**Worksheet 2**

**Resistors, LEDs, and Sensors**

**CPSC 3555 - Spring 2018**

Section 1: Reading Resistors. Assume these are 4 band resistors, calculate the resistance.

1. brown, black, orange, silver \_\_10,000\_10%\_\_\_\_\_\_\_

2. blue, gray, brown, gold \_\_\_\_680 5%\_\_\_

3. yellow, violet, yellow, gold \_\_470,000\_5%

4. brown, black, green, silver 1,000,000 10%

5. brown, black, brown, silver 100 10%

Section 2: For each of the resistances, list the color bands that would be on the resistor. Assume the tolerance for all resistors are 10%.

1. 330Ω orange orange brown silver

2. 470Ω yellow violet brown silver

3. 2.2 kΩ red red red silver

4. 1000Ω brown black red silver

5. 1 kΩ black brown orange silver

Section 3: Using the following PDF (<https://www.hobbytronics.co.za/Content/external/1082/37-in-1%20Sensor%20Kit%20Guide_compressed%20(1).pdf>), answer the following questions. You will be describing the functions of all 37 sensors. Make sure you note what each sensor does and basics of how they work:

1. What are the 3-Pin Analog Sensors and what does each of the sensors do?
2. What are the 3-Pin Digital Sensors and what does each of the sensors do?
3. What are the Analog + Digital Sensors and what does each of the sensors do?
4. Explain the remaining sensors and what they do.

3-pin Analog Sensor Module:

* Photoresistor- Measures light, resistance varies depending on brightness
* Analog Hall- measures movement through magnetic fields
* Hall Magnetic- measures movement through magnetic fields. This on has an LED that lights the presence of a strong field.

3-pin Digital Sensor Module:

* Tilt Switch- activates when the mercury moves to one end of the tube
* Ball Switch- activates when the ball moves to one end of the tube.
* Mini Reed- activates when a magnet moves near one end of the tube.
* Tracking- activates when it senses an object within the calibrated distance
* Light Blocking- Activates when something blocks the beam of light between the 2 parts of the component

The Analog/Digital Sensor Module:

* Flame Sensor- Detects the IR output of a naked flame
* Linear Hall- Measures magnetic fields
* Big Sound- a microphone, measures sound waves
* Touch- a touch sensor. Detects human skin contact
* Small Sound- a microphone, measures sound waves
* Digital Temp- Measures temperature using a digital thermometer
* Tracking- Essentially measures reflectivity, although people come p with very interesting uses for these. This module ahs only 3 pins, essentially the analog out is removed. You have digital + and gnd.
* Reed Switch- This is a switch that is activated by holding a magnet near it. Open or closed only.

Other Sensors:

* Button Module – is stores the last time the button was pressed, if there was a minimum of x mS since then, we can process the button data. This is called debouncing.
* Buzzer Module-
  + Active Buzzer- this buzzer will contain its own oscillator, which means you simply need to provide it with 5v and it will make a sound. The oscillator will turn the input voltage off and on very fast, producing a tone. The pitch can be varied with PWM.
  + Passive- this type of buzzer has no oscillator, and if you apply a DC current it will simply make a click sound as the diaphragm moves to its limit and stays there. If you apply a PWM signal it will make a sound, because PWM turns the supply on and off in a similar way an oscillator.
* 18B20 Digital Temp Module- digital sensor which has unique serial number printed on it, and can be addressed using this. You can change settings such as precision et on the device sing the libraries also.
* The Heartbeat Detector Module- this module is built around an IR LED and an IR receiver. The IR led shines a certain wavelength of light through your finger. Our skin allows IR to pass through, but our blood looks very different to an IR sensor when it has oxygen present vs no oxygen present. In this way, we can sense when the heart beats by watching for the changes in opacity.
* IR Receiver and Transmitter Module – The IR receiver module will accept and decode IR remote control signals, so we can tell which button has been pressed on a remote. The transmitter is an IR LED, which is able to be pulsed at the correct frequencies to send commands as if it was a TV remote. We can use remote controls as inputs using the receiver and we can make our own remotes with the IR LED.
* The JoyStick Module – this module is built around 2 potentiometers and a tactile button. A voltage is passed in to each potentiometer, which then outputs a value that is directly related to the position of the stick. We can then read these values and use them to control our projects. The button will need to be de-bounced as always to prevent multiple readings.
* Laser Module – Laser tripwire system. Use the Laser emitter, shining onto an LDR (photoresistor), when the light level drops rapidly and significantly something broke the beam of light, trigger the alarm. You can also make laser microphones etc with these modules, they will not cut however.
* The Magic Light Cup Module- this module is a red LED paired with a mercury tilt switch. The components are discrete, that is – they share a power connection, but do not influence each other without the Arduino. Essentially it is supposed to be similar to pouring the light form one cup to the other. The cup being the LED. In reality, we simply check if the tilt switch has changed orientation. If it has we increase brightness from 1 LED to the other. We then reverse the process when it is tilted the other way, we get is 2 LEDs controlled by tilt sensors.
* Multi-LED Packages Module – With these LED packages we can wire them in such a way that the Arduino can pull either pin LOW or HIGH in order to turn on the appropriate LED.
* Relay Module – A relay is a device that is able to switch extremely high voltages and currents on or off with relatively small voltage and current. In other words, you could use a relay to turn a 240V appliance on, even though the Arduino is only running at 5 volts. A relay is an electromechanical switch. That means it has physical metal contacts, literally strips of metal that are on a rocker arm with a spring and a coil. When we apply power to the coil we turn it into an electromagnet, which pulls the contacts to the other side. At this point the NO (normally open) output becomes closed, and the NC (normally closed) output becomes open. (Closed meaning it is conducting, and open meaning it is not conducting).
* The RGB LED Module- This is a standard LED through-hole package on a module board. These RGB LED modules all contain 3 LEDs, a Red, a Blue and a Green. By varying the brightness of each color using PWM, we can mix the colors and make any color we desire.
* Rotary Encoder Module - A rotary encoder is a component which counts rotations. With a potentiometer, we can only turn so far before the knob will not turn any further. A rotary encoder does not have this problem, it can spin in either direction indefinitely. It can also be pushed in, functioning as a button. It is useful for using one knob for an entire setup rather than independent controls for volume, pitch, balance etc for example.
* Temp & Humidity Module - This is a digital sensor that will report the temperature, humidity and heat index on request. You may want to monitor the weather, use it in an automation system for your heating or cooling, or remotely monitor the environment.
* Thermistor (Analog temp) Module – A thermistor is a special type of resistor which has a linear and rapid value change based on its temperature. We can read the resistance changes and work out the temperature with some clever math. Sometimes you want to know the temperature of an enclosure or perhaps the ambient temperature to automatically adjust values etc.