MIDDLE EAST TECHNICAL UNIVERSITY NORTHERN CYPRUS CAMPUS

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MIPS Assembler Project Submission Report

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Introduction

While technological enhancements are increasing, the demand from the computers are also increasing accordingly. For this reason, engineers have been trying to develop new perspectives in computer era to increase the performance while trying to minimize the power consumption. Enhancing the feature of computers most likely means that enhancing the Central Processing Unit (CPU). CPU is the essential part of a computer. All the calculations we want from computers are happening in there. Unlike humans, computers cannot understand human and each other via speech. They use different language; whose name is machine code. All the applications we use in the personal computers are translated into machine code behind the screen. In some level of that process, we need a compiler and assembler to convert high level language like Java into a low-level programming language assembly then we need the assemble it for computers. For performance enhancement process, engineers should take care all these processes. Performance of a computer is measured by how much time the computer takes to execute the specific program and beside hardware implementation, all these conversion between languages directly affect the performance of a computer. Therefore, compilers and assemblers are important while we care about performance. For this reason, like the high-level programming languages, there are also some different assembly language in marketplace, and they all use different algorithms and techniques to solve this performance problem in this level. In this document, new assembler, which is one of MIPS compilers written in Python language, Kompaq is presented.

Kompaq Assembler

Kompaq assembler is written in one of the most popular high-level language, which is Python. The reason for the Python is that Python is an user-friendly, interpreted and Object Oriented Programming (OOP) language in the industry (What is Python? Executive Summary, n.d.). Python language is the most preferred in 2019 for the people, interesting in and working as software programming. (Carbonnelle, 2019). Due to this reason, this assembler has been coded in Python programming language. Before coding part of the project. I have done research about compiler and assembler and planned a road map to solve the problem. For this project, the time-complexity is the most important thing that I care about because time performance of a program is mostly calculated according to time complexity (Time complexity, space complexity, and the O-notation , n.d.). To reduce the time-complexity, using nested loops is avoided. Instead, some other python features are used in case of need. Second important thing was readability and improvability. When we consider the importance of the open-source application development and team working, readability is significant and it can be obtainable using global naming structure (Tan, 2019). During the project, all the written function and classes and variables have been named using naming conventions. In addition, all the instruction and program memory registers names are stored in dictionaries, which is the look up tables in Python. In the test process, I used more than one online MIPS assemblers. To do that, I have first tried the code that mentioned in Computer Organization and Design book 5th edition, and it has been observed that the assembler can handle most of the user-based differences like using non-ascii characters or not using proper convention. Then, I have cross-checked the result machine code with the online MIPS assemblers.

Conclusion

While working on this project, I have gained some skill and knowledge about assembler design, Instruction Set Architecture (ISA) and project management. To solve a problem in this project, I have researched the topic and tried find proper way to solve it like getting rid of nested loops. I also tried to think as hardware designer realizing that regularity for ISA is important because even recognizing the different type of instructions is difficult while trying to keep the code simple and clean. It is obvious that the algorithms take a huge place not for short codes but for possible number of lines of code. I can also criticize myself about planning stage because I faced some problems that I did not consider. Therefore, fixing it was a bit difficult at next stages. However, thanks to open-source family, I have figured it out with avoiding of wastage of execution time. To sum up, I may say that this project became a big chance to see myself working on a comprehensive project for me. I am also planning to take next computer architecture course to use the knowledge that I obtained this course.

References

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