

CS370 Computer Architecture

Lab 1: Get Familiar with LogicWorks

Total Points: 50

Objective:

LogicWorks is an interactive circuit design tool that allows you to run quick and efficient simulations on screen. It's the fastest solution to help you learn digital logic. The purpose of this lab is to let you get familiar with the LogicWorks software. Note that this lab assignment is **individual** assignment, which means each student needs to complete it independently.

Problem Statement:

1. Create a 4-1 MUX using **ONLY** tri-state buffers and inverters (i.e. NOT gates) in LogicWorks. This circuit will select one output from four inputs based on two additional switches. Please read textbook Page 140 Section 3-7 (Selecting) Multiplexers before implementing this lab assignment. You can test out your circuit using binary switches and a Hex keyboard (use Ctrl-F to show signal values). Please read Page 140 for detailed information about MUX (Multiplexer).

(a) This MUX should have two selector lines S0 and S1 and four input lines A-D.

(b) The output should match the following table:

S1	S0	OUTPUT
0	0	A
0	1	B
1	0	C
1	1	D

In other words, when S0 and S1 are both zero the MUX will select input A for use as the output.

2. Use the created circuit from Step 1 to create a part in LogicWorks. This can be accomplished using a LogicWorks part called "port in".

(a) You will need a port in for each of the six inputs. Label each port in using the text tool (Ctrl-E). Make sure you click the port in part and name them with their appropriate name such as S0, S1, A, ... and so on. Note that the text labels should become purple.

(b) There will be one output line which will require the use of a “port out” part in LogicWorks. Name it as you like. Use the same method above to label the port out part.

(c) Save your LogicWorks file and leave it as an open circuit.

3. With the circuit from Step 2, create a part and save it into a library file.

(a) Open a new device symbol. (File --> New --> Device Symbol)

(b) Select the Options menu, and then “Subcircuit and Parts Type”. This opens another window. Select “Create a sub-circuit symbol and select an open circuit to attach to it”. Click the subcircuit that you have created in Step 2.

(c) Auto-create a device symbol if desired. (Under Options menu)

(d) Layout the part graphic as desired. If you want, you can create almost any shape in LogicWorks since it is only a logical representation and not an actual part. Ensure pins are in the correct location.

(e) Save the part to a new library (File --> Save). The name of the library file should be the first initial of your first name and your last name. For example, student Andrew Jordan’s library file would be ajordan.clf.

4. Submit your library file in Canvas.

Additional Notes: You can add more parts to this library for later use. One useful device produces a constant 1 signal. It can be created by using an inverted ground. Remember to always test your circuit for the correct output.