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ELEC 5200

Project Part 5

1. Throughout the duration of this project, I have learned the basic steps to designing a processor. I have learned different methods of transferring data through the datapath and the different types of control units needed to control the datapath. I have also become familiar with Altera’s Quartus II software. I have also become significantly better at programming finite state machines using VHDL.

**Specific Things:**

**Single- Cycle/Multi-Cycle:** My first attempt at this project featured a single cycle datapath. Upon attempting to simulate it and debug it, I realized that I had no clue what was going on and why I was getting errors in certain places. I discovered that a multi-cycle datapath would be easier to debug because it allowed me to look at all of my signals after each clock cycle and discover the errors as they were happening.

**Finite State Machine in VHDL:** When I first learned that the control unit for a multi-cycle datapath had to be a finite state machine, I had a very vague idea of how to program it in VHDL. Eventually I learned how to time the clock cycles correctly, and I was able to use two processes a synchronous process and a combinational process.

**Register Write Problems:** During my simulation and verification, I noticed that my instructions were not writing the registers correctly. The values were ready to be written, but they never got written to the registers. I remedied this by alternating clock edges between when the data is available and when the write signal is sent.

1. If I had the chance to do this project over again, I would have started out trying to implement a multi-cycle processor. At first I was attempting to implement a single cycle processor, but I was unable to make any part of it work. I decided that debugging a single cycle processor is ridiculous because everything happens in one clock cycle and there is no easy way to step through the execution of instructions. I switched to a multi-cycle processor and was able to successfully simulate it, but I was unable to get it running on the DE2 board. I believe that if I would have started with the multi-cycle processor, I would have had enough time at the end of the project to get everything running properly.
2. My advice to someone who is going to work on a similar project would be to make sure you complete every step thoroughly and check for errors from the beginning. I would tell him/her to make sure that he/she thinks everything out clearly and creates appropriate diagrams and visual aids to help check for completeness and errors. This project can be extremely rewarding, but it is very challenging. Staying organized and thoroughly verifying at every stage will give you the best chance of succeeding.