CS 4760	**Operating Systems**	Test 1
Name:	Winter 2004	Max Pts: 46

Important: This is an open book test. You can use any books, notes, or paper, but not exchange anything with other students. You are not allowed to use any electronic/communication devices, including a calculator. *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 lose five points for not writing your name.

1. [8 pt] Why is it important to access kernel data structures only through system calls? Explain with an example kernel structure of your choice.

2. [2+2+6 pt] Consider a hypothetical 32-bit microprocessor having 32-bit instructions composed of two fields: The first byte contains the opcode and the remainder an immediate operand or an operand address.

   (a) What is the maximum directly addressable memory capacity (in bytes)?

   (b) How many bits are needed for the program counter and instruction register?

   (c) Discuss the impact on the system speed if the microprocessor bus has

      i. a 32-bit local address bus and a 16-bit local data bus

      ii. a 16-bit local address bus and a 16-bit local data bus

3. [6 pt] Is there a performance disadvantage with microkernel compared to a monolithic kernel? What is it?

4. [10 pt] Comment on the following solution to solve critical section problem. Make sure that you cover all three requirements of the protocol for the solution. The solution is meant for just two processes, numbered 0 and 1 for convenience and passed to the function using the variable `i`.

```
/* flag is a shared variable; one for each process */

extern bool flag[2] = { false, false };

process ( const uint i )        /* i = 0 or i = 1 */
{
    while ( 1 )
    {
        while ( flag[1-i] );
        flag[i] = true;

        critical_section();

        flag[i] = false;

        remainder_section();
    }
}
```

5. [6 pt] What is a zombie process in Unix? How does it affect the performance of the system? How do you get rid of a zombie process?

6. [6 pt] Differentiate between `condition` variables and semaphores. Can we use semaphores to replace `condition` variables in monitors? What will be a potential problem in that?