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M/W 2:00PM - 4:00PM
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Title:
Decimal Converter

Purpose:
The purpose of this lab is use LC-3 program on Windows operating system and create a conversion program that allows an user to convert decimal number to binary. This lab has many steps to create the converter and a pdf that shows a flowchart is provided to students so that students can use that flow chart to follow the procedure to create a decimal converter on LC-3 environment. I used Assembly language to program, debug and compile the application for this lab assignment.

Procedure:
This lab assignment has many steps to proceed, and when I was programming this converter on LC-3 environment, I used Assembly language to program this. It was necessary to use a flowchart that was provided for us to work on. Also, we had to create our own flowchart so that we can implement our flowchart into the LC-3 program.

Algorithm and Other Data:
For algorithm to create this specific program on LC-3 in Windows operating system environment, I had to understand how the flow chart is showing the procedure to convert the decimal number to a binary number. There were in total of three loops and these loops allowed some circumstances when an user enters a number on Console. In order to understand the flow chart fully on PDF, I drew another version of flow chart that looks similar to the PDF that was provided by the professor, but I had to implement my own version of the LC-3 program into the new version of flowchart. In this flow chart, I could make some changes when the system does not work out properly. As the TA suggested, I had to draw the flowchart first and needed to understand how each step of the loop worked. Afterward, I showed the flowchart to the TA to verify if my flowchart works perfectly fine.

For programming part of the lab 6, I had to keep up in the track of the registers. This means that I had to know what value is stored in which register. Moreover, I had to understand which function or call I had to use to make the LC-3 program to work. In order to do this, I wrote down register number on a piece of paper so that I know which register has what value. In the beginning of the program, I have cleared registers so that the registers are completely empty. Afterward, I initiated codes to allow a program to quit if an user pressed X from a keyboard. Later, I began creating loops that allows an user to see Greeting from the program. In this greeting, an user can see what he or she can do with the program. Greeting prints a string that

contains "Enter a number to convert to binary". If an user inputs a number and presses enter, the program runs and prints out another greeting and binary number that is converted from an user's input.

The procedure of making this to happen was not easy. The number of an user had to go inside the loop and check if the number can be converted. For instance, if an user enters 12, then the program would print out 1100, which is 12 in binary. For this number goes inside the first loop. In this loop, the program checks if the number has gets a character. The program subtracts 48 because that makes the number to transform into zero and it is subtracted by 10 because ASCII value is 10 and then DASH stores 45, then this number goes to the next step of which an integer is multiplied by 10 and added by digit. Afterward, this goes back to the loop and then into the MASKptr. In MASKptr, the number is stored in memory, which is MASK.

The program goes into 2's complement to make the number to represent into 2's complement. And then this number goes to the next loop which loads MASK, int AND MASK and then checks if a digit is 0.

This allows the program to convert a decimal number into a binary number.

What went wrong and what were the challenges?
Honestly speaking, this lab was the hardest lab I have ever done. The reason is that I have not got used to the new programming environment and it was very challenging to figure out which register contains which value. Moreover, debugging procedure looked way different from other programming languages. For instance, on Simulate application, there is a button that allows a programmer to go through each line of the codes, and then had to figure out which part of the program has a bug. The console shows from R0 to R6 and each register contains different number. It was important to understand how one line of codes can mess up with the whole codes in general.

The challenges were struggling and exhausting to me , but this experience made me to visualize how LC-3 worked in the program and also it was a good experience to figure out how to debug a LC-3 program.

Conclusion:
Even though this was the hardest laboratory assignment I have ever done in this class, I could learn that a simple converter program can take up a lot of time to program. Also, this program was the first calculator I have created in an Assembly language. With this experience that I had in this lab, I hope I can create even more complicated application to challenge myself in the future. Debugging procedure was frustrating since this took me a lot of time to figure how each program worked, but it was a new way to learn how each line of codes means and it was very interesting to learn Assembly language. If I had a problem with the understanding the code, I raised up my hand and asked for help to TA's and they were willing to help me out so that I understand the material fully.