CDA 3103 Computer Organization  
Homework #1

**Assigned:** Wed., Aug. 25th, 2014  **Due:** 11:55pm via Blackboard, or in-class, Sep. 3th, 2014

1. **Problems**

1. (5 pts) What are the essential building blocks for a computer?  
   
   See Section “The Main Components of a Computer”.

2. (5 pts) Technical societies such as IEEE and ACM as well as other entities organize contests for computer science and engineering students. Name a few such contests.  
   
   See Section “Standards Organizations”

3. (5 pts) What are Charles Babbage and Ada Gordon famous for in the history of computers?  
   
   See Section “Generation Zero: Mechanical Calculating Machines (1642-1945)”.

4. (5 pts)  
   a) How many milliseconds (ms) are in 1 second?  
   b) How many microseconds (µs) are in 1 second?  
   c) How many nanoseconds (ns) are in 1 millisecond?  
   d) How many microseconds are in 1 millisecond?  
   e) How many nanoseconds are in 1 microsecond?  
   f) How many kilobytes (KB) are in 1 gigabyte (GB)?  
   g) How many kilobytes are in 1 megabyte (MB)?  
   h) How many megabytes are in 1 gigabyte (GB)?  
   i) How many bytes are in 20 megabytes?  
   j) How many kilobytes are in 2 gigabytes?  

   **Ans.** Typically, time is measured in powers of 10, so we have:  
   a. $1,000 = 10^3$  
   b. $1,000,000 = 10^6$  
   c. $1,000,000 = 10^6$  
   d. $1,000 = 10^3$  
   e. $1,000 = 10^3$  

   f. $1,000,000 = (2^{30})/2^{10} = 2^{20}$  
   g. $1,000 = (2^{20})/2^{10} = 2^{10}$  
   h. $1,000 = (2^{30})/2^{20} = 2^{10}$  
   i. $20,000,000 = (20*2^{20})$  
   j. $2,000,000 = (2^{31})/2^{10} = 2^{21}$

5. (5 pts) Briefly explain two breakthroughs in the history of computing.  

   **Ans.** Acceptable answers include explanations of vacuum tubes, transistors, integrated circuits, VLSI, binary arithmetic, quantum computing, and parallel computing.

6. (5 pts) List five applications of personal computers. Is there a limit to the applications of computers? Do you envision any radically different and existing applications in the near future? If so, what?
7. (5 pts) In the von Neumann model, explain the purpose of the a) processing unite, b) program counter.

Ans.

a) The processing unit performs all of the arithmetic and logic functions.
b) The program counter is responsible for keeping track of the next instruction to fetch.

8. (5 pts) 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?

Ans.

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.

9. (5 pts) Explain why modern computers consist of multiple levels of virtual machines.

Ans.

The virtual machines abstract out the tasks each layer of the machine performs. This allows us to use a “divide and conquer” approach and view the computer organization as separate layers, each built upon the ones below it. We can study one layer and get a detailed understanding on what it does and what it provides to the next higher layer.

2 Submission Requirements

The following requirements are for electronic submission via Blackboard.

- Your solutions must be in a single file with a file name yourname-hw1.
- Upload the file by following the link where you download the homework description on Blackboard.
- If scanned from hand-written copies, then the writing must be legible, or loss of credits may occur.
- Only submissions in the designated location on Blackboard are graded. Submissions in any other forms will be ignored.

For in-class hardcopy submission, your name must be written on every page. Your writing needs to be legible, or loss of credits may occur. All pieces of papers for your submission must be properly ordered and stapled together.