# Contents

# 1 Arduino Intermediate Class

In this class each week will go over a specific circuit from the vilros book, going over some electronics and programming before building and testing the circuits. Students are welcome to try other circuits from the book if they have already completed this exercises, and we will try and provide tips as time allows.

## 1.1 This weeks class: Tinkercads web based Arduino simulation

This week we give a tutorial on the circuits.io tool offered by autodesk. This tool allows you to create and simulate your own breadboard

#### 1.1.1 Note on licenses - everything you create in circuits.io (at least the free version) is covered by an open source license of some sort, but there are choices.

## 2 A brief diversion on simulators

Simulators make up an important part of electronics design. There are many different types of simulators depending upon the task at hand. Some simulation tools are targeted for integrated circuit design, and other Target for printed circuit board design. The circuits.io simulator simulates both the CPU as well as some analog behavior.

## 3 Logging into Tinkercad Circuits simulation tool

If you already created an account just browse to tinkercad.com and log in. Otherwise you can login with Facebook, Google+, or create a free login with you email address

## 4 Tinkercad Home Page

Your Tinkercad homepage has several features

### 4.1 My recent designs

Shows what you have designed. Swtich between 3d design to circuits to to circuit design

### 4.2 Gallery

Explore what others have done

### 4.3 Blog

Read about new things on the sight

### 4.4 Learn

Tutorials

### 4.5 Search tool

Use this to search by username or project name for other circuits

### 4.6 Profile Icon - change your profile settings

## 5 Creating your first Tinkercad circuit

Press Circuts to bring up the circuit view Pressing the "new" button and selecting electronics lab will create a blank electronics circuit for you to start with.

### 5.1 Overview of electronics lab tool

#### 5.1.1 PROJECT NAME - defaults to a unique name

click on this to change the name

#### 5.1.2 CODE EDITOR

use to add/edit code

#### 5.1.3 START SIMULATION

Used to start simulation

#### 5.1.4 EXPORT and Share

To use other tools

## 6 Using Components and Starters

On the right there is a menu to add components and starters. Starters are like "examples" in the Arduino IDE, except that you get both the circuit and code

## 7 Doing Blink with simulator

Lets start with blink. Select starters and the click on blink. Move your mouse over the canvas, and you shoud see your circuits. Left click to place it.

# 8 Viewing the code

Once it's placed Select "code" to view the code. You can then run the code using the "start simulation" button. IMPORTANT NOTE - you cannot change the code or the circuit while the simulation is running.

# 9 Building a the circuit

# 10 Adding wires

Mouse over the breadboard and you will see that you can "click" to create wires. This is how you make a wire

## 10.1 Bending Wires

Click while dragging wires to create joints in them. This is handy to make your drawing tidy.

## 10.2 Wire colors

Note when you select the wire you get a dialog on the right to change the color from the default green. Usually I do red for power and black for ground.

# 11 Adding components

Select the basic menu on components. Click in the search box and type "resistor" to find the resistor component. Drag it onto the screen and place it on the breadboard.

# 12 Changing component position, orientation and values

## 12.1 Position

By selecting the component with the mouse you can drag it around

## 12.2 Orientation

Sometimes you want to rotate a component 90 or 180 degrees. Use the rotation button in the upper left hand corner to incrementally rotate it.

Note it only works in one direction so if you go to far you have to circle around.

### 12.3 Value

Some components (like resistors) have values associated with them. Click on the component to bring up a dialog box on the right hand side.

## 13 Add the LED and Resitor to make your own blink circuit

## 14 Adding Code

Once you have created your circuit you select "code editor" to start the coding. A new window will appear at the right of your screen, splitting the window. Select text mode.

### 14.1 Default Code

There will be some default code in there. We can delete this

### 14.2 Libraries.

There is a button where you can add some of the Arduino libraries.

## 15 Running the project

Press start simulation to run the project

## 16 Debugging the project

### 16.1 Debugging electronics

#### 16.1.1 Test Instruments

The Electronics Lab has several test tools, like meter, power supply, oscilloscope which you can add in your circuit to see what is going on.

### 16.2 Debugging code

The code editor has the serial monitor, just like the Arduino IDE. But it also has a debugger where you can enter a breakpoint to stop the code and you can inspect variables. This is something you cannot do with the Arduino IDE.

## 17 Sharing Circuits

The easiest way I found to share the circuits is to just have someone search for my user name. But they can also search for the title, without logging in `https://www.tinkercad.com/things/1onQ02knksS`

## 18 Extras

As mentioned before, you can also do a PCB design and get a parts list from Tinkercad. You can also create your own components for a PCB design, but I don't think you can simulate them

## 19 Questions?

## 20 Make the DC Motor Circuit

Find the DC Motor Circuit breadboard and parts list in the pdf file in the folder. Find the parts and add them one at a time. The arrange them the way you want, and finally add your wires. Note there is a "halfsize" breadboard in the component list and I like to delete the bigger breadboard since the halfsize matches what we have in the hub.