CS 4760	**Operating Systems**	Test 1
Name:	Fall 2015	Max Pts: 54

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. [6 pt] What is the distinction between *spatial locality* and *temporal locality*?

2. [10 pt] Consider a memory system with the following parameters:

$$\begin{array}{ll} T_c = 100\text{ns} & C_c = 0.01\text{cents/bit} \\ T_m = 1200\text{ns} & C_m = 0.001\text{cents/bit} \end{array}$$

   T_c and C_c are the access time and cost for cache memory, respectively. T_m and C_m are the access time and cost for main memory, respectively.

   (a) What is the cost of 1MByte of main memory?

   (b) What is the cost of 1MByte of main memory built using cache memory technology?

   (c) If the effective access time is 10% greater than the cache access time, what is the hit ratio H?

3. [8 pt] In a multiprogramming and time-sharing environment, several users share the system simultaneously. This situation can result in various security problems.

   (a) Name two such problems.

   (b) Can we ensure the same degree of security in a time-shared machine as a dedicated machine? Explain your answer.

4. [8 pt] What is the distinction between *blocking* and *nonblocking* with respect to messages.

5. [12 pt] The following state transition table is a simplified model of process management, with the labels representing transitions between states of `READY`, `RUN`, `BLOCKED`, and `NONRESIDENT`.

	READY	RUN	BLOCKED	NONRESIDENT
READY	-	1	-	5
RUN	2	-	3	-
BLOCKED	4	-	-	6

Intrepret transition 2 as the fact that the process can change from `RUN` to `READY`. Give an example of an event that can cause each of the above transitions. Draw a diagram if that helps.

6. [10 pt] Consider the following program:

```
const int n = 50;
int tally;
void total()
{
    for ( int count = 0; count < n; count++ )
        tally++;
}
void main()
{
    tally = 0;
    parbegin
        total();
        total();
    parend;
    write ( tally );
}
```

(a) Determine the proper lower bound and upper bound on the final value of the shared variable `tally` output by this concurrent program. Assume processes can execute at any relative speed and that a value can only be incremented after it has been loaded into a register by a separate machine instruction.

(b) Suppose that an arbitrary number of processes are permitted to execute in parallel under the assumptions of part (a). What effect will this modification have on the range of final value of `tally`?