Name: _____ ID# _____

Date Submitted: _____ Lab Section # _____

CSE 2441 – Introduction to Digital Logic Spring Semester 2020

Lab Number 9 – TRISC Processor Control Unit

To be performed April 27- May 8, 2020

Note: This lab is performed on the DE1 FPGA.

CSE 2441 **LABORATORY ASSIGNMENT 9** **SPRING 2020**

TRISC PROCESSOR CONTROL UNIT

(100 POINTS)

PURPOSE/OUTCOMES

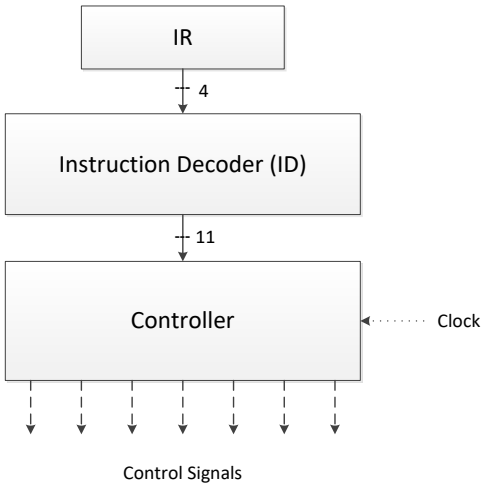
To design, implement on the DE1, and test an Instruction Decoder (ID) and controller for a subset (INC, CLR, JMP, LDA, STA, ADD) of the Tiny Reduced Instruction Set Computer (TRISC) instruction set. By successfully completing this assignment, you will have demonstrated an ability to design a simple FSM-based controller.

BACKGROUND

You have been designing and implementing various components, e.g., ALU, PC, AC, IR, and FR, for the Tiny Reduced Instruction Set Computer (TRISC) over the past several laboratory exercises. In this lab, you will design and implement an Instruction Decoder (ID) and a controller to fetch and execute the INC, CLR, JMP, LDA, STA, and ADD instructions. Please refer to the class notes for more details on TRISC.

DESIGN REQUIREMENTS

1. Design an ID for decoding **all** of the opcodes in the TRISC instruction set. Capture your design using a Verilog behavioral model.
2. Design a controller for generating the sequence of control signals necessary to fetch and execute the INC, CLR, JMP instructions. Capture your design using a Verilog behavioral model.
3. Redesign your controller to handle INC, CLR, JMP, LDA, STA, and ADD instructions.



INSTRUCTION DECODER (ID) AND CONTROLLER LAB EXERCISE

1. Implement and test your ID on the DE1. Use DE1 slide switches to simulate the IR. Display your decoder outputs on DE1 LEDs.
2. Implement and test your first Controller on the DE1. Again use DE1 slide switches to simulate the Controller inputs. Use DE1 pushbutton switch Key1 for the clock input. Display your controller outputs on DE1 LEDs.
3. Implement and test your second Controller on the DE1. Again use DE1 slide switches to simulate the Controller inputs. Use DE1 pushbutton switch Key1 for the clock input. Display your controller outputs on DE1 LEDs.
4. Integrate and test your ID and second controller as a single unit. (25 BONUS POINTS)