

# CSCI 1510 Lab 0 – Introduction to Logisim Evolution

## ***Purpose***

This lab introduces the ***Logisim Evolution*** software used throughout this class for your logic design lab work. You will be using this software to examine logic gates, their functionality, and larger circuits.

Just like many other graphical logic design simulation tools available out there, ***Logisim Evolution*** allows you to design and simulate digital circuits. It is an educational tool helping you learn how logic circuits work.

The ease of Logisim Evolution comes from its interactive graphical user interface developed with ***Java Swing GUI*** library. Users can create circuits with simple drag and drop actions of the mouse. ***Logisim Evolution*** enables the creation of logic circuits of any scale, including sub-circuits as well as complex structures. Color-coded wires impart clarity to the representation.

***Logisim Evolution*** is a free and open source software. Being a Java application, the software is platform independent as long as a valid JRE (***Java Runtime Environment***) is installed on any client machine. It runs on ***MS Windows, MacOS*** and ***Linux*** seamlessly with minor User Interface discrepancies.

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## 1. Introduction

This document describes:

- how to locate and execute **Logisim Evolution** software from the lab machines
- how to install **Logisim Evolution** software on your personal computer
- how to find and use the software tutorial.
- basic steps to build simple logic circuits

## 2. Your lab work environment(s)

There are several ways you can complete the labs in this class.

- Use the school computers in the Lawrence Street Center 8<sup>th</sup> floor CSCI labs. On these machines, the software is already installed, and you only need to locate the program and execute it.
- You can **remotely** login and use the lab machines. To access remotely, please follow the instructions for remotely logging located in the Canvas Modules. The instructions are titled “*Remote Login Instructions*”, then proceed with Section 2.1
- You can set up **Logisim Evolution** your own laptop as well. To do so, read Section 2.1.

### 2.1 Instructions for installing **Logisim Evolution** on your personal computer

**Logisim Evolution** is a free and open source software written in **Java** Programming Language.

Since **Logisim Evolution** is a **Java** application, the software is platform independent as long as a valid **JRE** (**Java Runtime Environment**) is installed on your local machine. Without any extra platform specific deployment, it runs on **Windows**, **MacOS** and **Linux** with minor User Interface differences (all instructions included in this document discuss the Windows Environment).

1. Most of the school machines already have a JRE installed, and its version will be later than the required version. The newest version is Version 8 update 341. You should be sure to have this version installed. <https://www.java.com/en/download/manual.jsp>

If you want to ensure that you have a JRE version running later than “version 8 update 341”, you may run the following command:

- a. On Windows, open the command prompt: follow the menu path **Start** → **Programs** → **Accessories** → **Command Prompt**. Alternatively, you can click **Search** on taskbar then type ‘**cmd**’ and choose **Command Prompt**.

Type: `java -version` and press Enter on your keyboard.

- b. On Mac, open a new terminal and type `java --version` followed by Enter.

**NOTE:** If you are installing **Logisim Evolution** on your personal computer and you don’t have a JRE installed, you will need to install a JRE before the Logisim Evolution software will work. If you need assistance with this, please contact your instructor.

2. Visit the following website to download and run your platform specific version of the Logisim Evolution program.

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- a. <https://github.com/logisim-evolution/logisim-evolution>
- b. Click on a link in Download section to download your platform specific version of **Logisim Evolution**.

## Download

Logisim-evolution is available for [download in compiled form](#) with ready to use installable packages for Windows, macOS, and Linux or in [source code form](#), which you can [build yourself](#).

The following [platform specific packages](#) include the Java runtime and do not require it to be installed separately:

- `logisim-evolution-<version>-1_amd64.deb` : Debian package (also suitable for Ubuntu and derivatives),
- `logisim-evolution-<version>-1.x86_64.rpm` : Package for Fedora/Redhat/CentOS/SuSE Linux distributions,
- `logisim-evolution-<version>.msi` : Installer package for Microsoft Windows,
- `logisim-evolution-<version>.dmg` : macOS package. Note that Logisim-evolution may also be installed using [MacPorts](#) (by typing `sudo port install logisim-evolution`) or via [Homebrew](#) (by typing `brew install --cask logisim-evolution`).

- c. From the **Logisim Evolution** download home page, follow the shortcut instructions on “**MacOS X**” or “**Windows**” versions. (There is also a Linux version)
3. Please note that if you already have a **JRE** installed on your machine, this software includes all the resources files in its package. You do not need to take any other extra installation or configuration steps.
4. Once you have Logisim Evolution installed on your machine, you can work on your lab.

## 2.2 How to start Logisim Evolution.

### 2.2.1 Using a Windows Computer

If you are on a lab machine, double click on the **Logisim Evolution** icon from the desktop or start menu of your lab computer. (See **Fig 1**.) The icon might be in different places depending on the machine.

If you are on your personal computer, the Logisim Evolution executable is in your downloads folder. If you haven't already, move it from the downloads folder to your desktop or a folder of your choosing. Double-click on the file to open the application.



Figure 1: Logisim Evolution Icon

### 2.2.2 Using a Mac Computer

Open the folder you downloaded the zip from the web and open it. It will decompress the zip and the application file should appear.

You can move it to your applications folder to have the application available in your launch pad or run it directly from the folder by double clicking on the file. The application should run. If your system does not have JRE installed, you



Figure 2: Logisim Icon Mac (not most current icon)

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will get the error shown on Figure 3. Click on *More Info* and follow the instructions to install it. Then try again opening the application.

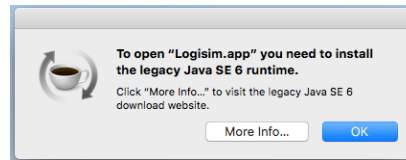


Figure 3: No JRE available on Mac Error

## 2.2.2.1 Using Mac OsX Big Sur

On Mac Big Sur, the application may abort abruptly upon starting as shown in Figure 4.

If this happens, click on *OK* and follow the procedure depicted below. Otherwise, you can just continue with the remainder of the lab.

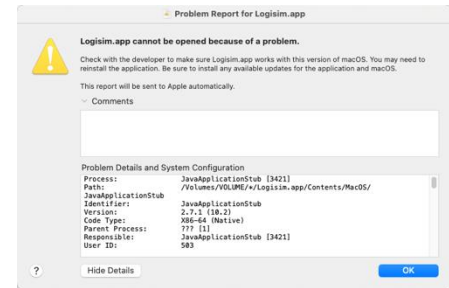
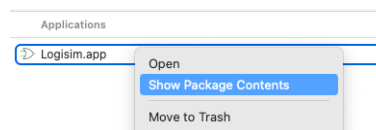


Figure 4: Error on Mac Big Sur

1. Open Finder and navigate to the location of `Logisim Evolution.app` file.
2. Right Click on the file and select show package contents.



3. Navigate then to `Contents` → `Resources` → `Java` and right click on `Logisim Evolution.jar` and select `Copy`.

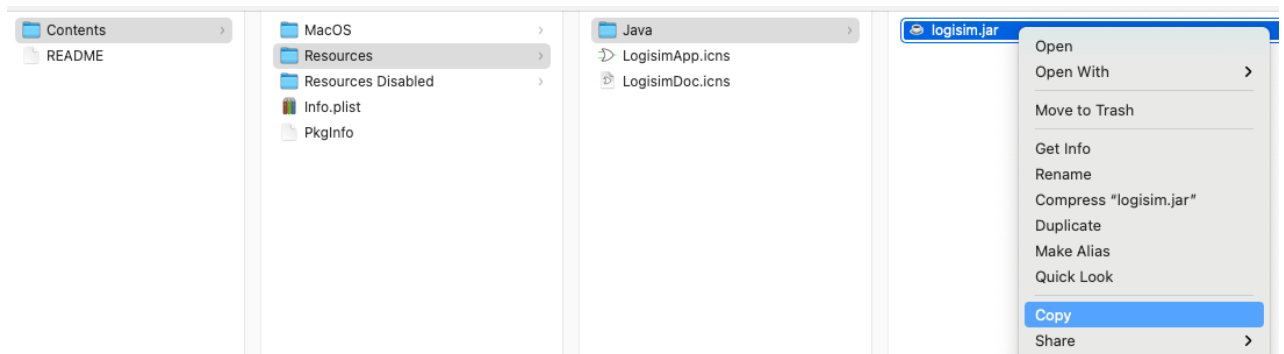
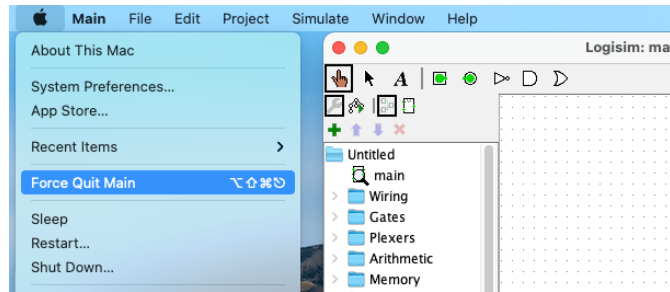


Figure 5: Logisim.app Package Contents

4. Go back to your directory and paste the file next to `Logisim Evolution.app` file.
5. Then double click on `Logisim Evolution.jar` to run the app.
6. Running the app this way, you will need to force it to terminate the application. To do so, select the app (which will appear as "Main" but it is Logisim Evolution), then click on the Apple menu and with the "Shift" key pressed, click on "Force Quit Main", as shown in the figure below.

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## 2.3 Using Logisim Evolution

1. After the application opens, **Logisim Evolution** workbench is displayed.
2. The first thing you should do before using any new program is find the tutorial and go through it. The tutorial is under “**Help/Tutorial**” menu in the menu bar (see Figure 6 below for Help menu item) and follow the example in the tutorial. For this class, it is recommended that you go through steps 0 – 4.

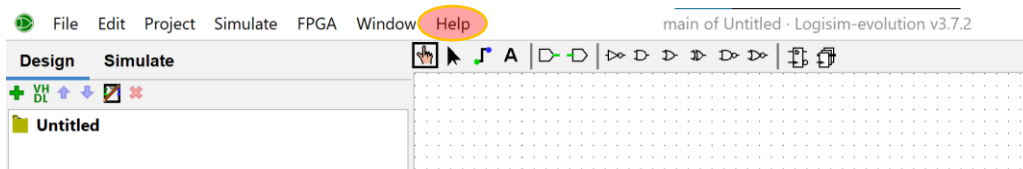
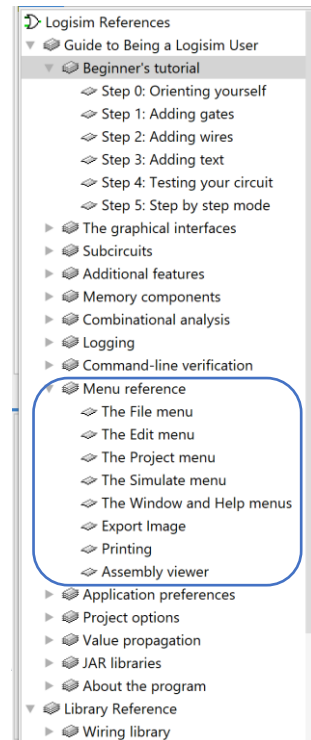


Figure 6: Logisim Workbench

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3. Besides the tutorial, there are many more topics in many different sections under “Help” menu item. However, initially, we recommend you read the “**Menu references**” sections only at this point. We will revisit other tool references as needed, in later Labs, when we do work that is more complex.
4. You will create a new **Logisim Evolution** project for every lab. You should have a `CSCI-1510Labs` folder. As each new lab is started, it is recommended that you put it in its own folder. In some cases, you may need to create more than one project. To create a new project, you simply select **File** → **New** from the menu bar. When you open the program, you are already in a new project, so you do not need to create a new project, unless required by later labs.
5. We recommend you save the new project as follows at the start of your lab session (**File** → **Save** or **Save As**). Enter your project name in the following recommended format, `LAB#_yourlastname`. The default file extension of Logisim Evolution project is “`.circ`”. **Do NOT change the default file extension.**

**Example: Lab0\_Brown.circ**



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## 3. Lab 0 – Assignment

### 3.1 Completing the instructions in Logisim Evolution “Beginner’s tutorial”

Follow all the instructions in the **Logisim Evolution** Beginner’s tutorial from Step 0 through Step 4, if you haven’t already. You are required to the following for the **Lab 0** assignment. All the necessary steps are included in the tutorial.

1. **Initial drawing** –draw the following circuit by adding gates, wires, inputs and output, and text in Step 1, Step 2, and Step 3 from the tutorial in the workspace. Your final circuit should look like the drawing in Step 3. Make sure all wires are green or dark green.

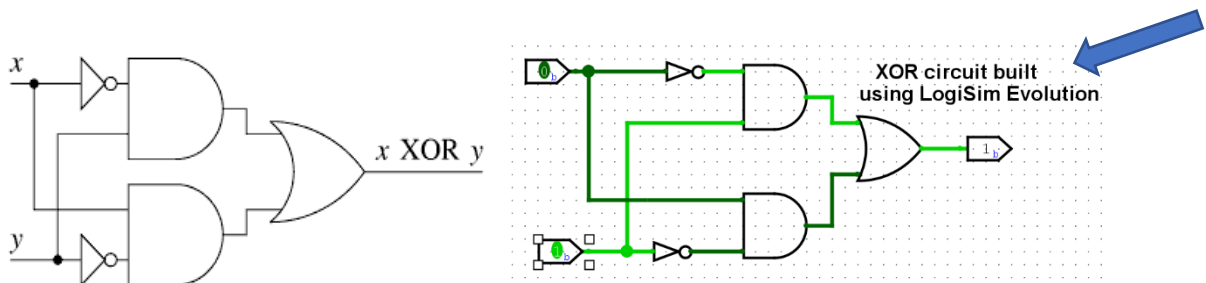



Figure 8: Logisim Circuit

2. Once your drawing is complete, make sure you save, as described above, the logic circuit in Logisim Evolution file format (\*.circ)
3. **Simulating your circuit** - the final step is to test the above circuit to ensure that it really does as intended. You may go over the instructions in Step 4 to test the circuit.

Select the Poke tool (  ) and start poking the inputs by clicking on them. Each time you poke an input, its value will toggle between 0 (false) and 1 (true). When you change the input value, **Logisim Evolution** will show light green (1) or dark green (0).

During the simulation, you should capture the set of input values and the corresponding output value and record them in a table format using a tool like Microsoft Word or Excel. For this assignment, please do not worry about the specific outputs. This is discussed later. This lab is about orienting you to Logisim Evolution.

Figure 9 below shows the truth table for Step 4 from the tutorial. Note that,  $x$  and  $y$  are inputs and  $x \text{ XOR } y$  is the output of each set of corresponding input sets (total: 4 sets of inputs)



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$x$	$y$	$x \text{ XOR } y$
0	0	0
0	1	1
1	0	1
1	1	0

Figure 9: Truth Table for Exclusive OR (XOR)

## 3.2 Multiple Data bits

In the previous exercise, you have entered the input data using Poke tool interactively one by one and manually recorded the output in a table. Now let us try to enter all the possible inputs in a batch mode all at once. This will allow you to get all possible results at the same time without requiring human interaction for each input set

Here are the instructions on setting up multiple **Data Bits**

1. Open your saved Part 1 **Logisim Evolution** file
2. Select the Edit tool () from the tool bar.
3. Click on each input icon, then go to the “Selection: Pin” attribute table.
4. In the “Data Bits” row, change the value to 4. We have 4 different set of values.
5. This will change the color of wires to orange or red because of the data bits mismatches among the gates and input. Now we need to fix them.
6. For every gate directly or indirectly connected to each input,
  - a. first, go to **Edit** mode
  - b. click on the gate, and
  - c. change the “Data Bits” value to 4
  - d. do not forget to update them for the “**Not**” gates and the output as well.
7. Correct any possible errors until you see the color of all the wires are turned to “**black**”
8. Verify the lists of input and output bits are the same with those from the truth table recorded using **Poke** tool in part 1.
  - a. Click on each bit in the input list to toggle the value of a specific input bit.
  - b. Whenever you change the input values, the output is updated accordingly.
9. Upon successful testing, save it in a different Logisim Evolution file name. (\*.circ) (You may wish to save to a different name first in later labs.)
10. The final output of the logic circuit may look like the one shown in Figure 100.  
Note that it does not matter which inputs (left side of the gates) you use.

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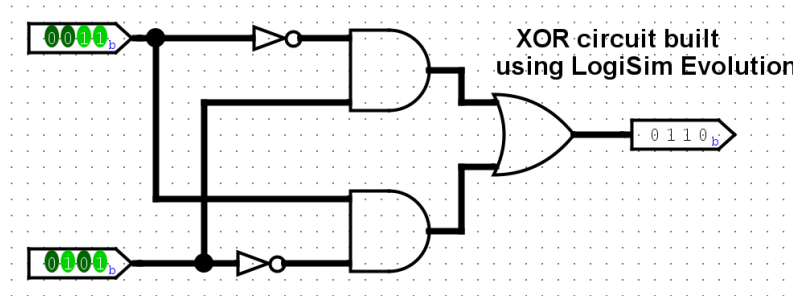


Figure 10: Logic Circuit

## 4. Deliverables

1. Part 1 Logisim Evolution file (e.g., `Lab0_Part1_myName.circ`)
2. Part 2 Logisim Evolution file (e.g., `Lab0_Part2_myName.circ`)
3. Using a word processor, you may put the images of the results from both Part 1 and Part 2 in a file.
  - The Snipping Tool is very useful for this.
  - The recommended file name is `Lab0_Output_YourLastName`.
  - **Please make sure to save the file as a PDF file.** If you don't know how to do this, ASK!

The file should contain:

- the picture of `XOR` logic circuit of Part 1 using a screen capture tool
- the picture or a table of the truth table reflecting Part 1 simulation result
- the picture of multiple data bit version of the `XOR` logic circuit using a screen capture tool. **Note:** You do not need to add a truth table for Part 2 logic circuit because the combination of input and output represents its truth table.

## 4. Submit the files by uploading it in the Lab 0 assignment in Canvas