Name:_Dmitry Landy

CMIS 310
HOMEWORK #7 – Week #7

This homework is worth 10% of your course grade.

Read each problem carefully. Failure to follow the instructions for a problem will result in a zero score for that problem.

Submit the completed Homework via Assignment in LEO.

CHAPTER 8

1. Do Exercise 4 in Chapter 8 (System Software) of Null and Lobur

   What is the difference between multiprogramming and multiprocessing? Multiprogramming and multithreading?

   Chapter 8 of Null and Lobur (2003) explained the following differences:

   Multiprogramming: **multiple programs can be executing in memory at the same time**
   Multiprocessing: **Multiple processors work together and execute tasks. Coordinated scheduling must occur for multiprocessing to work properly**
   Multithreading: **A process is broken down into multiple threads that get executed.**

2. Do Exercise 11 in Chapter 8 (System Software) of Null and Lobur

   Why should assembly language be avoided for general application development? Under what circumstances is assembly language preferred or required?

   Assembly is quite difficult and it is very easy to cause errors due to the complex programming (Null & Lobur, 2003). It is even more difficult to update the program if the person editing is not the same as the person who wrote it. Lastly, different architectures would not be able to process the code if it wasn't written for them. Assembly should be used for specialized hardware in order to get the device to perform exactly as needed. Otherwise, higher-level languages should be used.

3. Do Exercise 12 in Chapter 8 (System Software) of Null and Lobur

   Under what circumstances would you argue in favor of using assembly language code for developing an application program?

Since assembly can directly access the machine architecture in a way that higher-level languages can't, it would be beneficial to use it for specialized hardware (Null & Lobur, 2003). This would allow the programmer to make the hardware perform to their exact liking.

4. Do Exercise 13 in Chapter 8 (System Software) of Null and Lobur

   What are the advantages of using a compiled language over an interpreted one? Under what circumstances would you choose to use an interpreted language?

   Compiled languages are faster since the code that is executed is already compiled, whereas interpreted code is compiled on-the-fly (Haas, 2019). All the errors for compiled code have already been fixed before it can run. However, interpreted code has the advantage of being very portable. This means that the program can run on multiple operating systems as long as it has that interpreter for the language (such as python). If a program will need to have this portability, then an interpreted language would be better.

CHAPTER 9

5. Do Exercise 6 in Chapter 9 (Alternative Architectures) of Null and Lobur

   A RISC processor has 152 total registers, with 12 designated as global registers. The 10 register windows each have 6 input registers and 6 output registers. How many local registers are in each register window set?

   152 registers – 12 global register = 140 registers

   140 registers / 10 register windows = 14 registers per register window

   14 registers – 6 I/O registers (overlap) = 8

   There are 8 local registers in each register window

6. Do Exercise 33 in Chapter 9 (Alternative Architectures) of Null and Lobur

   Indicate whether each of the following applies to CISC or RISC by placing either a C (for CISC) or an R (for RISC) in the blank.

   __R___ Simple instructions averaging one clock cycle to execute.

   ___C__ Single register set.

   __R___ Complexity is in the compiler.

__**R**___ Highly pipelined.

__**C**___ Any instruction can reference memory.

__**C**___ Instructions are interpreted by the microprogram.

___**R**__ Fixed length, easily decoded instruction format.

__**C**___ Highly specialized, infrequently used instructions.

___**R**__ Use of overlapping register windows.

___**R**__ Relatively few addressing modes.

For problems 7 through 9, consider a CPU that implements two parallel fetch-execute pipelines for superscalar processing. Show the performance improvement over scalar pipeline processing and no-pipeline processing, assuming an instruction cycle similar to figure 4.1 in the Section I B of "Advanced Systems Concepts", i.e.:

- a one clock cycle fetch
- a two clock cycle decode
- a three clock cycle execute

and a 50 instruction sequence:

Show your work.

7. **No pipelining** would require _**300**_ clock cycles:

50 instructions x 6 clock cycles/instruction = 300 clock cycles

8. **A scalar pipeline** would require __**55**_ clock cycles:

6 clock cycles for initial instruction + (49 instructions x 1 clock cycle/instruction) = 55 clock cycles

9. **A superscalar pipeline** with two parallel units would require _**30**__ clock cycles:

6 clock cycles for initial two instruction + (24 instructions x 1 clock cycle/instruction) = 30 clock cycles

10.a. What is the essential characteristic of the superscalar approach to processor design?

Multiple instructions are allowed to be executed at the same time each clock cycle (Null & Lobur, 2003, Chapter 9). Superscalar processors rely on both hardware as well as compilers.

b. What is the difference between the superscalar and superpipelined approaches?

Superpipelining involves stages with less than half of a clock cycle to execute, whereas superscalar processing allows for multiple instructions to be executed at the same time requiring a full clock cycle to execute (Null & Lobur, 2003, Chapter 9).

References

Haas, J. (2019). The Difference Between Compiled and Interpreted Languages. Retrieved from https://www.lifewire.com/compiled-language-2184210

Null, L. & Lobur, J. (2003). Chapter 8 - System Software. *The essentials of computer organization and architecture.* [Books24x7 version] Available from http://library.books24x7.com.ezproxy.umgc.edu/toc.aspx?bookid=5893.

Null, L. & Lobur, J. (2003). Chapter 9 - Alternative Architectures . *The essentials of computer organization and architecture.* [Books24x7 version] Available from http://library.books24x7.com.ezproxy.umgc.edu/toc.aspx?bookid=5893.