

CARES Lab Interim Report

From the week of June 8th to July 10th, I was assigned the task to completing the Computer Architecture course at Seoul National University. This report is a reflection of my experiences at the end of the six weeks not only related to the course material, but also my experiences within the lab. During my initial meeting with the professor, I had the feeling that he wanted to improve the course. Consequently, while I was taking the course, I tried to put myself in the position of a student taking the course and took detailed notes on what I believed was done well and what I thought could be improved. Of course, being an undergraduate student myself, I should mention that this report should be taken with a grain of salt.

To begin, the course material covered the majority of the concepts required in an introductory computer architecture class. Often times, introductory computer architecture classes leave out branch prediction, complex combinational circuits, and data hazard handling, but I thought it was commendable that the course went into these topics and explained it with ease. Some topics that I personally thought could supplement the lectures were finite state machines and Boolean algebra (Lecture 3), the compiling process (lecture 9), and thread level parallelism (after pipelining). In addition, I thought the course material could have gone more into the IA32 assembly language, such as the instruction format and couple this with the aforementioned compiling process to give a broad overview of how code interacts with the architecture.

To continue, the labs provided the students with practical experience and allowed them to experiment with the concepts they learned in class. Before going into my evaluation of the labs, I want to mention that all of the labs were catered to complement the course material for the week and did an amazing job of helping me get a deeper understanding through experimentation. Most of the lab was done in Bluespec Verilog, programming hardware level components with a high level language. Personally, I thought this was a great choice, as many of the students taking the course would have a background in high-level languages but not too

much in hardware. Given their background in high-level languages, BSV bridges the gap between software and hardware and extends their knowledge of programming with consideration to hardware limitations and exploits. The language itself revolved around the core ideas of cycles, clocks, and overall hardware, which made it easy to learn computer architecture through programming. As a result, many of the labs required analysis of the entire code to solve the problem, which ensures that the student understands BSV and its hardware limitations by the end of the course.

However, there were some drawbacks that BSV had in comparison to some of the more popular computer architecture languages. As I mentioned before, I personally believe that BSV was a great choice for the course, however because it is a relatively new language, it lacked support for bugs and errors that occurred during the course. It was difficult to look up errors and bugs when they occurred in the labs. I felt that the lack of support from the web might be a hindrance for a student learning the material for the first time, often through exploration.

Also, I felt that some of the assignments needed a little more instruction in the introductory PDF. Often times, I would first have to understand the entire code to know what to do and sometimes I would edit an unnecessary part and it would cause errors for the entire lab. For example, one of the biggest problems I had during the first few labs was the concept of Action and ActionValue. It was not explained in detail in the course slides, but was used within the labs. I often got type-checking errors that I did not know how to fix even after reading the reference books. Of course, the purpose of these labs is for the student to learn; therefore, providing blatant hints would be counter-productive. Providing a general area in which to fix the code, or explaining some of the integral functions in the code would be an appropriate compromise between the two.

Considering the pros and cons of the course, my personal experience with it was overall a positive one. I was able to not only learn a new and very helpful language, but I was also able to strengthen my understanding of computer architecture. The overall difficulty of the course was not too hard nor was it too easy. I especially had a great time with the binary bomb project, which I thought was a novel and entertaining way to learn about assembly language through a detective-like atmosphere. I had the most difficulty with lab 3, which was the first

lab that actually tested the student's knowledge of BSV and its inner workings. At the end of the course, I personally thought that it could use another project or a few more labs. In my opinion, a project pertaining to building a pipeline through a circuit program would be a great one to complement the concept of pipelines and combinational circuits, registers etc. In regards to additional labs, I felt that a lab covering exceptions or virtual memory would be a good addition to the course.

Finally, since I spend the last six weeks at the lab for most of the day, I can't help but mention some of the interactions I've had with the CARES lab members. Considering that I've spent most of my life abroad, it is often hard for me to understand Korean culture fully, yet I felt comfortable working and socializing at the lab. The lab members were very kind and supportive from the beginning, asking if I needed any help or helping me set up my desk. Once I got used to the lab, I looked forward to eating lunch and dinner with the lab members or going to the convenience store for a snack. From an external point of view, I could see that the lab has a firm leadership structure complemented by mutual respect for one another.

More specifically, Mr. KeonSoo Ha and Mr. JaeYong Jeong listened to some of the problems I was having and gave me valuable advice regarding higher education, the army, and research. Also, I am grateful to Mr. HoYoon Jun who took time out of his busy schedule to answer the questions I had about the course. He often took the time to look over my code and write down hints that would help me find my errors. Mr. InHyuk Lee was also very helpful in my adjustment period in the lab, answering any questions I had as well as providing me with information regarding the buses or meal plans at SNU. I was especially appreciative of the effort he put in to help me each time such as giving me a copy of his student card when I mentioned that I enjoyed working in the library.

All in all, I see the past six weeks as a learning period to learn the necessary tools to actually begin helping at the lab. The professor was kind enough to give me the opportunity to study at the lab for the last six weeks and I believe that I should repay the favor by helping with some of the research that the lab is conducting. I look forward to continue working alongside the lab members and the progressive work they are doing in the field of computer architecture.