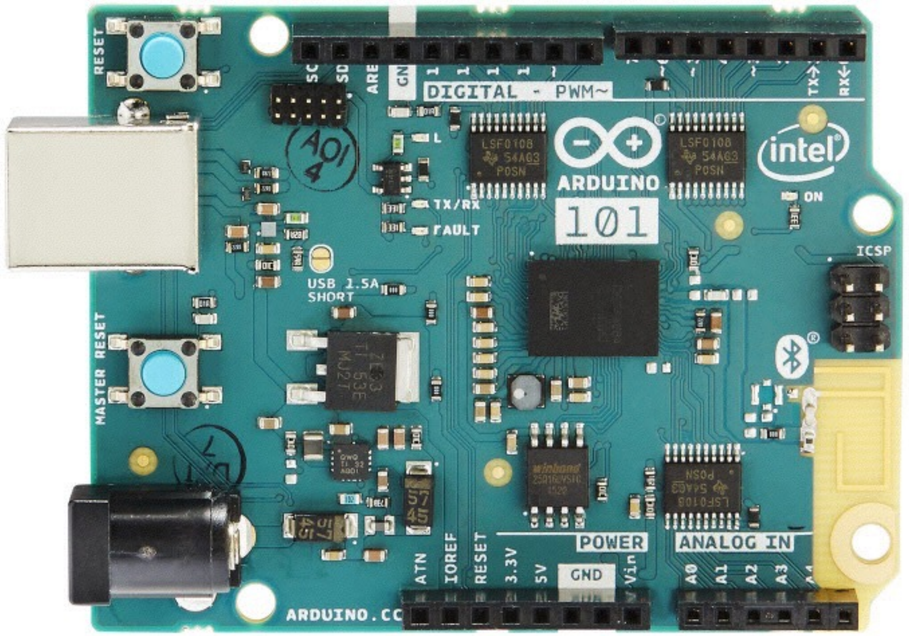
Arduino & Machine Learning

What’s an Arduino 101?

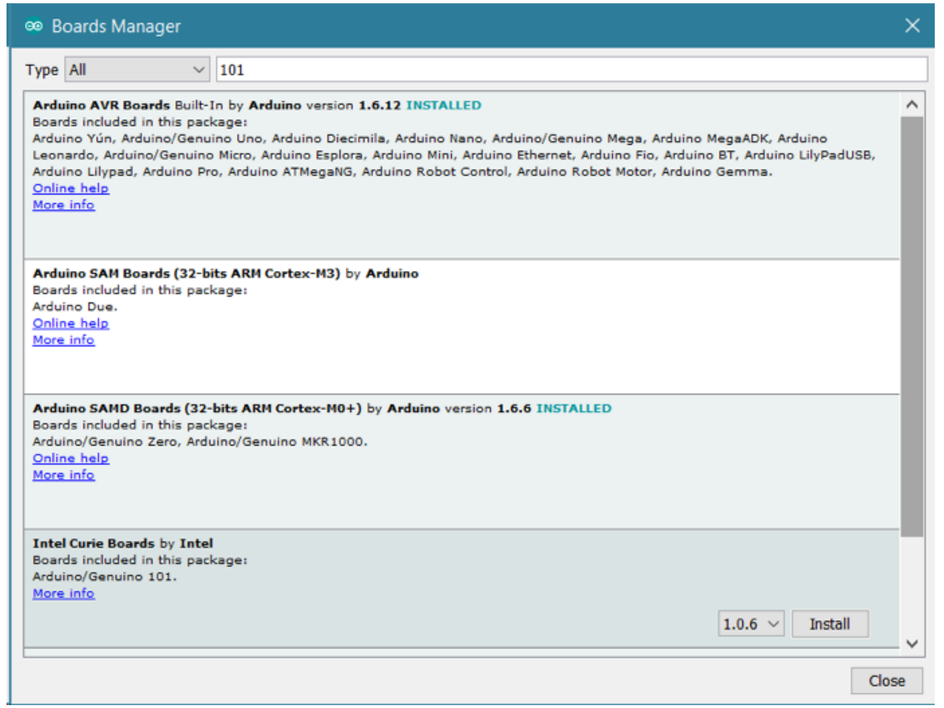
- Microcontroller - a tiny computer executing a single program
- Intel Curie Module - 2015, low-power microcontroller
- Accelerometer, gyroscope, bluetooth built in



Set up your computer to program the Arduino

- Download Arduino IDE
  https://www.arduino.cc/en/Main/Software

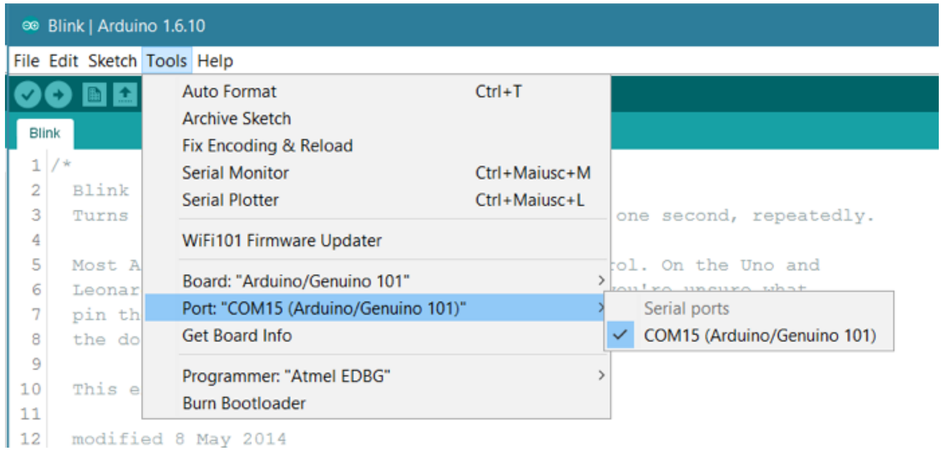
- Install Arduino 101 board software
  https://www.arduino.cc/en/Guide/Arduino101



Add the Intel Curie Core to the Arduino Software (IDE): Select **Tools** menu, then **Boards** and last **Boards Manager**. Search for “Intel Curie.” Click on its box and click on the **install** button.

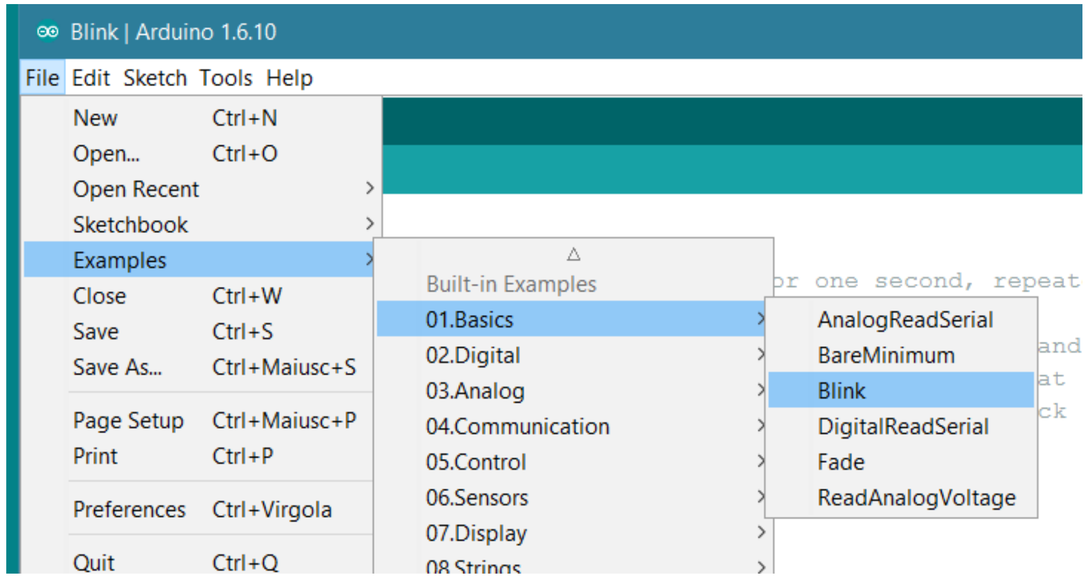
Connect the board to the computer. Then from **Tools** select the Board **Arduino/Genuino 101**

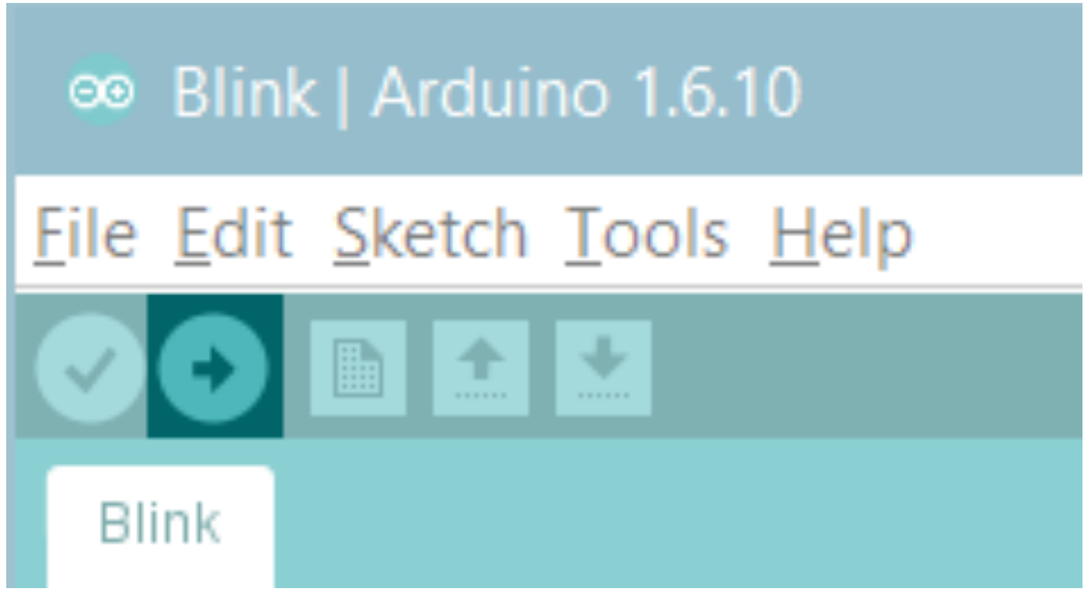
Everything is now ready to upload your sketch.



Make an LED blink!

- Go to **File** > **Examples** > **01. Basics** > **Blink**
- Press the **upload** button (right arrow)
- Example folder of the Arduino IDE contains lots of examples and good explanations; you can explore Arduino's capabilities by uploading different examples



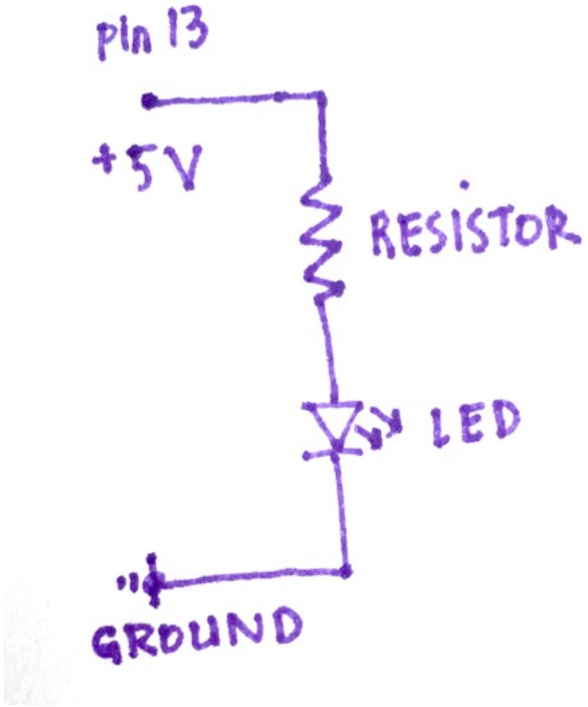


Speaking of references

- Arduino 101 Getting Started (tutorials on page)
  https://www.arduino.cc/en/Guide/Arduino101
- Intel Curie libraries (tutorials at bottom)
  - CurieBLE (to control Bluetooth Low Energy module)
    https://www.arduino.cc/en/Reference/CurieBLE
  - CurieIMU(to control the 6-axis accelerometer + gyro)
    https://www.arduino.cc/en/Reference/CurieIMU
  - Curie Timer One (to control Timer functions)
    https://www.arduino.cc/en/Reference/CurieTimerOne

Make another LED blink

- External LED
- Add the protoshield to your Arduino
- Resistor - what resistor to use?
  - (Ohm's Law!)



Example LED specs:
Requires 2.2 V
Max current 25 mA

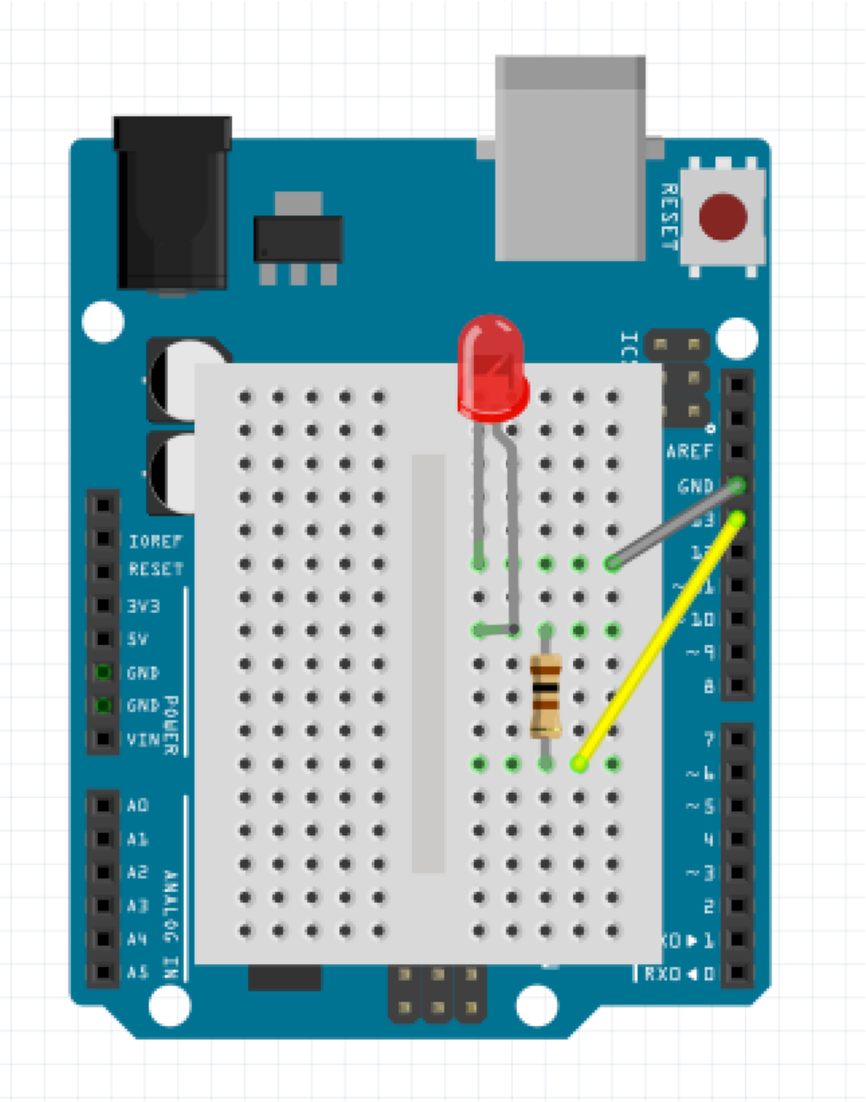
$$V = IR$$

$$(V_{pinout} - V_{led}) = I_{rated} R$$

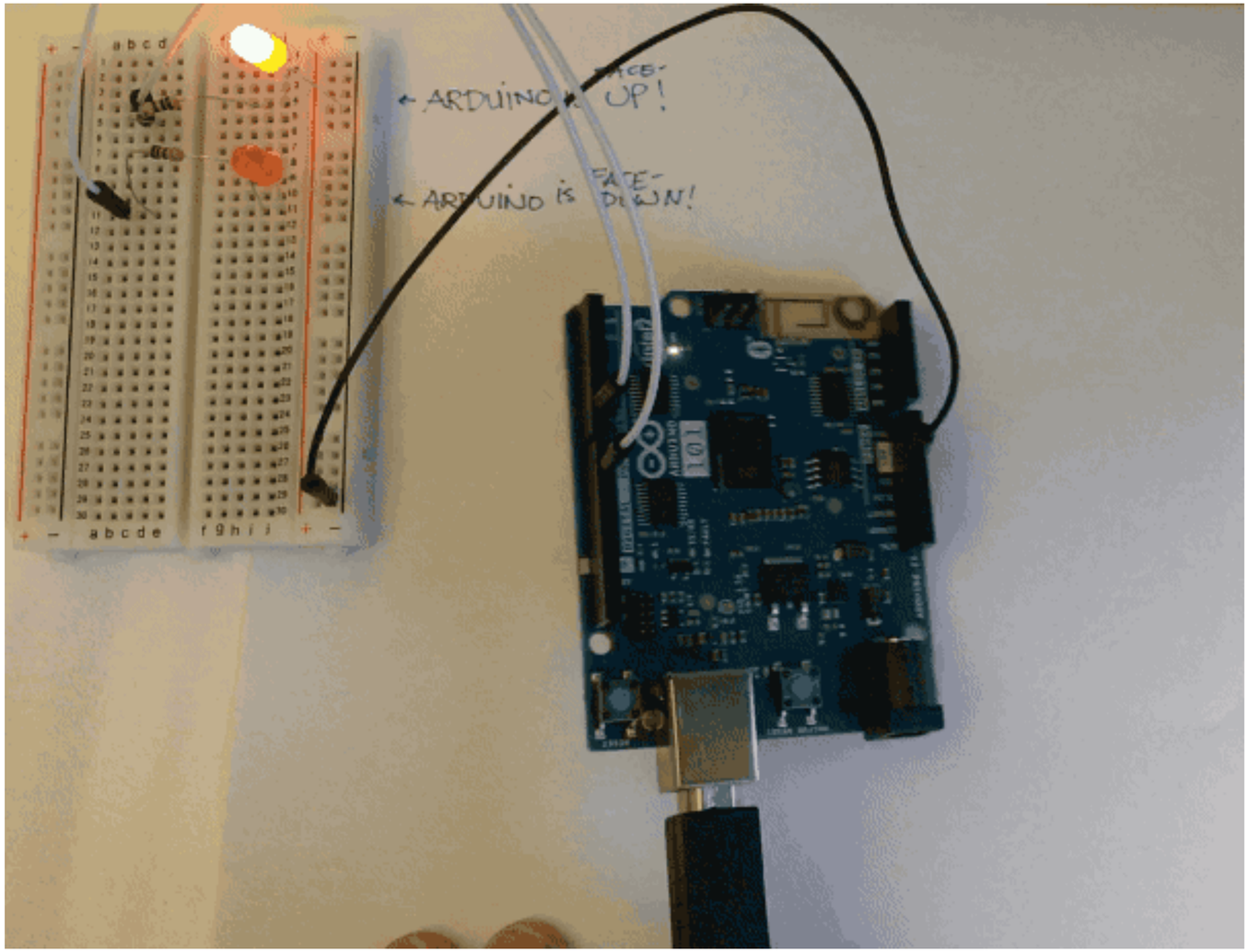
$$R_{resistor} = \frac{V_{pinout} - V_{led}}{I_{rated}}$$

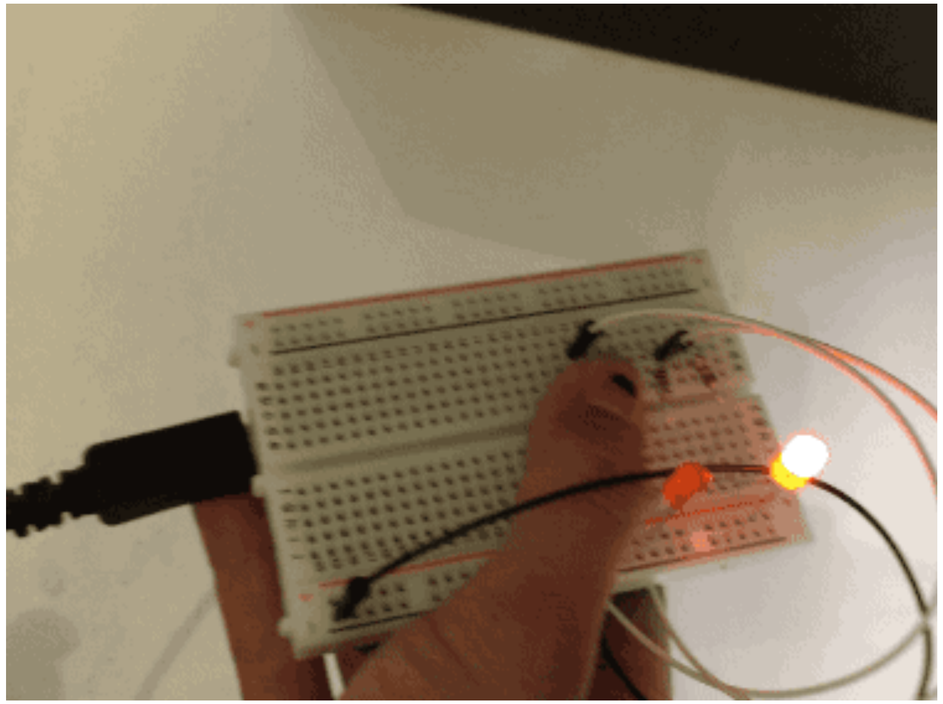
Make another LED blink

- Add the protoshield to your Arduino
- External LED
- Resistor
- LED leads have a polarity (longer connects to positive)



Displaying the board's orientation with LEDs

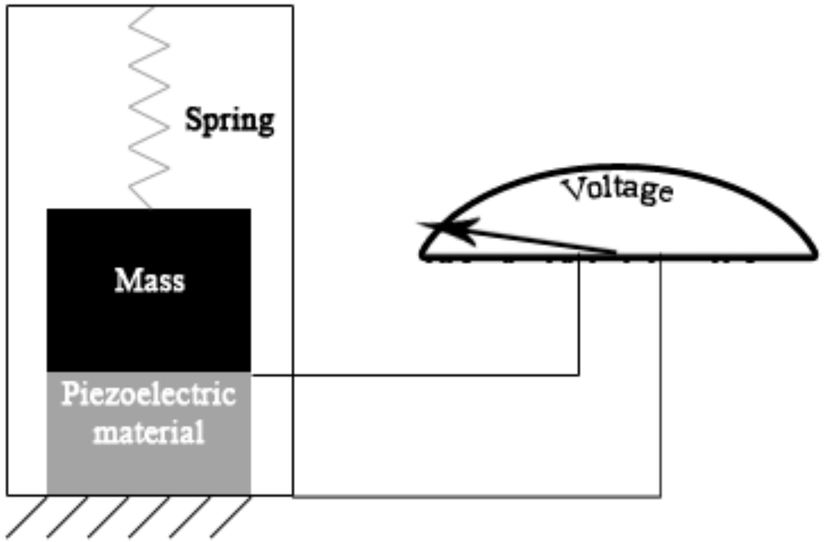




Gathering accelerometer data with CurieIMU

- Serial port
- CurieIMU library

What's an accelerometer?



- https://learn.sparkfun.com/tutorials/accelerometer-basics

/dev/cu.usbmodem1421 (Arduino/Genuino 101)

```
530     -71     18264
574     -49     18281
569     -499    18362
452     -1234   18337
471     -738    18303
733     822     18368
905     1851    18160
289     -2126   20295
47      -2680   21382
-881    -2996   21007
702     -5426   17282
2479    -5951   19340
2146    -2445   32767
1976    2936    32767
-2950   11835   29877
2072    9153    25744
2619    3992    18655
4150    3006    14302
6103    2691    11166
11344   2674    12486
13658   6585    14919
1337    12793   13725
-3933   11591   11876
3195    -4212   15621
2773    -9073   19876
220     -6738   25145
-1594   -92     25323
-705    11715   21561
-3025   13573   13462
-4051   4258    -11917
-3954   -4716   -13860
329     -10998  -4568
382     2569    -5455
-117    6942    -13483
-155    7864    -21626
-3840   -1229   -26403
-2692   -6503   -19343
-2923   -5152   -19721
-681    18      -21826
-1486   2313    -22519
-1049   -1875   -17210
-91     -2741   -11818
-204    -2313   -11953
-388    -3721   -13956
-1950   1271    -15647
-1007   -7461   -32768
-2689   -10976  -16173
1267    -2810   -1352
-1125   1978    -14810
-1615   2045    -17834
```

Arduino orientation challenge

- Display information about the Arduino’s orientation using LEDs.

Arduino orientation pseudocode

- If the absolute value of the z-axis reading is the greatest
  - If it’s positive, then the board is facing up.The first LED is on.
  - If it’s negative, then the board is facing down. The second LED is on.

Arduino orientation pseudocode

- If the absolute value of the z-axis reading is the greatest
  - If it's positive, then the board is facing up.The first LED is on.
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