**CPU Design Project: Part 6 – Final CPU**

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**(a) What do you learn from this project?**

From the design project, I learned how to design a processor. And it actually covers lots of things, the ISA design, which makes me understand the relationship between C code and machine code. And through the datapth design, I figure out how the data flow in the processor, and how we control it. By verifying the design by VHDL code and simulation it, I started to understand that a good design should be easy to be implemented, that is, the design of datapath should clearly show how each bit flows. Otherwise it will have some problems. When try to verify it with VHDL codes, lots of problems pop up. And drawing a diagram is always easier then actual implementing it. Over all, I gain a lot from the project, especially in the data flow of the datapath.

**(b) What would you do differently next time?**

Next time, I will add a hazard detection component and some hazard avoiding units in my pipeline datapath. Because the hazards in pipeline datapath really slows down the processor. Furthermore, the structure hazard should be taken into account. Because this time there’s some structure hazard in my datapath, like the memory is one cycler slower then MEM/WR register, it slows my processor down too. On the other hand, I will redesign the ISA. Next time I will use 4-bits for the opcode so that I can have more instructions. A larger number of instructions may not be an idea, but if it is too small, the function of the processor is very limited.

**(c) What is your advice to someone who is going to work on a similar project?**

For someone who first time to do a similar project, I strongly recommend to use Quartus 13 which support Cyclone II. Because Cyclone II is a very old family version, if you generate the memory in a higher version like Quartus II 15, it won’t work. And if you are going to design pipeline datapath, be careful about the structure hazard. Especially in the load word instruction as mentioned above. The last thing is that if you trying to download your processor to the DE2 board from the computer on room 320, you will need some help, because it required the administrator’s priority to install the USB blaster.