

Andrew login ID: _____

Full Name: _____

Recitation Section: _____

CS 15-213, Fall 2008

Final Exam

Friday, December 12, 2008

Instructions:

- Make sure that your exam is not missing any sheets, then write your full name, Andrew login ID, and recitation section (A–H) on the front.
- The exam has a maximum score of 106 points.
- This exam is **OPEN BOOK**. You may use any books or notes you like. No calculators or other electronic devices are allowed.

1 (18):
2 (12):
3 (10):
4 (8):
5 (6):
6 (7):
7 (8):
8 (12):
9 (8):
10 (8):
11 (9):
Total (106):

Problem 1. (18 points):

For the following questions, indicate whether each of the statements following them is true or false.

1. The register `rax` currently has value 0. Which of the following statements are true?

T/F: ___ Executing `movq (%rax), %rcx` will cause a segmentation fault.

T/F: ___ Executing `leaq (%rax), %rcx` will cause a segmentation fault.

T/F: ___ Executing `movq %rax, %rcx` will cause a segmentation fault.

T/F: ___ Executing `addq 8, %rsp` will increase the stack allocation by 8 bytes.

2. After a process calls `fork()`, which of the following are shared by it and the new child process? (By “shared,” we mean that an update by one process could affect the behavior of the other.)

T/F: ___ All file table entries corresponding to files open in the parent before the call to `fork()`.

T/F: ___ New file table entries corresponding to files `open()`'d by the parent after the `fork()`.

T/F: ___ New file table entries corresponding to files `open()`'d by the child after the `fork()`.

T/F: ___ All of virtual memory.

T/F: ___ The stack.

T/F: ___ All register contents.

T/F: ___ All sockets with connections established before the `fork()`.

3. Consider the following global variable declaration:

```
char str[80];
```

Which of the following outcomes should be of significant concern if you write a program that calls `gets(str)`?

T/F: ___ There could be a stack overflow leading to execution of malicious code.

T/F: ___ There could be a buffer overflow that modifies other global variables.

T/F: ___ There could be a `SEGV`.

T/F: ___ You might get a bad score if you did this for your 15-213 lab.

4. Consider the following structure definition:

```
struct data {
    short things[3];
    unsigned int doodad;
    char stuff[8];
}
```

Which of the following holds for an x86-64 machine:

T/F: ___ The size of `struct data` is 18.

T/F: ___ The size of `struct data` is 20.

T/F: ___ The size of `struct data` is 24.

T/F: ___ Network code should use `htons()` for each entry in `things` that is sent to another computer.

T/F: ___ Network code should use `htons()` for data in `stuff` that is sent to another computer.

5. When you run two programs on the same Linux machine, why do you not have to worry about them using the same physical memory?

T/F: ___ The programmers knew to avoid using the same addresses and were careful not to do so.

T/F: ___ The virtual addresses used by the running programs are translated to non-overlapping physical addresses.

T/F: ___ Only one program really runs at a time, and the physical memory is saved/restored as part of each context switch.

6. Suppose we compile and run the following code on a processor where integer multiply has a 10 clock cycle latency and a 2 clock cycle issue time. That is, although a single product computation requires 10 clock cycles, the multiplier can start a new computation every 2 clock cycles.

```
int prod = 1;
for (i = 0; i < n; i+= 2) {
    prod = prod *
        a[i] * a[i+1]; // Line P
}
```

Which of the following statements hold for this code:

T/F: ___ It will properly compute the product for any array `a` of length `n`.

T/F: ___ It will have a CPE of 10.

T/F: ___ It will have a CPE of 2.

T/F: ___ Changing Line P to be `(a[i] * a[i+1])` will change the CPE.

T/F: ___ Changing Line P to be `(a[i] * a[i+1])` could change the computed result.