CS 376	**Operating Systems**	Test 1
Name:	Winter 2000	Max Pts: 42

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. [6 pt] Explain the terms array processing, symmetric multiprocessing, and general multiprocessing. How do they differ from each other?

2. [5 pt] What are the components to be added to a program to make it into a process?

3. [5 pt] What is the difference between a `condition` variable and a semaphore?

4. [5 pt] What is the difference between concurrency due to threads and processes?

5. [10 pt] Look at the following implementation of bakery algorithm. Is there a problem in here? Which of the three requirements of critical-section problem does it violate?

```
extern bool choosing[n]; // Shared array
extern int  number[n]; // Shared array
// Initially, all number[n] are 0 and all choosing[i] are false.

process ( const int i )
{
    while ( 1 )
    {
        choosing[i] = true;
        number[i] = 1 + max (number, n);   // Assume this function is available
        choosing[i] = false;

        for ( int j ( 0 ); j < n; j++ )
        {
           while ( choosing[j] );
           while ( (number[j],j) < (number[i],i) && number[j] );
        }

        critical_section();

        number[i] = 0;

        remainder_section();
    }
}
```

6. [6 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.

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?