CSCI-UA.0201-001

# Computer Systems Organization

Midterm Exam Fall 2016 (time: 60 minutes)

Last name: First name:

**Notes:**

- **If you perceive any ambiguity in any of the questions, state your assumptions clearly.**
- **Questions vary in difficulty; it is strongly recommended that you do not spend too much time on any one question.**

**1. (5 points) Circle the correct answer among the choices given. If you circle more than one answer, you will lose the grade of the corresponding question.**

(A) The assembler is:
1. machine dependent 2. language dependent 3. both 4. none

(B) The following number: 0x1F000001 can be interpreted as:
1. signed int 2. unsigned int
3. single precision floating point 4. all of them

(C) The instruction *leal (%eax), %ebx* accesses the memory:
1. once 2.twice 3. 0 times 4. depends on whether 32-bit or 64-bit

(D) Regarding instruction set architecture, backward compatibility means
1. executing old instructions on new hardware
2. executing new instructions on old hardware
3. both 1 and 2
4. none of the above

(E) Which of the following pointers has a larger size (in terms of bytes)?
1. pointer in a 32-bit machine 2. pointer in a 64-bit machine
3. pointer in a 32-bit machine pointing to an array of 100 integers

2. (2 points) assign a value to x and a value to y (you can specify them in binary) such that

a. (x && y) is evaluated to true and (x & y) is evaluated to false

b. How about the other way around?

3. [2 points] In C, like in many other languages, we need to declare a variable before we can use it. For instance, we have to declare *int x;* before we can use x. Why is that (state two reasons)?

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4. [2 points] Suppose we have the following decimal number: -10

a) Write that number in an 8-bit binary number. To get full credit, show all the steps.

b) Translate the number you calculated in a) above to hexadecimal.

5. [2 points] Suppose x is an integer. We want to test whether the two most significant bits of x are 1 or not (i.e. the two left most bits), so we wrote the C expression:

**if( …. )**
    **{ *tests successful and the two bits are 1* }**
**else**
    **{*means at least one bit of the two most significant bits is 1*}**

What will you put between the parenthesizes in order to test that condition?

6. Suppose that we have the following number: 0xAA

a) [1 point] Write this number in binary:

b) [2 points] Suppose that this number is interpreted as unsigned number, what is the decimal equivalent (note: you don't have to write a final decimal number, you can leave it in the format of $2^x+2^y+ \ldots$). To get full score, show all the steps.

c) [2 points] Suppose that this number is interpreted as signed number, what is the decimal equivalent (note: you don't have to write a final decimal number, you can leave it in the format of $2^x+2^y+ \ldots$). To get full score, show all the steps.

7. [2 points] Suppose “a” is a pointer to unsigned integer
(i.e. it was declared as *unsigned int * a;* ) and points to the following array of unsigned integers: {1,1,2,2,3}.
How many times the body of the following loop will be executed? Justify

**while( (*a++) & 0x1 ) { .... loop body …. }**