

CSCI-UA.0201-001  
**Computer Systems Organization**  
Exam 1 Fall 2018 (time: 60 minutes)

Last name:

First name:

NetID:

**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.**
  - **The exam consists of 5 pages, 5 questions, and a total of 50 points. Last paper is left intentionally blank, for you to use if you want.**
  - **You answer on the question sheet.**
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**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) If we write a C program that consists of 5 C files. The output of the assembler will be:

1. five files    2. one file    3. depends on the type of the compiler    4. depends on OS

(B) By seeing the number: 0xFFFF700B we know for sure that it is a:

1. negative number                      2. positive number  
3. unsigned number                      4. We do not know for sure

(C) Suppose we have a 32-bit machine. The size of “long int \*” is:

1. 4 bytes                                  2. 8 bytes  
3. 2 bytes                                  4. Depends on the OS.

(D) Suppose we have a 64-bit machine. The size of “long int \*” is:

1. 4 bytes                                  2. 8 bytes  
3. 2 bytes                                  4. Depends on the OS.

(E) If we write a C program that includes a parenthesis that we opened but forgot to close.

Then:

1. the compiler will complain                      2. the assembler will complain  
2. the linker will complain                      3. the loader will complain

2. [4 points] We have seen that the floating point presentation has normalized form and denormalized form. State two reasons we need denormalized form. Every reason must not be more than one sentence.

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3. [8 points] Suppose you want to include this condition in your C code: **if( x & mask)**  
x is a char. You want the condition to be true if the third bit from the left of x is set to 1.

- What value **mask** must have in binary?
- What value **mask** must have in hexadecimal?
- Suppose  $x = 5$ , will the condition be true? Show the value of  $x \& \text{mask}$  in binary to justify.
- What if  $x = -5$ ? Show the value if x in binary to justify.

4. Suppose we have the following piece of C code (%p in printf just prints the address in hex):

```
void foo(int i)
{
    char a[2];
    double d= 3.14;

    a[i] = 0xFFFFABCD;
    printf("%d", d);
}
```

- a. [2 points] How many bytes does array a require?
- b. [2 points] Suppose array a is stored at address A1. What is the address of a[0]? What is the address of a[1]?
- c. [3 points] Suppose array a is stored at address A1. Will variable d always be stored in memory after array a? Justify.
- d. [3 points] Something is wrong with the line: **a[i] = 0xFFFFABCD;** What is it?
- e. If we call the function foo as follows: foo(2);
  - [3 points] What will happen?
  - [3 points] Will this affect the value of d? Justify

5. Given the following C code:

```
int compute(int a, int b)
{
    int c;

    while (b != 0) {
        c = (a & b) << 1;
        a=a^b;
        b=c;
    }

    return a;
}
```

a. [4 points] Suppose the two inputs to the above function are:  $a = 10$  and  $b = 20$   
What will the function return (both in decimal and in binary)?

b. [3 points] Given the above two inputs (  $a = 10$ ,  $b = 20$ ), how many times will the above loop execute? For each iteration, write down the value of  $c$ .

c. [4 points] Assume  $x = 5$  and we call `compute(~x, 1)`, what will be the value returned (in binary and decimal). [Hint, you can use dots “...” to represent repeated bits when you state the binary result]

d. [6 points] Suppose we have two pointer `int * k` and `int * m` declared inside `compute`. Write three statements: one to make  $k$  point to  $a$ , the second to make  $m$  points to  $b$ , and the third to execute statement **`a=a^b`**; using only  $k$  and  $m$ .

