Arduino Programming Part 2

EAS 199A
Lecture 6
Fall 2010

Overview

- Variables: assigning and using
  - int
  - float
- Loops
  - for loops

Assigning and Using Variables

Arduino web site

- http://www.arduino.cc/en/Tutorial/Variables
- http://arduino.cc/en/Tutorial/Foundations

Defining and using variables:

- All variables must be declared before use
- Declaration consists of a type specification and the variable name
- A declaration may also include an assignment
- Use meaningful variable names
- Add comments to further clarify meaning

```
int    red_pin;           //  declaration only
int    blue_pin = 5;      //  declaration and assignment
int    greenPin = 0;
float  scale = 5.0/1024.0;   //  Convert 10-bit value
                             //  to 5V scale
char   name = 'Bob';
```

int Variables

An int is a 16 bit, signed integer

- See: http://www.arduino.cc/en/Reference/Int
- Storage requires two bytes or 16 bits
- $2^{16} = 65536$
- Split into negative and positive range: –32,768 to 32,767
- Computations are rounded and rolled-over as needed

Examples:

```
int  sensorVal;           //  declaration only
int  sensorPin = 3;       //  declaration and assignment

sensorVal = analogRead(sensorPin);     //  assignment
```

float Variables

A float is a signed number with a fractional part

- See: http://www.arduino.cc/en/Reference/Float
- Stored in 32 bits (twice as much memory as an int)
- Range: $-3.4028235 \times 10^{38}$ to 3.4028235×10^{38}
- Floating point arithmetic introduces rounding

Examples:

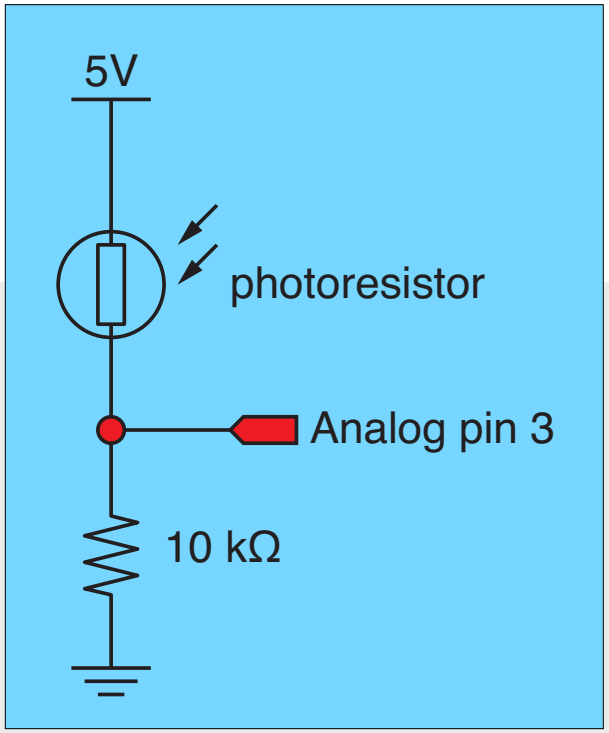
```
int   sensorVal;         //  value returned from analog input
int   sensorPin = 3;     //  pin assigned to analog input
int   range = 1024;      //  Maximum range of 10 bit value
float voltage;           //  Voltage of the input signal
float maxVoltage = 5.0; //  Maximum range of analog input

sensorVal = analogRead(sensorPin);     // get reading

// convert to floating point voltage
voltage = float(sensorVal)*maxVoltage/float(range);
```

Try it! Measure photoresistor output

Build the photoresistor circuit and run this program




```
int   sensorVal;
int   sensorPin = 3;
float voltage;
float input2volts = 5.0/1024.0;

void setup () {
  Serial.begin(9600);
}

void loop () {
  sensorVal = analogRead(sensorPin);
  voltage = float(sensorVal)*input2volts;
  Serial.print("Voltage = ");
  Serial.println(voltage);
}
```

Loops

Loops allow code to be repeated

- Repeated code goes in a block, surrounded by { }
- for loops
  - need a counter
- while loops
  - need an escape

```
int  i;                        //  declare counter

for ( i=0; i<=12; i++ ) {  //  standard structure

  Serial.println(i);  // send value of i to serial monitor

}
```

Loops

Initial value of counter
i=0 only on first pass through the loop

Stopping test: Continue while this condition is true

```
int  i;                          //  declare counter

for ( i=0; i<=12; i++ ) {  //  standard structure

  Serial.println(i);  // send value of i to serial monitor

}
```

Increment: How to change i on each pass through the loop

Loops

Common loop: increment by one

```
for ( i=0; i<=12; i++ ) {  //  increment by one
  ... code block goes here
}
```

Common loop: increment by two

```
for ( i=0; i<=12; i+=2 ) {  //  increment by two
  ... code block goes here
}
```

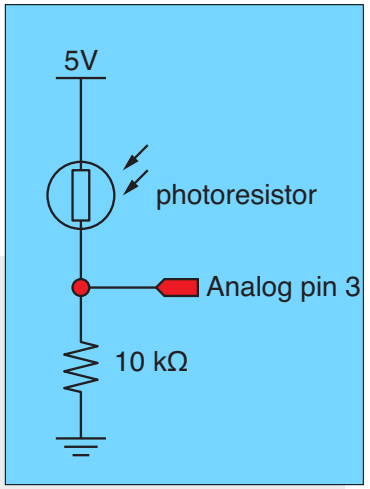
Decrement by one

```
for ( i=12; i>=0; i-- ) {  //  decrement by one
  ... code block goes here
}
```

Try it! Modify the photoresistor program

Change the loop function

(modify your previous code)




```
void loop () {
  float sensorAve;
  int   sensorSum;
  int   nave=5;

  sensor_sum = 0.0;
  for ( i=1; i<=nave; i++ ) {
    sensorVal = analogRead(sensorPin);
    sensorSum = sensorSum + sensorVal;
  }
  sensorAve = float(sensorSum)/float(nave);
  voltage = sensorAve*input2volts;
  Serial.print("Average voltage = ");
  Serial.println(voltage);
}
```

This code contains errors that you will need to fix before it runs!

Test it! Break your code to learn how it works

Change nave

- Increase nave from 5 to 10, 50, 100, 500
- Why is the reading negative for large nave?
- How can you fix this by changing the variable type for sensorSum?

Add print statements inside the averaging loop

```
Serial.print("\t Reading = ");
Serial.println(sensorVal);
```