CS 376	**Operating Systems**	Test 1
Name:	Fall 1998	Max Pts: 47

Important: This is an open book test. You can use any books, notes, or paper. *Do not log into the computer during the test.* Any calculations and rough work can be done on the back side of the test pages. You will loose five points for not writing your name.

1. [5pt] What is the difference between a system call and a library function in UNIX?

2. [5 pt] Write a program using `cobegin/coend` to solve the following expression with maximum parallelism.

$$(x * (y * z * w * r) + m + n + p)$$

3. [5 pt] Consider the following program segments for two different processes executing concurrently:

```
extern int x = 0;       // Shared variable initially assigned as 0

void p1 ( void )                      void p2 ( void )
{                                     {
    for ( int a = 0; a < 3; a++ )         for ( int b = 0; b < 3; b++ )
        x++;                                  x++;
}                                     }
```

If `p1` and `p2` execute only once at any speed, what are the possible resulting values of `x`? Explain your answers.

4. [10 pt] Recode teh following program segment to run more efficiently in a single-processor system:

```
int y[12];
for ( int i = 0; i < 12; i++ )
{
    int j;
    scanf ( "%d", &j );
    if ( j == 0 ) y[i] = 0;
    if ( j != 0 ) y[i] = 10;
}
```

Now give the pseudocode to solve the above problem using fork, join, and exec.

5. [2 pt] What is the difference between a thread and a process?

6. [5 pt] Consider a computer that does not have a `test_and_set` instruction but does have an instruction to swap the contents of a memory and a register in a single indivisible instruction. The value in the register can be checked to be zero (false) or non-zero (true). Can that be used to enter critical section. Write the function to do so.

7. [5 pt] Show that in semaphores, if wait and signal operations are not executed atomically, the critical section problem is not solved. Which requirement of critical section problem is violated in such a case?

8. [10 pt] Does the following code meet the stated requirements for the solution to critical section problem. If yes, argue its correctness. If not, provide a counterexample and discuss the cause for failure. The code is meant for two processes; p1 is given while p2 can be assumed from it.

```
extern bool p1using, p2using;     // Shared variables

void process p1 ( void )
{
    while ( 1 )
    {
        p1using = true;
        while ( p2using )
        {
            p1using = false;
            { sleep for random time }
            p1using = true;
        }

        critical_section();

        p1using = false;

        remainder_section();
    }
}
```