ICS Lab Report - lab6

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Lab Name

Learn from the past

Lab Purpose

Implement all the code that has been written before using a high-level programming language.

Lab Content

The last lab might be the simplest one. Use a high-level programming language (e.g. C, Python, C++) to implement all the code that has been written before. The algorithm needs to be consistent with what was used before, e.g. a replication of the first experiment cannot be implemented with just one line of multiplication.
Program list:

- lab0l (lab1 L version).

- lab0p (lab1 P version).

- fib (lab2 fibonacci).

- fib-opt (lab3 fibonacci).

- rec (lab4 task1 rec).

- mod (lab4 task2 mod).

- prime (lab5 prime).

For this experiment, you should think about the following questions:

1. How to evaluate the performance of your own high-level language programs?

2. Why is a high-level language easier to write than LC3 assembly?

3. What instructions do you think need to be added to LC3? (You can think about the previous experiments and what instructions could be added to greatly simplify the previous programming)

4. Is there anything you need to learn from LC3 for the high-level language you use?

Lab Environment

macOS Monterey 12.1, Visual Studio Code, LC3Tools v2.0.1.

Lab Procedure

In most cases, we just rewrite those programs using C++, as code under directory "program/" shows. For the four questions, answers as follows are given.

1. Since they implement the same algorithm, they should have the same time complexity. However, due to the packaging of the high-level language, the two should differ in the constants.

2. Because high-level languages are closer to natural languages, they are more easily understood by humans.

3. The main one is the right shift instruction, which can greatly simplify the implementation of division and mode-taking. The next is the multiply instruction, which can accelerate basic operations from the hardware level.

4. It is possible to use more bitwise operations to increase the efficiency of program execution.

Correctness Verification

Use llvm to compile the C++ code, comparing the result with LC3Tools.