

# Arduino Programming Part I

EAS 199A, Fall 2010, Lecture 5

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## Overview

- Discuss details, now that you had a taste
- Arduino Environment
- Basic code components
  - ❖ Two required functions: `startup()` and `loop()`
  - ❖ Variables
  - ❖ Calling built-in functions

## References

- These notes borrow from
  - ❖ Arduino web site
    - ▶ <http://arduino.cc/en/Guide/Environment>
    - ▶ <http://arduino.cc/en/Tutorial/HomePage>
  - ❖ Adafruit tutorial #1 and 2
    - ▶ <http://www.ladyada.net/learn/arduino/lesson2.html>
  - ❖ Leah Buechley's Introduction to Arduino
    - ▶ [http://web.media.mit.edu/~leah/LilyPad/03\\_arduino\\_intro.html](http://web.media.mit.edu/~leah/LilyPad/03_arduino_intro.html)

## Basic Process

### Design the circuit:

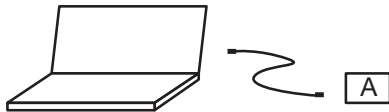
- ❖ What are electrical requirements of the sensors or actuators?
- ❖ Identify inputs (analog inputs)
- ❖ Identify digital outputs

### Write the code

- ❖ Build incrementally
  - ▶ Get the simplest piece to work first
  - ▶ Add complexity and test at each stage
  - ▶ Save and Backup frequently
- ❖ Use variables, not constants
- ❖ Comment liberally

## Writing and Downloading Code

Write sketch on PC

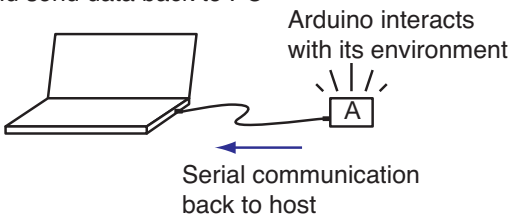


Download sketch to Arduino



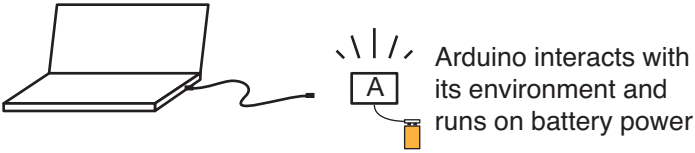
## Running Code While Tethered

Run sketch on Arduino  
and send data back to PC



# Running Code Stand-Alone

Run Arduino in stand alone mode



## Arduino IDE

IDE =  
Integrated  
Development  
Environment

<http://www.arduino.cc/en/Guide/Environment>

Annotations for the IDE interface:

- Stop serial monitor
- Verify/Compile
- New sketch
- Open sketch
- Save sketch
- Upload sketch
- Open Serial monitor
- Tab controls
- Code pane
- Message pane

```

/*
 * Blink
 * Turns on an LED on for one second, then off for one second, repeatedly.
 * This example code is in the public domain.
 */

void setup() {
  // initialize the digital pin as an output.
  // Pin 13 has an LED connected on most Arduino boards:
  pinMode(13, OUTPUT);
}

void loop() {
  digitalWrite(13, HIGH); // set the LED on
  delay(1000);           // wait for a second
  digitalWrite(13, LOW); // set the LED off
  delay(1000);           // wait for a second
}
    
```

## Arduino IDE

Annotations for the IDE interface:

- Stop serial monitor
- Verify/Compile
- New sketch
- Open sketch
- Save sketch
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```

<http://www.arduino.cc/en/Guide/Environment>

# Arduino Web Site References

- Overview of the development environment
  - ❖ <http://www.arduino.cc/en/Guide/Environment>
- Language reference
  - ❖ <http://arduino.cc/en/Reference/HomePage>
- Code tutorials
  - ❖ <http://arduino.cc/en/Tutorial/HomePage>

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## Code Structure: Header

```
Blink | Arduino 0021  
Blink §  
/*  
Blink  
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  delay(1000);           // wait for a second  
  digitalWrite(13, LOW); // set the LED off  
  delay(1000);           // wait for a second  
}
```

Header provides information.  
Later, it will also contain code

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## Code Structure: setup function

```
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Blink §  
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*/  
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  pinMode(13, OUTPUT);  
}  
void loop() {  
  digitalWrite(13, HIGH); // set the LED on  
  delay(1000);           // wait for a second  
  digitalWrite(13, LOW); // set the LED off  
  delay(1000);           // wait for a second  
}
```

setup function is executed  
only once at the start

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# Code Structure: loop function

```
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Blink §
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void setup() {
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  // Pin 13 has an LED connected on most Arduino boards:
  pinMode(13, OUTPUT);
}
void loop() {
  digitalWrite(13, HIGH); // set the LED on
  delay(1000); // wait for a second
  digitalWrite(13, LOW); // set the LED off
  delay(1000); // wait for a second
}
```

loop function is repeated indefinitely

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# Code

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Blink §
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void loop() {
  digitalWrite(13, HIGH); // set the LED on
  delay(1000); // wait for a second
  digitalWrite(13, LOW); // set the LED off
  delay(1000); // wait for a second
}
```

pinMode(13, Output)  
prepare pin 13 for outputs of voltage

Digital I/O Functions:  
pinMode  
digitalWrite  
digitalRead

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# Code

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void loop() {
  digitalWrite(13, HIGH); // set the LED on
  delay(1000); // wait for a second
  digitalWrite(13, LOW); // set the LED off
  delay(1000); // wait for a second
}
```

digitalWrite(13, HIGH)  
Sets pin 13 to voltage that means "on"

Digital I/O Functions:  
pinMode  
digitalWrite  
digitalRead

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## Code

```
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  pinMode(13, OUTPUT);
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void loop() {
  digitalWrite(13, HIGH); // set the LED on
  delay(1000); // wait for a second
  digitalWrite(13, LOW); // set the LED off
  delay(1000); // wait for a second
}
```

`delay(1000);`  
tells microcontroller to do nothing for 1000 ms = 1 s

Digital I/O Functions:  
pinMode  
digitalWrite  
digitalRead

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## Code

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  delay(1000); // wait for a second
  digitalWrite(13, LOW); // set the LED off
  delay(1000); // wait for a second
}
```

`digitalWrite(13, LOW)`  
Sets pin 13 to voltage that means "off"

Digital I/O Functions:  
pinMode  
digitalWrite  
digitalRead

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## Arduino Variable Types

int	Integer values: 1, 2, 3, -4, 7234
float	Values with non-zero fractional part, 7 digits
double	Currently the same as a float. Normally a double stores values with non-zero fractional part, 15 digits
char	Character values: 'a', 'b', 'D', 'l'
boolean	True or false values

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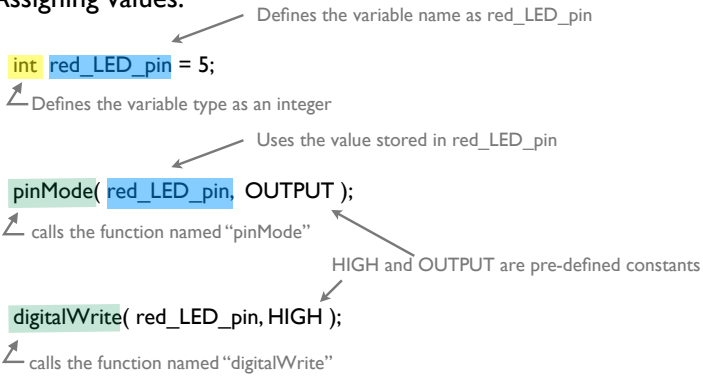
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# Using variables and functions

## Assigning values:



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