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STEAM CLOWN™ PRODUCTIONS

ARDUINO STEAM ACADEMY

Art without Engineering is dreaming. Engineering without Art is calculating.

- Steven K. Roberts

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CONTROL STRUCTURES

Program Structure and Control

- Program Structure
  - Define Variables
  - Setup
  - Loop
- Controlling Program Flow
  - **if**
  - **if...else**
  - **for**
  - switch case
  - **while**
  - **do... while**
  - break
  - continue
  - return
  - goto

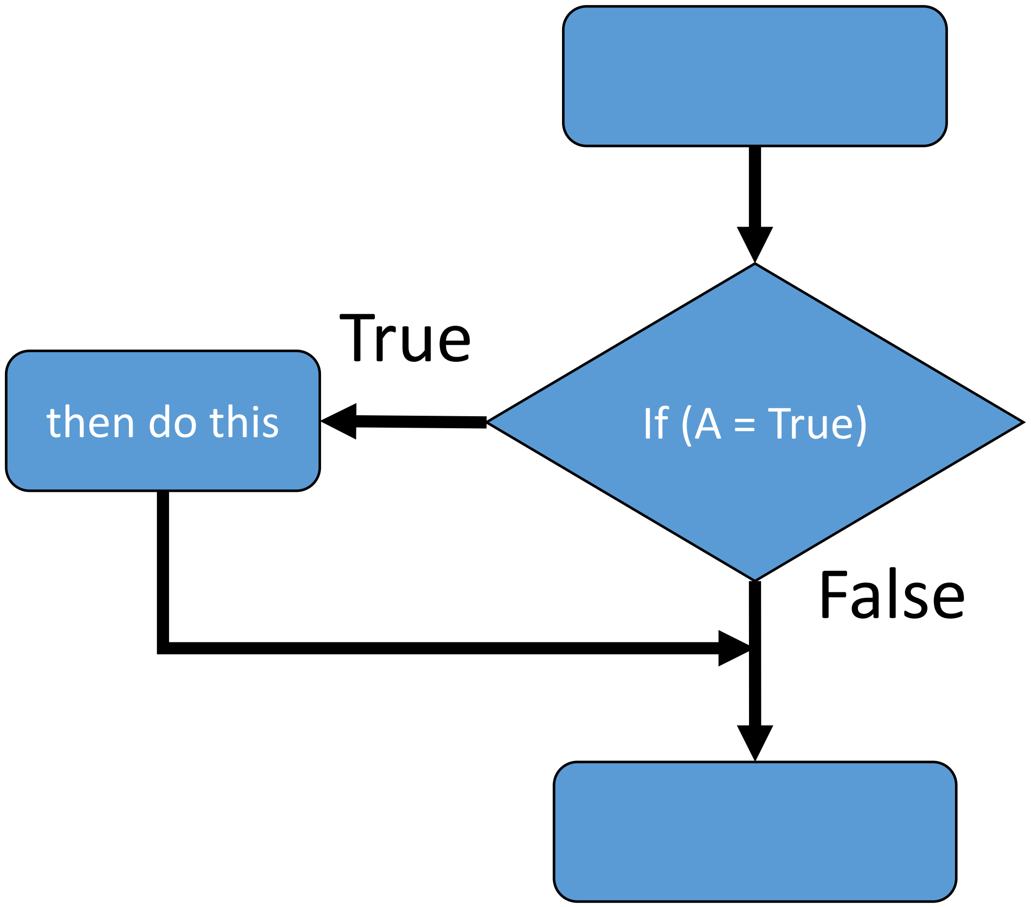
If Statement

```
If (Statement Evaluated As True)
{
   //do something here
}
```

```
If (someVariable == 50)
{
    //do something here
}
```

```
If (someVariable > 50)
{
    //do something here
}
```

```
If (someVariable == anotherVariable)
{
    //do something here
}
```



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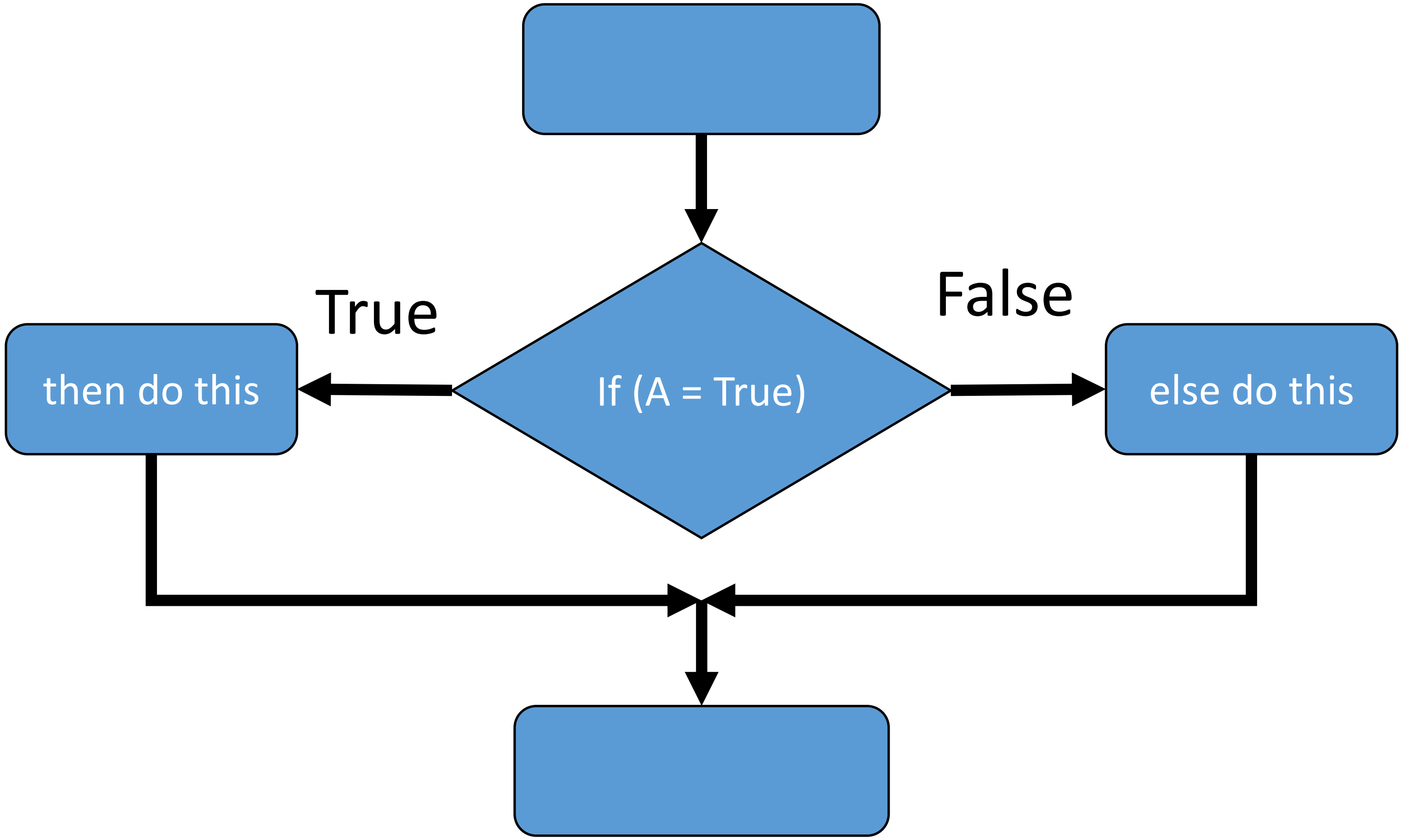
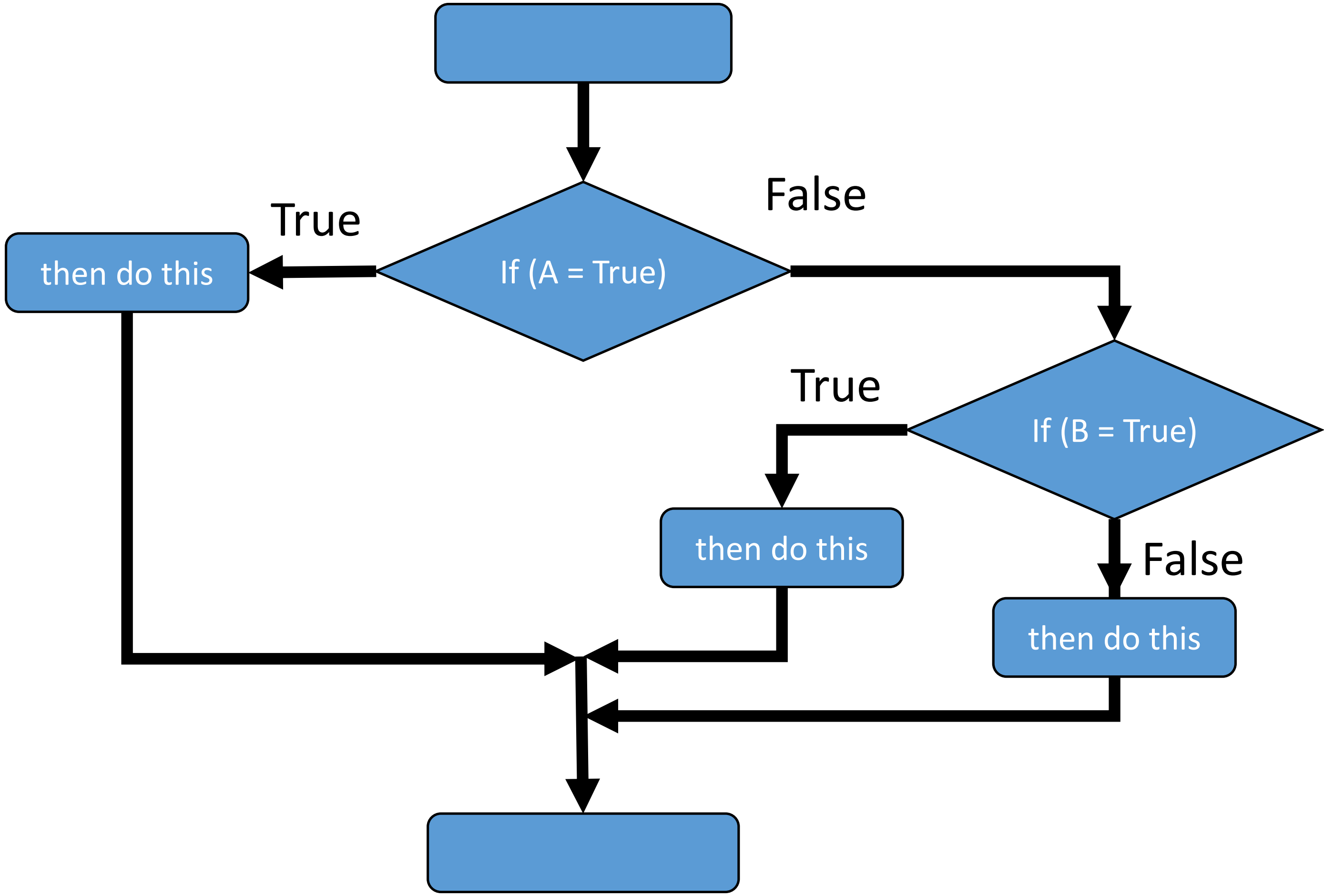
If Else Statement

```
if (someVariable < 500)
{
  // action A
}
else
{
  // action B
}
```



If Else Statement

```
if (someVariable < 500)
{
  // do Thing A
}
else if (someVariable >= 1000)
{
  // do Thing B
}
else
{
  // do Thing C
}
```



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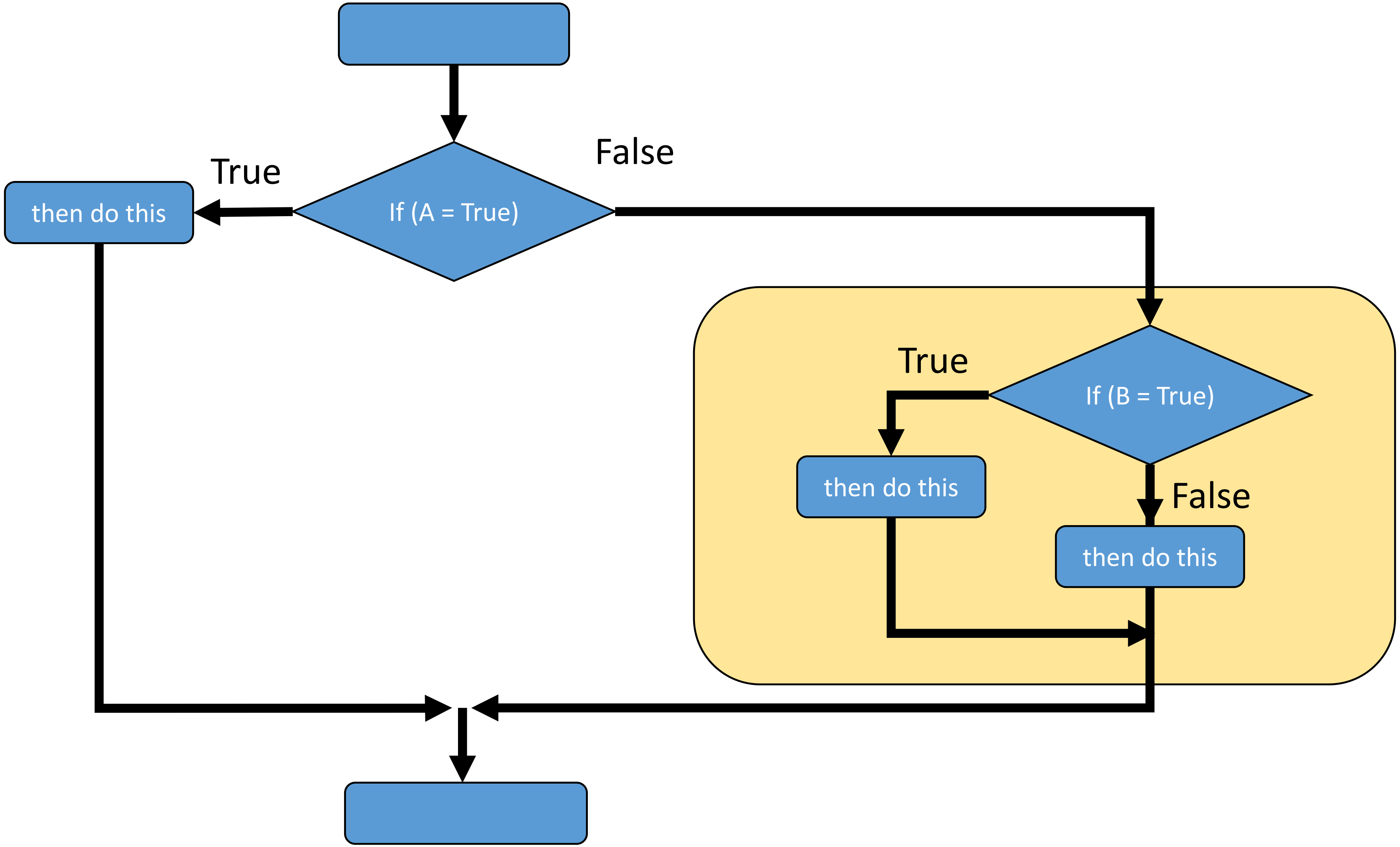
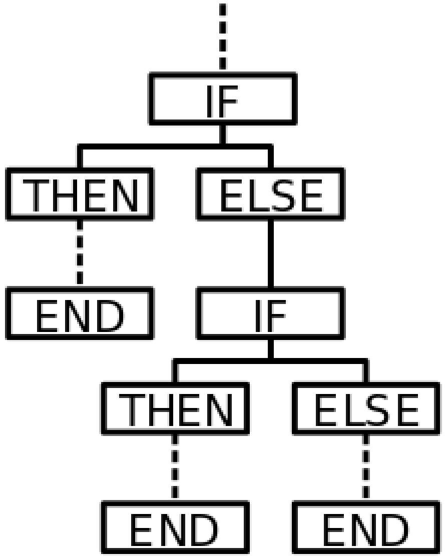
Nested IF ELSE Statement





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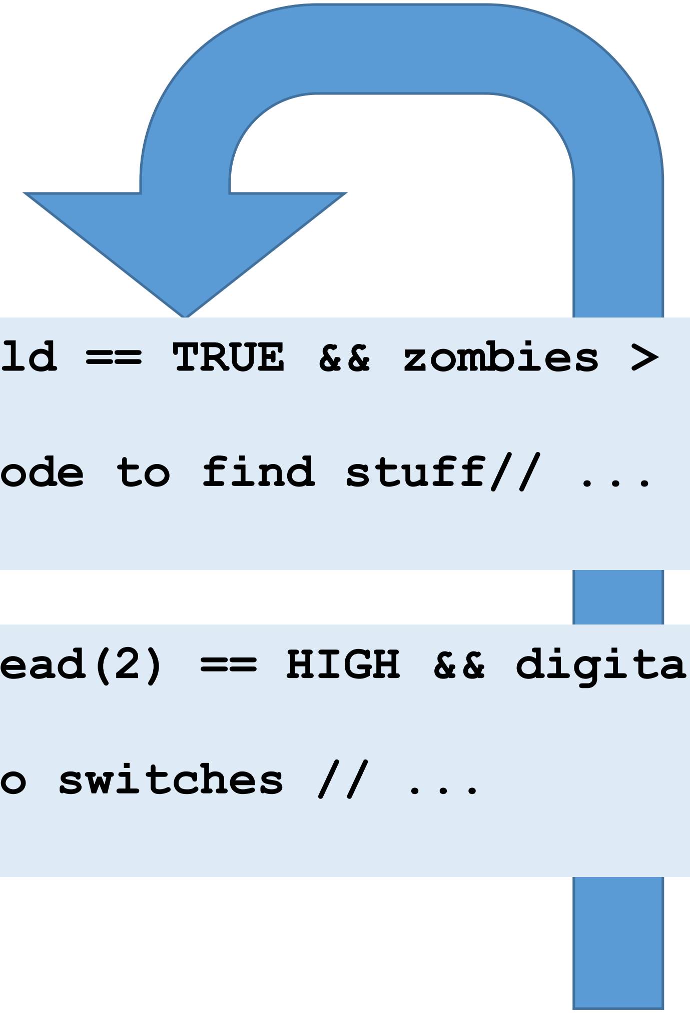
WHAT CAN BE IN A CONDITIONAL STATEMENTS



```
if (endOfWorld == TRUE && zombies > 1000000)
{
  // write code to find stuff// ...
}
```

```
if (digitalRead(2) == HIGH && digitalRead(3) == HIGH)
{
  // read two switches // ...
}
```

If the conditional statement resolves to “TRUE”

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IF STATEMENT

```
If (someVariable >50)
{
//do something here
}
```

- Search for “if_1”sketch
  - pushButton_LED_1_STEAMClown
  - pushButton_LED_2_STEAMClown
  - pushButton_LED_3_STEAMClown
  - What does this sketch do?

```
digitalWrite(arduinoBoardLED, HIGH);
delay(myDelayTime);
digitalWrite(arduinoBoardLED, LOW);
delay(myDelayTime);
Serial.print(".");
myDelayTime = myDelayTime + 20;
   if (myDelayTime > 500)
   {
       myDelayTime = 10;
       Serial.println("R");
    }
```

- Comparison Operators

```
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)
```

- Lets Change it…
  - How could we change it?
  - Look back at the “Debug” Sketch

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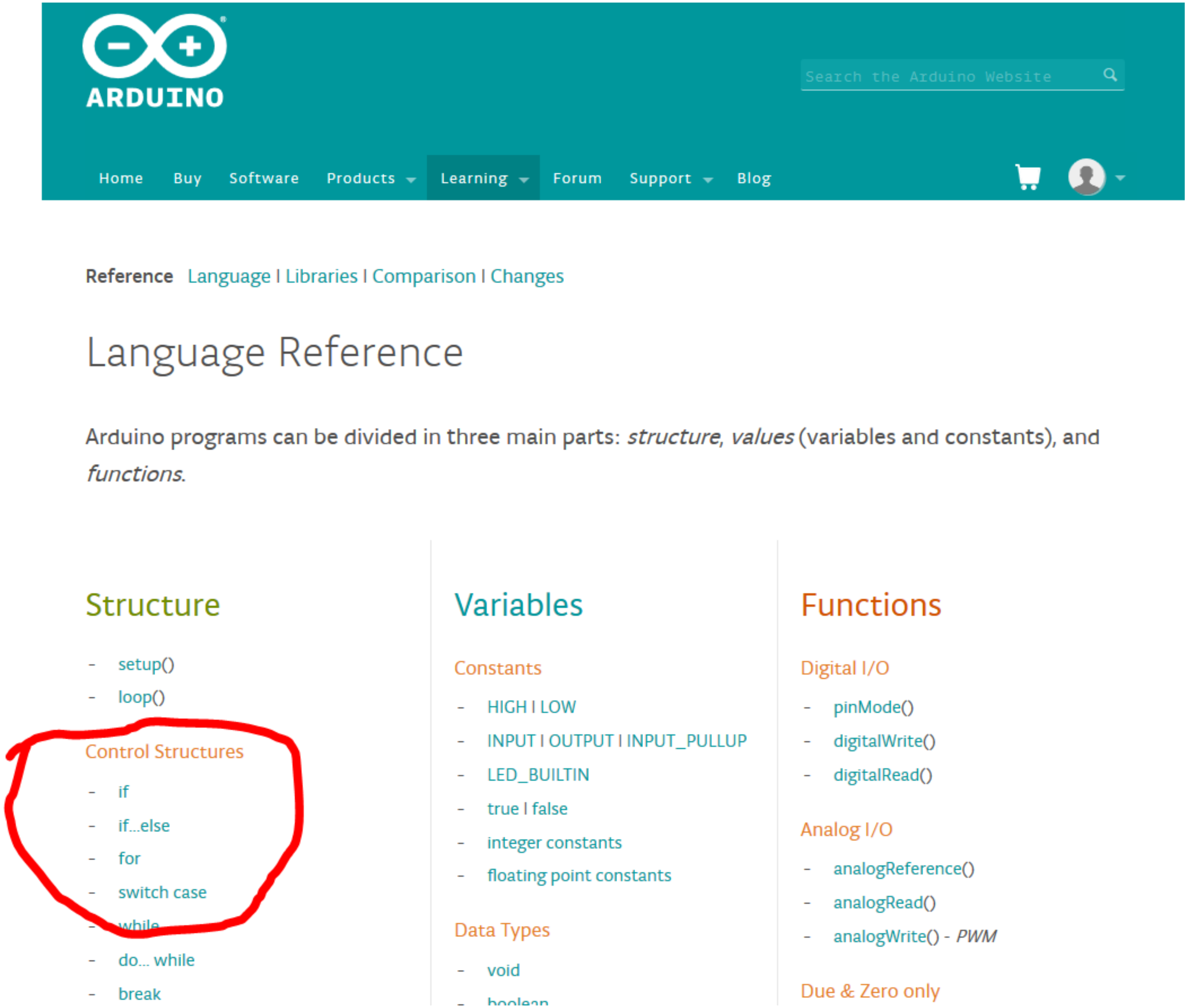
WWW.ARDUINO.CC



Reference Language | Libraries | Comparison | Changes

Language Reference

Arduino programs can be divided in three main parts: *structure*, *values* (variables and constants), and *functions*.

Structure

- setup()
- loop()

Control Structures

- if
- if...else
- for
- switch case
- while
- do... while
- break

Variables

Constants

- HIGH | LOW
- INPUT | OUTPUT | INPUT_PULLUP
- LED_BUILTIN
- true | false
- integer constants
- floating point constants

Data Types

- void
- boolean

Functions

Digital I/O

- pinMode()
- digitalWrite()
- digitalRead()

Analog I/O

- analogReference()
- analogRead()
- analogWrite() - *PWM*

Due & Zero only

Lets do some coding – Write Your Own Sketch

- Review the code in the sketches and code you have done
  - Look at my sketches on github or other websites
  - Look at coding examples on www.Arduino.Cc
- Use “if”, “if/then”, “if/then/else” statements
- Make the LED blink differently based on your program control
- Before you start coding… plan it out in your lab book
- Ask me how to turn it it….

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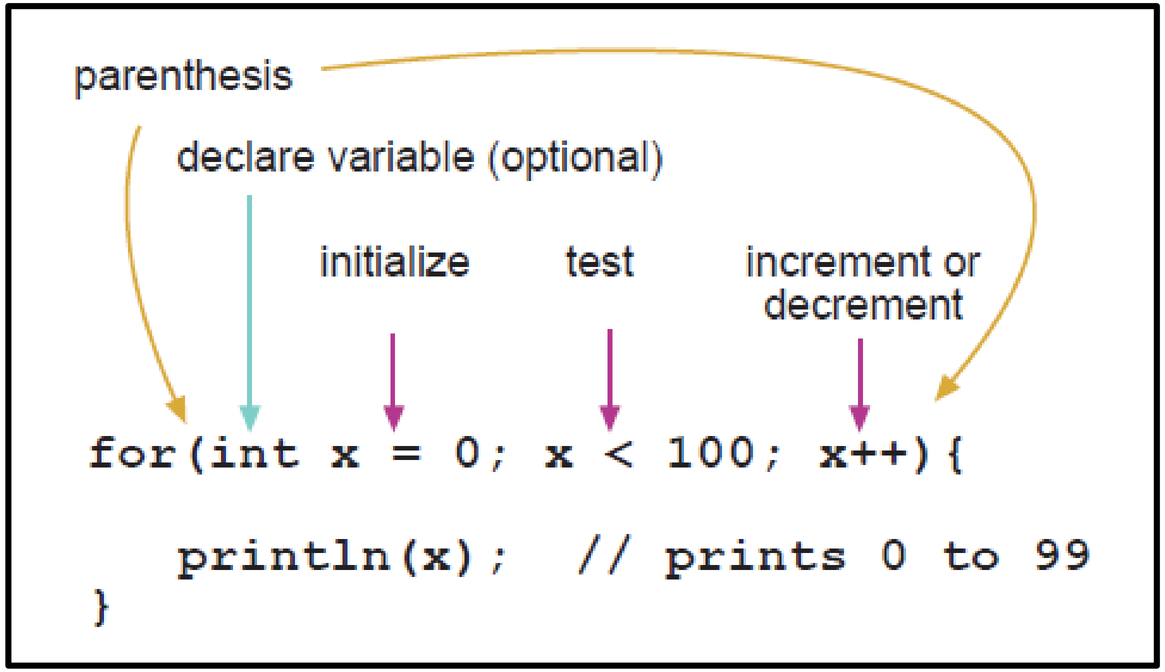
For Loop Statement

- Loop “for” some time…
  - What does this code do?
  - Why would you use code like this?
  - forLoop_STEAMClown



```
for(int x = 0; x < 100; x++){
   println(x);  // prints 0 to 99
}
```

```
for(int x = 2; x < 100; x = x * 1.5)
{
println(x);
}
```

```
for (int i = 0; i < 20; i ++)
 {
  digitalWrite(ledPin, HIGH);
  delay(delayPeriod);
  digitalWrite(ledPin, LOW);
  delay(delayPeriod);
 }
```

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While and Do While Loop Statement

- Do Something “While” statement is “TRUE”

```
while(expression)
{
  // statement(s)
}
```

```
do
{
  // statement(s)
} while(expression)
```

```
var = 0;
while(var < 200)
{
  // do something repetitive 200 times
  var++;
}
```

```
var = 0;
do
{
  // do something repetitive 201 times
  var++;
} while(var < 200)
```

- What if we set var = 1;

While and Do While Loop

- Search for whileLoop_STEAMClown
- What are these loops doing?
- Are they different?

```
loopCounter = 1;
//  while(loopCounter != 10)
 while(loopCounter < 10)
 {
  delayTime = 200;
  digitalWrite(arduinoBoardLED, HIGH);
  delay(delayTime);
  digitalWrite(arduinoBoardLED, LOW);
  delay(delayTime);
  loopCounter++;
 }
```

```
do
 {
  delayTime = 500;
  digitalWrite(arduinoBoardLED, HIGH);
  delay(delayTime);
  digitalWrite(arduinoBoardLED, LOW);
  delay(delayTime);
  loopCounter++;
 }while(loopCounter < 10);
```

Lets Do Some Coding – Add For and While Loop

- Review the code in the sketches and code you have done
  - Look at my sketches on github or other websites
  - Look at coding examples on www.Arduino.Cc
- Create A New Sketch
- Add a “for” Loop and “While” Loop Statements
- Make The LED Blink Differently Based on Your Program Control
- Before you start coding… plan it out in your lab book
- Ask me how to turn it it….

Appendix

Appendix A: License & Attribution

- This content is primarily the Intellectual Property of Jim Burnham, Top STEAM Clown, at STEAMClown.org
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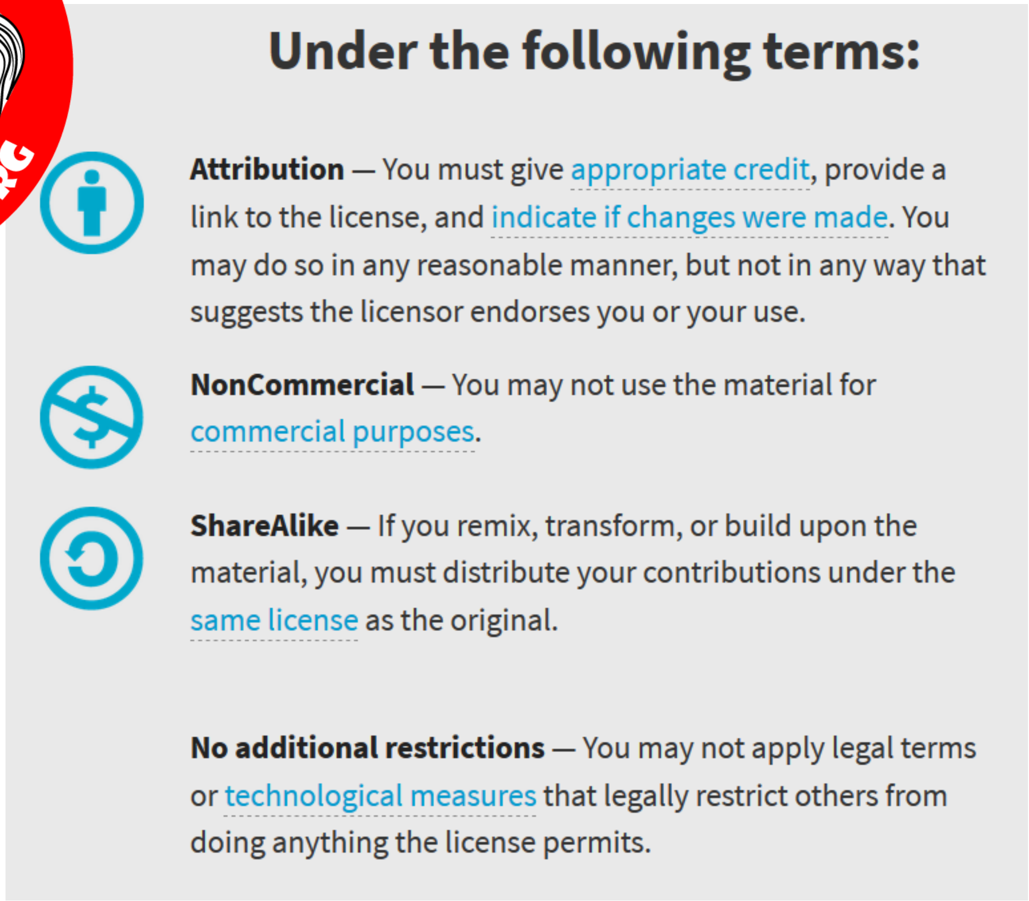
- My best attempt to properly attribute, or reference any other sources or work I have used are listed in Appendix B



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Appendix B: Attribution for Sources Used

Reference Slides

Is it possible to get help?

- Git Hub – See Steam Clown's Files
- http://www.arduino.cc/ ← Official Arduino Site
- http://www.arduinobook.com/
- Google Is Your Friend…
  - Google Arduino Getting Started
  - Google Arduino Tutorials
  - Google Arduino Sketches
- PDF books
  - Arduino Programmers Notebook
  - Arduino in a Nutshell
  - Introduction to Arduino - A piece of cake!
- YouTube
  - Arduino: Your First Arduino Sketch
  - Tutorial 01 for Arduino: Getting Acquainted with Arduino