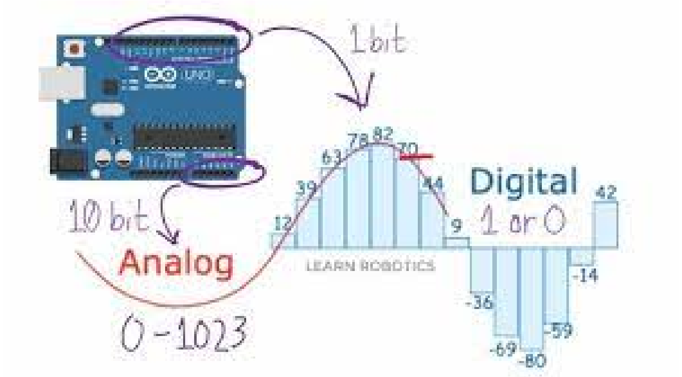
Name:________________________ Analog vs Digital Activity
Introduction to Computer Science BTHS Engineering

Page 1: Analog vs Digital Note Sheet and Intro

Today we will be rotating station to station to explore different analog peripherals, and options for our upcoming Halloween project. Start at the station assigned and work to others when directed. Sample code for each station is available on the google classroom!



Analog Vs. Digital Circuits

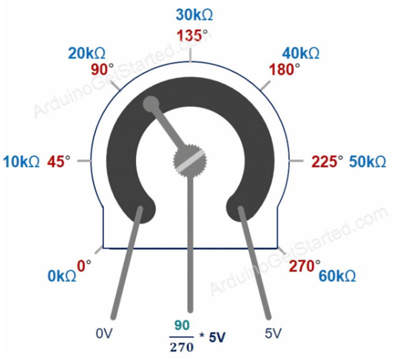
(left) Digital circuits are exact, with either a 1 or 0 or consistent read. Analog signals have a wider range and are measured with greater precision, but prone to interference.

Typical Analog Range: _________________

Typical Digital Range: _________________

<u>What do we mean by 10 bit for analog?</u> 1024, 2^{10} , or 111111111 in binary! (that's 1023 in binary, but 0 counts here!)

Why does the potentiometer turn to a 1 halfway through the twist, and a 0 before?



A potentiometer is a ___________ ____________. (2 words)

Analog sensors include:

Photo resistor	Light Sensor
Potentometer	Twist Knob
Accelerometer	Movement Sensor
Transducer	Range Sensor
Atmospheric	Humidy, Temperature, CO2/Oxygen Sensors
Moisture	Moisture Sensor
Sound	DB Sensor, Sound Level

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Station 1: Laser Cutting

Today we will cut for the first time! The following 4 things need to be turned on before running the laser:

1. Mr. Fowler will turn on the Air Compressor and give you the laptop with Lightburn
2. The Chiller must be turned on and the beeping should stop. Beeping indicates the machine needs additional distilled water which Mr. Fowler will fill. **Do not adjust the chiller settings.**
3. Open the laser. Only open the machine from **the center of the handle bar**. If you need help ask. Ensure there are no obstructions to the machine before turning it on. Turn the key to turn on the laser cutter.
4. Turn on our hepa filter by pressing the power button. **Do not adjust the fan settings.**

Operation Instructions

1. Use the manual screen on the laser to move the laser head. Use the cross hairs to set the origin point. F = fast movement @500mm/sec , S = slow movement @5mm/sec

2. Level the bed by going to auto and pressing focus. Select yes on the popup screen.

3. Upload your file from the laptop. Ensure cut colors are properly assigned. Black = cut through, red = engrave. These should be preset. Ask Mr. Fowler if you need something different.

4. Use the cut frame button to see the width and height of the cut. Is this correct? Does it run off the material? Does it seem way too big or small?

5. Double check your origin - ***OPTIMIZE SPACE TO SAVE MATERIALS!***

6. *Close the door carefully*

7. Start the cut!

8. Wait at least 10 seconds after the cut has finished to open the door and retrieve your piece. **Do the poke method!** Make sure the piece has cut fully through before removing. You will never get it back into the same place to re-run after moving.

****take notes on how to navigate the computer/user interface as needed**

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Station 2: Potentiometer

Sample Code: station_2

1. Plug your potentiometer into A2, and download the sample code from google classroom.

2. Upload the code to your arduino, and connect to the serial monitor by pressing the magnifying glass in the top right corner. What is the minimum and maximum value printed?
   Min: ____________ max: _______________

3. Plug the potentiometer into D2. Do not change analogRead. What does it print out now? When does the integer change?

4. Plug your potentiometer back into A2. Plug your servo into D3 and modify your code so that the servo will rotate to 180 when above 600, and to 0 when below 600.
   Hints:
   a. You will need to include the servo class
   b. You will need to declare the servo with a name
   c. You will need to create an integer to hold the trigger digital port of the servo
   d. You will need to attach the motor in void setup to ensure it gets power
   e. You will need to write the servo in two locations in the code

below are some comparators:

x == y	(x is equal to y)
x != y	(x is not equal to y)
x < y	(x is less than y)
x > y	(x is greater than y)
x <= y	(x is less than or equal to y)
x >= y	(x is greater than or equal to y)

Bonus:

Use the following lines of code if finished early to make your potentiometer value match the rotation of a servo

```
int twist;
twist = map(analogRead(twistPin), 0, 1023, 0, 180);
motor.Write(twist);
```

References:

https://sensorkit.arduino.cc/sensorkit/module/lessons/lesson/03-the-potentiometer
https://www.arduino.cc/reference/en/language/functions/analog-io/analogread/
https://www.arduino.cc/reference/en/language/functions/math/map/

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Station 3: Sound and Light Sensor

Sample Code: station_3

1. Plug your light sensor (photoresistor) or sound sensor into A0, and download the sample code from google classroom.

2. Upload the code to your arduino, and connect to the serial monitor by pressing the magnifying glass in the top right corner. What is the minimum and maximum value printed? Try waving your hand over the light sensor. Try making noise into the sound sensor.
   Min: ___________ max: ______________

3. Plug an LED into D2 and modify the code provided to make the LED turn on and off.
   Hints:
   a. You will need a variable to hold the LED location in D2
   b. You will need to set pinmode in void setup to allow the LED to be an output
   c. You will need an if statement to determine at what level the LED should turn on,
   Hints:

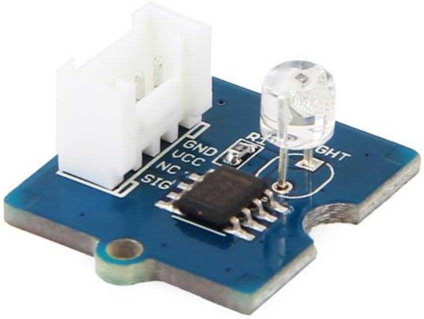
4. Now that you have it working with the light sensor, swap for the sound sensor. How does it differ?

Bonus:

If time permits, make a servo rotate with the sensor of your choice. Can you make the servo rotate to your voice? Use the code from Station 2 to help with this!

References:

https://sensorkit.arduino.cc/sensorkit/module/lessons/lesson/05-the-light-sensor
https://sensorkit.arduino.cc/sensorkit/module/lessons/lesson/06-the-sound-sensor
https://www.arduino.cc/reference/en/language/functions/analog-io/analogread/
https://www.arduino.cc/reference/en/libraries/servo/



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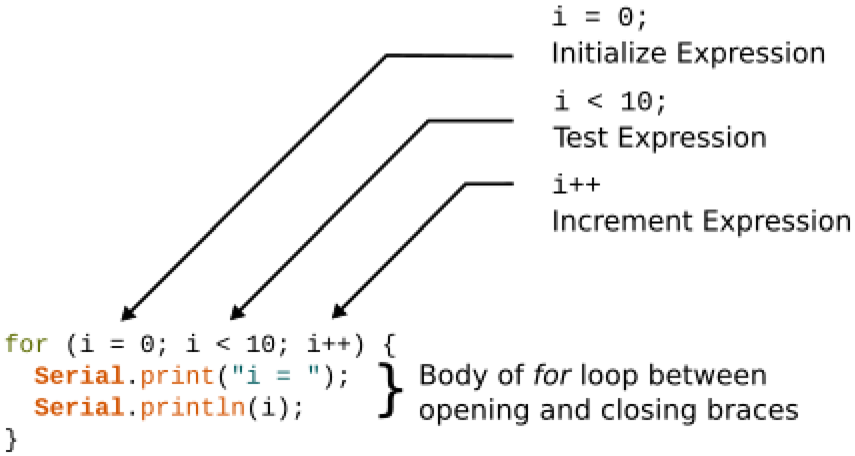
Station 4: Loops!

Sometimes we want a part of code to repeat several times, we can use loops to accomplish this!

Plug a button into Digital 2 and open the serial monitor when running sample code.

For Loops **- Sample Code: station4_for**
Runs a set amount of times, between a start and end value.
Example:



```
for (i = 0; i < 10; i++) {
  Serial.print("i = ");
  Serial.println(i);
}
```

I++ means that everytime the loop repeats, i increases by 1

While Loops**- Sample Code: station4_while**
Runs continuously so long as something is true.

Do While Loops**- Sample Code: station4_do**
Runs continuously so long as something is true, **but always runs at least once.**

Select one of the above examples and write code that….

When the button is pressed, flash an LED in D3 10 times.

Why will Do While function differently if chosen?