CS 4760	**Operating Systems**	Test 1
Name:	Spring 2019	Max Pts: 48

Important: This is an open book test. You can use any books, notes, or paper but no electronic device. *Do not log into the computer during the test, or use any electronic or communications device. Change your cell phones to silent mode.* Any calculations and rough work can be done on the back side of the test pages. If there is a syntax error in any program segment, just write it down and you will get full credit for the problem. Please write legibly; if I cannot read what you wrote, I'll give you a zero. You will lose five points for not writing your name.

1. [6 pt] What is the similarity between multiprogramming and time-sharing? What are the differences between the two?

2. [6 pt] When a process is terminated, it enters a state called `exit`. In this state, all the resources allocated to the process are reclaimed by the OS. Yet, the process may remain in `exit` state for an extended period of time. Why is this so even when the process has no memory allocated to it?

3. [8 pt] Consider two processes p_1 and p_2 that are scheduled by the kernel K. Indicate which out of the three actors p_1, p_2, and K causes the following state changes:

   (a) Transition of p_1 from ready to running.

   (b) Transition of p_1 from running to blocked.

   (c) Transition of p_1 from running to ready.

   (d) Transition of p_1 from blocked to ready.

4. [10 pt] A computer has cache, main memory, and a disk used for virtual memory. If a referenced word is in the cache, 20ns are required to access it. If it is in main memory but not in the cache, 60ns are required to load it into the cache (this includes the time to originally check the cache), and then, the reference is started again. If the word is not in main memory, 12ms are required to fetch the word from disk, followed by 60ns to copy it to the cache, and then, the reference is started again. The cache hit ratio is 0.9 and the main memory hit ratio is 0.6. What is the average time in ns required to access a referenced word on this system?

5. [6 pt] What is a trap? Give an example. How does it differ from an interrupt?

6. [6 pt] Why does the Linux kernel handle certain interrupts in two stages: top half and bottom half?

7. [6 pt] What is a context switch? What is the role of the kernel in a context switch?

8. [6 pt] What is the maximum number of processes in the system at any time using the following code segment?

```
extern char mypath[];
for ( int i = 0; i < 10; i++ )
{
    pid_t pid, pid_out;
    unsigned char status;
    if ( pid = fork() )
        pid_out = wait ( &status );
    else
        execl ( mypath, "child", "parameter", NULL );
}
```

Assume that `child` performs some simple computation and returns the result, that is captured in `status`.