Faculty of Science, Engineering and Technology

Computer Systems

Week 1

Overview

This laboratory session is designed to familiarise you with the Logisim Simulator and with the behaviours of simple gates, both individuals and in combination. You should spend time getting to know and trying the simulator's functions and features, and checking out the resources below.

Purpose:	Demonstrate your capacity to use Logisim to build simple digital circuits.
Task:	Create and test simple digital circuits using simple gates using Logisim.
Time:	This lab is due by the start of your week 2 lab.
Assessment:	This lab is worth 1% of your assessment for this unit, and only if demonstrated to your lab demonstrator in the week it is due.

Resources:	▪ Swin tutorials:
	  ▪ Logisim introduction
	  ▪ Half-adder tutorial
	▪ External links:
	  ▪ Logisim Beginner's Tutorial
	  ▪ Logisim Video Tutorial

Submission Details

You must submit the following files to Canvas:

- A document containing all required work as described below.

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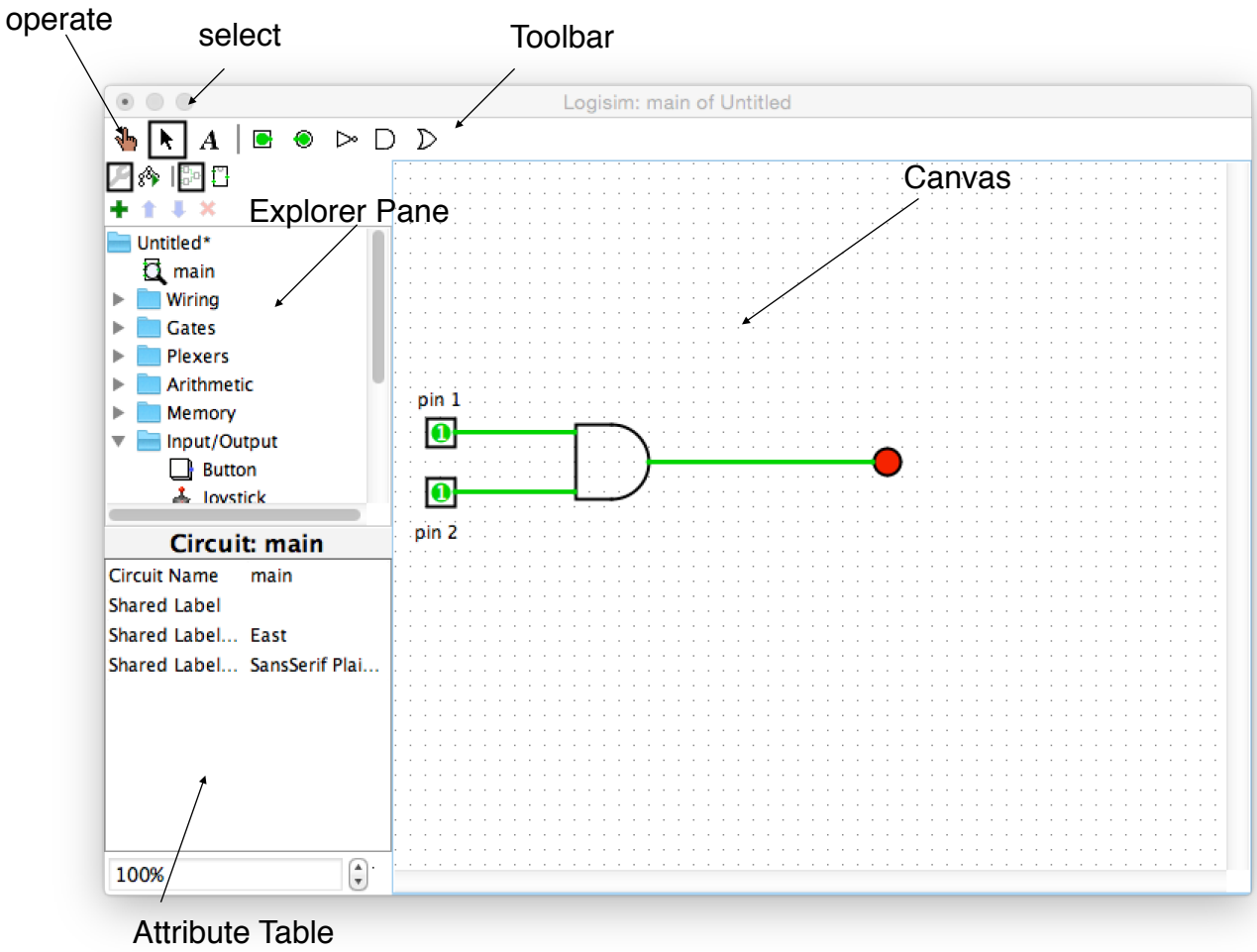
Instructions

1. Start Logisim and explore its graphical interface and components Install the tools you need to get started.
   - You may also want to install Logisim on your own machine, which you can download for Windows, Mac OS and Linux from: https://github.com/reds-heig/logisim-evolution

2. Lets take a look at Logisim's important controls:



3. Draw the circuit above in Logisim, including the labels. Notice the following:
   - You can select pins, gates and other components from the toolbar, or the Explorer Pane.
   - Once selected, you can click in the canvas to position them.
   - The red dot is an output LED.

- When you select the AND gate, notice the Attribute Table which shows the current settings for the gate. You can change the number of inputs from the default 5 to 2 (as above) by changing the "Number of Inputs" attribute (4th from the top).

4. Operate the circuit to verify its correctness. To do this, click the operate (finger) icon in the top left corner of the GUI, and then click the pins to see how changing their states effects the LED.

5. **Test your circuit for all possible input combinations using a truth table like the one below (where the LED being red represents 1).**

You should include a table like this in your submission document, along with a screen shot of your circuit.

Pin 1	Pin 2	Output
0	0	0
0	1	0
1	0	0
1	1	1

6. If you don't already have one, create a folder to store your logisim circuits (e.g., *Documents/Logisim/Lab1*). On a Swinburne computer you may wish to use a directory on your student drive or a USB storage device.

7. Save the current circuit and create a new canvas by selecting File | New from the menu bar.

8. Connect up an inverter (NOT gate), a pin and an LED to the output. **Check its correctness by filling out a truth table like the following. Add the circuit screen shot and the table to your submission document:**

Pin	Output
0	1
1	0

9. Save the current circuit and create a new canvas.

10. Connect up a 2-input NAND gate, connect a pin to each input and an LED to the output. **Check its correctness by filling out a truth table like the following. Add the circuit screen shot and the table to your submission document:**

Pin 1	Pin 2	Output
0	**0**	1
0	**1**	1
1	**0**	1
1	**1**	0

11. Name and save the current circuit and create a new canvas

12. Using the lecture slides as a guide, construct a half-adder and test it.

Check its correctness by testing and filling out a truth table like the following. Add the circuit screen shot and the table to your submission document:

Input 1	Input 2	Sum Output	Carry Output
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

13. Save the current circuit.

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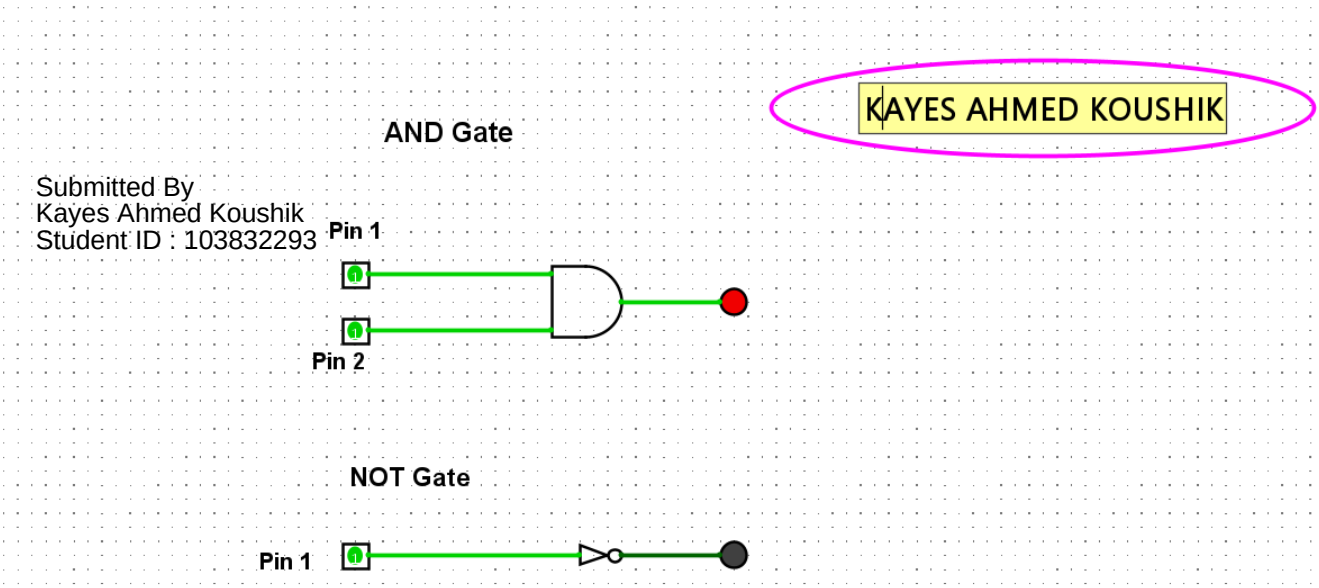
14. Now extend your half-adder to a full-adder, which in addition to the two input pins, also handles a *carry-in bit.*

Check its correctness by testing and filling out a truth table like the following. Add the circuit screen shot and the table to your submission document:

Input 1	Input 2	Carry In	Sum Output	Carry Output
0	**0**	**0**	0	0
0	**1**	**0**	1	0
1	**0**	**0**	1	0
1	**1**	**0**	0	1
0	**0**	**1**	1	0
0	**1**	**1**	0	1
1	**0**	**1**	0	1
1	**1**	**1**	1	1

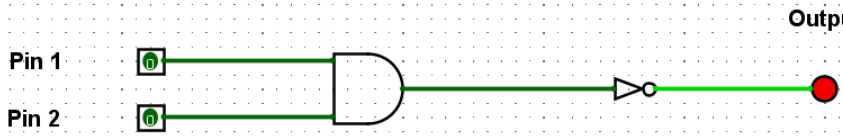
When complete:

- Submit your answers (screen shots, etc) in a single document on Canvas
- Show your lab demonstrator your working circuits in class (you must do this to get the 1%). Your lab demonstrator may request you to resubmit if issues exist.



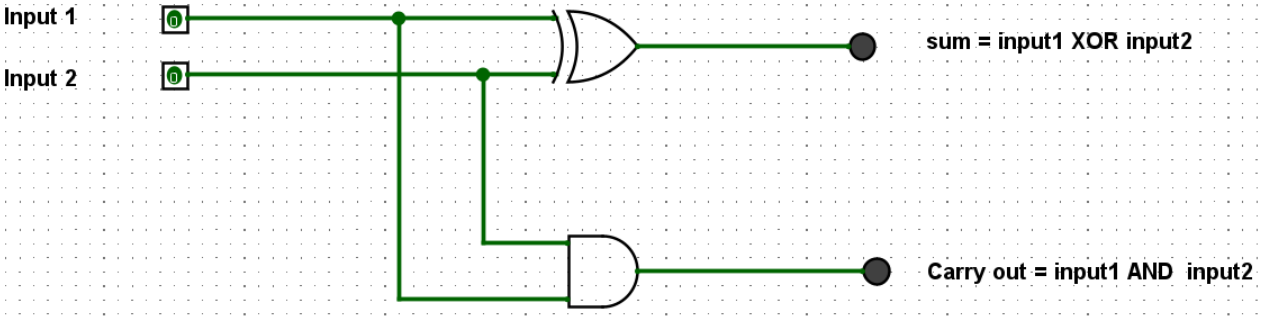
KAYES AHMED KOUSHIK

NAND Gate



KAYES AHMED KOUSHIK

HALF ADDER



KAYES AHMED KOUSHIK

FULL ADDER