METRO STATE UNIVERSITY

ICS 232 Computer Organization & Architecture
Homework 1 - Chapter 1 - 10 points
Due Date: 5/24/2023

Name: Key

Note: Please post your homework to ICS232 D2L on or before the due date.

Read Chapter 1 – Introduction

Essential Terms and Concepts

2. What is an ISA?

Instruction Set Architecture

4. Name the three basic components of every computer?

CPU, memory, I/O devices

28. How does the fetch-decode-execute cycle work?

The CPU fetches the next instruction from memory, the instruction is decoded, the instruction is executed.

29. What is a multicore processor?

A multicore processor contains multiple CPUs each capable of executing a different program at essentially the same time.

Exercises

1. In what ways are hardware and software different? In what ways are they the same?

Between hardware and software, hardware provides more speed, software provides more flexibility. Hardware and software are related through the Principle of Equivalence

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of Hardware and Software. They can solve problems equally, although solutions are often easier in one versus the other.

2. a) How many milliseconds (ms) are in 1 second?	1,000
b) How many microseconds (μs) are in 1 second?	1,000,000
c) How many nanoseconds (ns) are in 1 millisecond?	1,000,000 (10^9 / 10^3 = 10^6)
d) How many microseconds are in 1 millisecond?	1,000 (10^6 / 10^3 = 10^3)
e) How many nanoseconds are in 1 microsecond?	1,000 (10^9 / 10^6 = 10^3)
f) How many kilobytes (KB) are in 1 gigabyte (GB)?	1,000,000 (or $2^{30}/2^{10} = 2^{20}$)
g) How many kilobytes are in 1 megabyte (MB)?	1,000 (or $2^{20}/2^{10} = 2^{10}$)
h How many megabytes are in 1 gigabyte (GB)?	1,000 (or $2^{30}/2^{20} = 2^{10}$)
i) How many bytes are in 20 megabytes?	20,000,000 (or 20 * 2^{20})
j) How many kilobytes are in 2 gigabytes?	2,000,000 (or $2^{31}/2^{10} = 2^{21}$)

8. Briefly explain two breakthroughs in the history of computing.

Answers may include explanations of vacuum tubes, transistors, integrated circuits, VLSI, binary arithmetic, quantum computing, and parallel computing.

12. List five applications of personal computers. Is there a limit to the applications of computers? Do you envision any radically different and exciting applications in the near future? If so, what?

There are many applications, including such things as word processing, bookkeeping, digital image editing, creating/writing music, graphics design, gaming, coding, mapping, record storage (database), and control (such as in an assembly line or any real-time system), not to mention as an electronic resource or for various medical applications (such as in CAT scan machines).

13. In the von Neumann model, explain the purpose of the:
a) processing unit
The processing unit performs all of the arithmetic and logic functions.

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b) program counter
The program counter is responsible for keeping track of the next instruction to fetch.

14. Under the von Neumann architecture, a program and its data are both stored in memory. It is therefore possible for a program, thinking a memory location holds a piece of data when it actually holds a program instruction, to accidentally (or on purpose) modify itself. What implications does this present to you as a programmer?

Care must be taken when programming to make sure the code doesn't modify itself in some way. For example, if a memory location holds an instruction (which is represented by a binary number), and a value is added to that instruction, the result could be a valid instruction that is later executed, resulting in an error that is very difficult to track down. The modification of an instruction could also cause a program to crash.

19. Explain what it means to “fetch” an instruction.

The program counter holds the memory address of the next instruction to be executed. The control unit retrieves that instruction from memory so it can be decoded and executed.

23. What are the limitations of Moore’s Law? Why can’t this law hold forever? Explain.

There are technical limitations, including heat dissipation and power leakage, not to mention the physical limitations of space and the fact that transistors can only get so small (we can’t go smaller than the size of an atom).

Prepare for next class by reading Chapter 2 – Data Representation.

Read over the Group Projects document. Begin to decide which project may interest you and who you may like in your group.

Optional Questions:

1. What other computer science classes have you taken?

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2. What computer programming languages do you know?

3. Is there anything else you would like to tell me that you will help you succeed in this class?