

CSE 370 Introductory Laboratory Assignment

Constructing Simple Logic Circuits - II

Assigned: Monday, January 19, 2009

Due: End of Lab Section

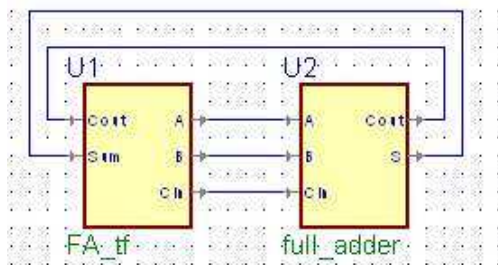
Objectives

In this laboratory assignment you will continue to learn how to use the Aldec Active-HDL tool. This time the focus will be on how to create Verilog modules. You will also see how Verilog modules can be used as test fixtures to help you verify your circuit. By the end of this lab you should feel comfortable creating a Verilog module directly and setting up a test fixture.

****Save all the files that you create in this lab. We will use them later.**

Tasks

1. Read Part 1 of [Tutorial #2](#) to familiarize yourself with test fixtures and how to use them to test a circuit in Active-HDL. You will need to know this for the next task.
2. Complete [Tutorial #3](#) which describes how to write simple Verilog modules and use them in schematics. As part of the tutorial, you will write and test the Verilog module for a full-adder; a full adder is an adder that handles both carry-in and carry-out conditions in addition to the sums and two inputs. You should create a test schematic by using the provided test fixture: [FA_tf.v](#) (right click and "save as" if the download doesn't start automatically). Test fixtures will be covered in more detail later so don't worry too much about why it works. However the basic premise is the test fixture generates a signal and checks to see if the returned signal is the expected output. An example of how to hook up your test fixture is below.



To test to see if your full adder works you do not have to manually create signals and simulate it in Active-HDL. Since you now have a test fixture, the test fixture should generate the signals so all you need to do is run the simulation. The test fixture should pass in a series of values to your full adder, if all goes well the console at the bottom will inform you that your full adder passed. If there are errors it will let you know as well.

****CAUTION:** Do not put complete faith in test fixtures, you should always practice common sense and make sure that the values that come out make sense. If you see a value like: X, that probably is not right.

3. Complete Part 2 of [Tutorial #2](#), which describes how to use buses and bus inputs and output terminals. A bus is simply a large group of wires, which means they can handle more than 1 signal, for example: an 8-bit bus can have 8 different signals across it. In Part 2 you will create a four-bit full adder by using one-bit full adders you created in Task 2. You can test your four bit full adder by using this test fixture: [addsub4_tf.v](#).

***Attention:** In the tutorial the four-bit full adder is made with the pink lib370 gates. However, since we will eventually be putting this four-bit adder on standard industry hardware you should use the built-in symbols included with Active HDL, these are yellow. If you have any pink gates, when you get to the lab where you need to

put this design onto the FPGA (Field Programmable Gate Array), it will not work.

4. Create a Block Diagram in Active-HDL to detect a Fibonacci number between 1 and 15. These numbers would be: 1, 2, 3, 5, 8, 13. Test it with the provided test fixture here: [fibonacci_tf.v](#). Once again since you will have to build this on the circuit board we are giving you a level of leeway in the design of the module, though it is highly suggested that you use logic that can be constructed (such as NANDs and NORs) from the chips in your kit. You can refer to the [chip map](#) to recall what logic gates are available to you. If you would like your TA to check your boolean logic before moving onto to the last step of building your circuit on the actual board, feel free to call over a TA.

Don't cares can be useful when simplifying a circuit. As long as you are feeling up to it, you may treat 0 as a don't care, though you should let your TA know if you have done so when the TA comes to check off your Fibonacci circuit. And finally, Active-High or Active-Low it is up to you.

5. Using the logic you created in Active-HDL, follow it and build your Fibonacci Detector on the circuit board. You will need 4 switches and 1 LED. We suggest that you use SW0 through SW3, where SW3 is the most significant and SW0 is the least. If you have any trouble with this last part and your logic is correct, you should check your wiring with the logic probe. You can use the logic probe to trace through each step of the circuit and check for unexpected outputs or inputs.

Lab Demonstration/Turn-In Requirements

A TA needs to "Check You Off" for each of the tasks listed below.

1. Demonstrate your working 4-bit full adder design from Task 3.
Do not wire up this circuit with your chips on your board.
2. Demonstrate your working Fibonacci **circuit** from Task 5.
Do wire up your Fibonacci circuit with your chips on your board.

Comments to: cse370-webmaster@cs.washington.edu