CS 4760	**Operating Systems**	Test 1
Name:	Fall 2014	Max Pts: 44

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. You will lose five points for not writing your name.

1. [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?

2. [6 pt] An I/O-bound process is one that, if run alone, would spend more time waiting for I/O than using the CPU. A CPU-bound process is the opposite. Suppose a short-term scheduling algorithm favors those processes that have used little CPU time in the recent past. Explain why this algorithm favors I/O-bound processes yet does not permanently deny CPU time to CPU-bound processes.

3. [6 pt] What is an instruction trace? What is an interleaved instruction trace?

4. [10 pt] You have executed the following C program:

```
#include <stdio.h>
#include <sys/types.h>
#include <unistd.h>

int main()
{
    pid_t pid = fork();
    printf ( "%d\n", pid );

    return ( 0 );
}
```

What are the possible outputs, assuming the `fork` succeeded?

5. [6 pt] Explain the difference between a semaphore and a condition.

6. [6 pt] Show how the bakery algorithm conforms to the tenet of the protocol for critical section problem.