CS 4760	**Operating Systems**	Test 1
Name:	Spring 2021	Max Pts: 56

Important: This is an open book test; you can use any books, notes, or paper. If there is a syntax error in any program segment, just write it down and you will get full credit for the problem.

1. [6 pt] How do we ensure that a basic machine language instruction is executed atomically?
2. [6 pt] What is the difference between a multiprocessor and a multicore system?
3. [2+2+6 pt] Consider a memory system with the following parameters:
   - Access time for cache: 100ns
   - Access time for RAM: 1200ns
   - Cost of cache: 0.01cents/bit
   - Cost of RAM: 0.001cents/bit

   (a) What is the cost of 1MByte of main memory?
   (b) What is the cost f 1MByte of main memory using cache memory technology?
   (c) If the effective access time is 10% greater than the cache access time, what is the hit ratio H?
4. [6 pt] How does an OS use the execution context of a process?
5. [6 pt] What is the purpose of system calls, and how do system calls relate to the OS and the concept of dual-mode (kernel-mode and user-mode) operation?
6. [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.
7. [8 pt] What are daemons and zombies? Why are they necessary in Linux?
8. [6 pt] What is the maximum number of processes in the system just after executing 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`. Also assume that no child has finished executing at the time under consideration.