16.317: Microprocessor Systems Design I

Fall 2014

Homework 1

Due **Wednesday, 9/17/14**

Notes:

- While typed solutions are preferred, handwritten solutions are acceptable (except for Question 3b).
- All solutions must be legible and contained in one file. Archive files are not acceptable.
- This assignment is worth 50 points.

1. (15 points) Given each of the binary or hexadecimal number below, determine what the decimal value is if the number is (i) an unsigned integer, and (ii) a signed integer. Note that, in some cases, your answers for both will be the same.

a. 01101010_2
b. 10110011_2
c. AEh (or 0xAE—recall that, in x86 assembly notation, the "h" at the end of a number signifies that the previous value is in hexadecimal)
d. 72FAh
e. BEADh

2. (20 points) Assume the contents of memory are shown below. All values are in hexadecimal. The table shows four bytes per line; the given address is the starting address of each line.

   Each block in the table contains a single byte, with the low and high bytes per line indicated as shown. Each byte has its own address, so the byte at address 10500h is 14h, address 10501h is 20h, address 10502h is 66h, and address 10503h is F7h.

   You should assume all multi-byte values are stored in little-endian format.

Address	Lo			Hi
10500h	14	20	66	F7
10504h	07	33	89	17
10508h	01	24	15	2B
1050Ch	BE	60	10	99
10510h	78	D6	32	33
10514h	34	35	12	16
10518h	93	03	7C	EF

a. (5 points) What is the result of the instruction MOV AL, [10509h]? What is the decimal value of the data transferred in this instruction?
b. (5 points) What is the result of the instruction MOV BX, [10511h]? Is this memory access aligned?
c. (5 points) What is the result of the instruction MOVSX EDX, WORD PTR [10517h]? Is this memory access aligned? (Alignment in this case is based on the number of bytes transferred from memory, not the size of the destination.)
d. (5 points) If EAX = 09102014h, what is the result of the instruction MOV [1050Ch], EAX? Is this memory access aligned?

3. (15 points) This simple exercise tests your ability to create a project in Visual Studio, add a program that has been provided for you, and execute that program. See the brief Visual Studio tutorial posted on the schedule page for directions on creating a Visual Studio project.

Download the program `hw1_p3.c` posted on the course schedule page. Create a new Visual Studio project, and add this file to your project, either by adding it as an existing item, or by creating a new C file inside your project and copying the contents of `hw1_p3.c` into your new file.

Answer the following questions about this program:

a. (6 points) Describe the general operation of this program and its purpose. What type of input values does it read in? What type of output values does it generate?
b. (9 points) Run this program to generate screenshots or printouts of the program output with each of the following input values: 15, 317, and 999. Submit those screenshots as part of your homework solution. ***Remember, if submitted electronically, all problem solutions must be in a single file.***