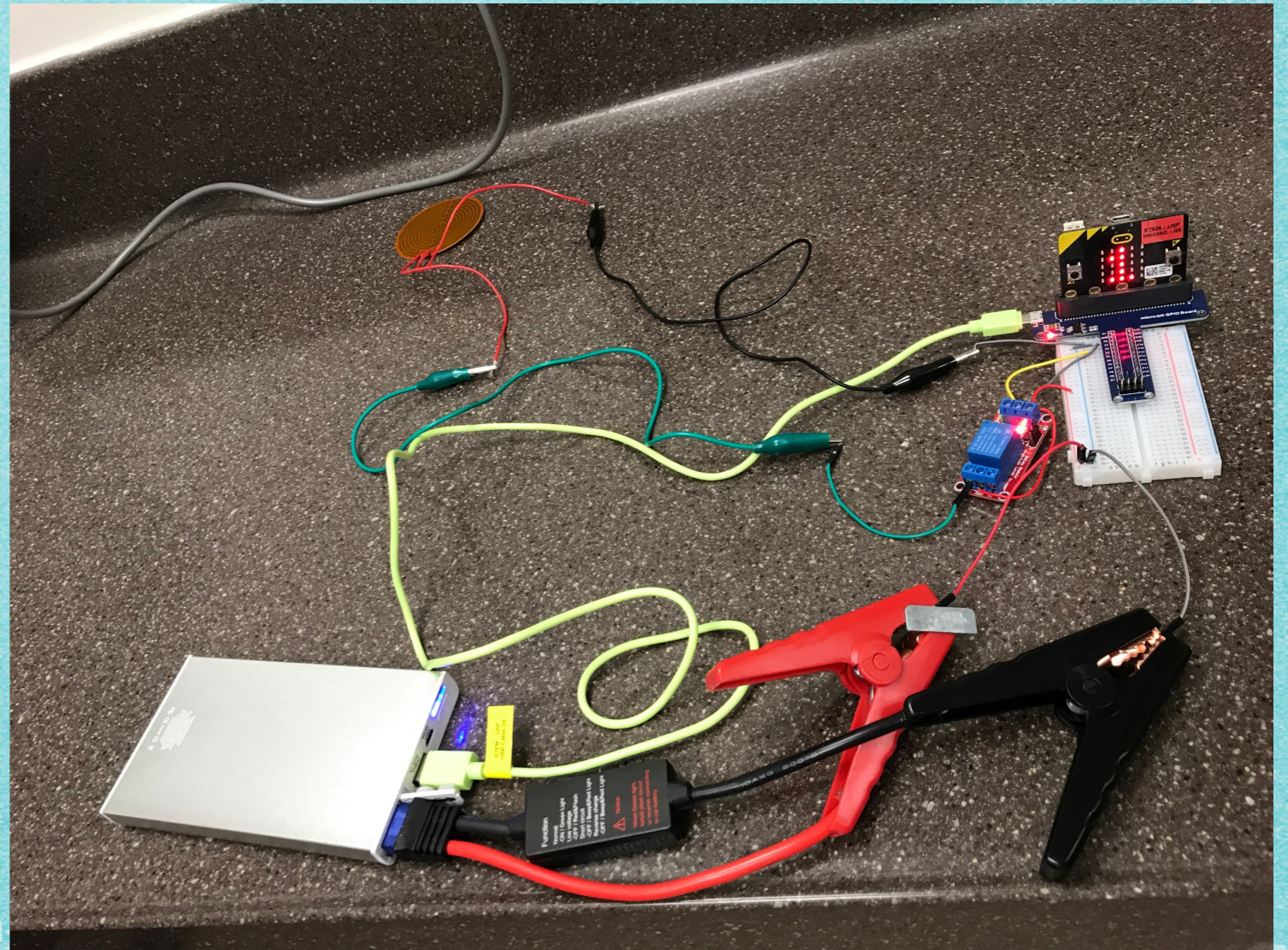


# Control Heater with Relay

Step 3: Connect relay to **heater** as shown:

**Green** -> Heater

**GND** -> Fan



# Control Heater with Relay

Step 4: The following codes control the relay by pin 2

Check whether the heater works

```
on button A pressed
```

```
digital write pin P2 to 0
```

```
show number 0
```

```
on button B pressed
```

```
digital write pin P2 to 1
```

```
show number 1
```

# Codes for Beverage Warmer

To keep beverages at around 36 degree Celsius,

Heater **On**

Fan **Off**



34

35

36

37

38



Temperature (Celsius)

# Codes for Heater with Relay

Step 5: The following codes switch on heater if temperature  $\leq 35$  degrees at pin 2

```
forever
  set temperature to round analog read pin P0 x 0.4022 - 72.777
  show number temperature
  if temperature ≤ 35 then
    digital write pin P2 to 1
  else
    digital write pin P2 to 0
```



# Codes for Beverage Warmer

Goal: keep beverages at around 36 degree Celsius

Heater **On**  
Fan **Off**

Heater **Off**  
Fan **Off**

Heater **Off**  
Fan **On**



34

35

36

37

38



Temperature (Celsius)

# Codes for Beverage Warmer

```
forever
  set temperature to round analog read pin P0 x 0.4022 - 72.777
  show number temperature
  if temperature ≤ 35 then
    digital write pin P2 to 1
  else
    digital write pin P2 to 0
  if temperature ≥ 37 then
    digital write pin P1 to 1
  else
    digital write pin P1 to 0
```

# Here is our Beverage Warmer

