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ELEC 5200

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November 20, 2014

Project Part 6: Project Reflections

Through this project I have learnt to create a functioning CPU. This was achieved through a step-by-step design process. However, many changes were made as the design was elaborated upon. Creating a CPU from the ground up is a time intensive process where changes are not just helpful, but necessary. The system as a whole must be taken into account and several revisions are necessary to produce an efficient processor. I also learned how to create RAM memory for a Cyclone II using Quartus II and simulate the memory using ModelSIM.

The order of the registers in my instruction set was not intuitive, so if I did the project again, I would reorder the registers sources for the dataset. Therefore more documentation during the earlier stages of the design would have been helpful. I would also place more emphasis on jumping over branching because jumps can access any address in the instruction memory whereas a branch might need to be followed by a jump to reach the same address. I would also try to better take subsequent design phases into account for each part. I also left too much time in between parts to remember what I had done in the previous step, which prolonged the design and debugging of the system. I think doing the design in two stages (instruction set and datapath, and the VHDL implementation) would have ultimately been more beneficial to the design process.

My advice to people working on a similar project is to design the datapath very carefully and to be sure to consider timing. I also believe that choosing to create a single cycle processor for my first CPU was a good choice because it reduces the number of timing issues and possible hazards. However, since pipelined CPUs have better performance, a future goal could be a second CPU utilizing this architecture. I also found the VLookup function in Excel to be helpful in generating the binary code corresponding to my assembly. It also made modifying the binary code much easier, as I could just change the assembly and the new binary code would automatically be generated. Finally, if the designer is unfamiliar with ModelSIM I would recommend trying it out before embarking on a project as complicated as a CPU.

Overall the project was a hands-on introduction to PCU design. It helped me to learn the majority of the topics covered in Computer Architecture. It also allowed me to get some real-world experience with VHDL and testing.