

CSCI-UA.0201-001
Computer Systems Organization
Midterm Exam Fall 2015 (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.**
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1. [1 point] Why do we need to know such information as an integer is 4 bytes in length?

2. [2 points] Beside dynamic allocation, state two other reasons as to why do we need pointers.
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3. [4 points] The following C code is buggy. List all the bugs you can find. No need to fix them.

```
struct _node{
    int x;
    int y; }

int populate_list( int M){

    struct _node employees;

    employees = malloc(M * sizeof(struct _node *));

    for( i = 0; i < M; i++){
        employees[i].x = i;
        employees[i].y = i*2;
    }
}
```

4. [2 points] Can the zero flag (ZF) and the sign flag (SF) be both 1 at the same time? If yes, give an example of an operation that does this (no need for assembly code, just describe the operation). If not, explain why not.

5. [2 points] State two reasons for why do we need an assembler and not making the compiler generate the binary presentation right away.

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6. [4 points] Suppose we have the following C code (assuming a, b, and c are unsigned integers):

```
if( a == b && b > c)  
    c += a + b;
```

Write the corresponding assembly code, assuming:
a will go in %eax, b in %ebx, and c in %ecx)

7. Suppose x is an integer (i.e. 4 bytes). We want to test whether the 3rd least significant bit of x is 1 or not (i.e. the 3rd bit from the right), so we wrote the expression:

`if((x & mask) != 0)`

a. [1 point] What is the value of `mask`, both in binary and hexadecimal?

b. [2 points] Which of the following expressions generate correct mask? Circle ALL correct answers. There may be more than one correct answer, or there may be none!

- `1 << 3`
- `1 << 2`
- two's complement of `0xFFFFFFFFC`
- two's complement of `(-2)`

c. [2 points] Please give the expression that sets the 3rd bit from left of x to 1 and leave all the other bits unchanged.