



Licenciatura em Engenharia Informática

TECNOLOGIA DOS COMPUTADORES

Year 2018/2019

Laboratorial assignment # 1

Getting Started with Arduino

Components list:

- Arduino UNO
- 1 USB cable
- 1 white breadboard
- 1 LED (any color)
- 1 150 Ohm resistor
- 2 wires
- Software: Arduino IDE

1. What is Arduino?

Arduino is an open-source electronics platform based on an user-friendly approach for developing hardware- and software-based systems. It is ideal for anyone making interactive projects. It has a very easy and simple way of programming in a C-like based language style with friendly software (Arduino IDE).

2. Blink in Arduino

1. Load the program Blink in the IDE (File > Examples > 0.1 Basics > Blink) and analyze the code you have just loaded. As you should observe it is composed of two functions: function `setup()`, which is run once, every time the Arduino is reset; and function `loop()`, which is continuously run until the board is plugged off or a reset occurs.
2. Plug your Arduino UNO board to your PC using the USB cable.
3. Upload the program to the Arduino UNO and observe the behavior of the onboard LED.
4. Change the parameters of the program to make the LED blink quicker and slower.

```
// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin 13 as an output.
  pinMode(13, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(13, HIGH); // turn the LED on (HIGH is the voltage level)
  delay(1000);           // wait for a second
  digitalWrite(13, LOW);  // turn the LED off by making the voltage LOW
  delay(1000);           // wait for a second
}
```

3. Blink an external LED

1. Mount the system as shown in figure 1. Please be extremely careful with the **polarity** of the LED (your teacher can explain you the electrical details of this circuit).
2. Upload the program to the UNO and observe the LED's behavior.

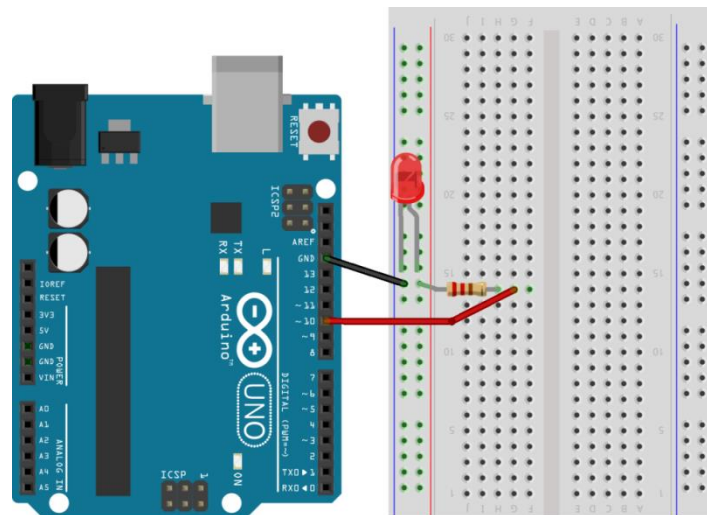


Figure 1 – Blink circuit. The resistor should be a 150 Ohm one.

3. Change the duty cycle of the blinking to 80%, 50%, 40%, 10% and 1%. Explain the differences and show them to your teacher. **Note:** the duty cycle is the percentage of the period for which the circuit is HIGH.

Examples:

1) Duty cycle of 70%

LED HIGH 1400 milliseconds
LED LOW 600 milliseconds

2) Duty cycle of 5%

LED HIGH 100 milliseconds
LED LOW 1900 milliseconds

In code:

```
digitalWrite(13, HIGH);
delay(1400);
digitalWrite(13, LOW);
delay(600);
```

```
digitalWrite(13, HIGH);
delay(100);
digitalWrite(13, LOW);
delay(1900);
```

4. Blink through a vector pattern

1. Build a vector with 32 cells and fill them with a pattern of 0's and 1's. The vector pattern should be equal your student number in binary, e.g. student number 2017001852 corresponds to a vector pattern $(1111000001110010000000101111100)_2$. Each cell should represent the **LED on** (value set to 1) or **LED off** (value set to 0).
2. Tell the Arduino to travel through the vector and produce the light effect you have chosen. Note that you must define a period of time for which the LED is on or off. You can start with half a second.
3. Guarantee that the pattern is repeated each time it reaches the end of the vector.

```
//Global variables
int VEC[32];
int pos;

void setup() {
  // initialize digital pin 13 as an output.
  pinMode(13, OUTPUT);

  VEC[0]=0;
  VEC[1]=0;
  ...
  VEC[30]=1;
  VEC[31]=1;

  pos=0;      //Initialize the position
}

// the loop function runs over and over again forever

void loop() {
  digitalWrite(13, VEC[pos]); // turn the LED on (HIGH)
  delay(200);                // wait for half a second
  pos++;                     // increment for the next position

  if (pos>=32)                // when reaching the end; restart
    pos=0;
}
```

5. Blink quicker and quicker

1. Mount a circuit that starts by blinking the LED for a period of 4 seconds (duty cycle of 50%) and then, in each `loop()` call it shall divide the period by half.
2. Upload to the UNO your circuit and test it.
3. What have you observed? Can you explain why the LED seems to have turned ON permanently?

```
//Global variables
int time;

void setup() {
  // initialize digital pin 13 as an output.
  pinMode(13, OUTPUT);
  time=2000;
}

void loop() {
  digitalWrite(13, HIGH); // turn the LED on (HIGH)
  delay(time);            // wait for half a period
  digitalWrite(13, LOW);  // turn the LED off (LOW)
  delay(time);            // wait for half a period
  time=time/2;            // half of period for the next time
}
```