```
    remainder section;
}
```

Does this code satisfy the requirements to solve the critical section problem? Explain your answer.

7. [8 pt] Consider the following logic that multiplies two $n \times n$ matrices A and B:

```
for ( i = 0; i < n; i++ )
   for ( j = 0, C[i][j] = 0; j < n; j++ )
      for ( k = 0; k < n; k++ )
         C[i][j] += A[i][k] * B[k][j];
```

If $n = 2$, rewrite this code to make maximum use of parallelism. That is, minimize the number of arithmetic operations that must be made sequentially. Use the "cobegin" and "coend" constructs. Can your code be generalized to any value of n?

8. [8 pt] If `s` is a semaphore, the following enforces mutual exclusion:

```
⋮
P(s);
critical section;
V(s);
⋮
```

Suppose we were to replace `P(s)` and `V(s)` with a call to equivalent monitor entries `P` and `V` (no `s` available now). Can we still force mutual exclusion? Show how?

CS 376 **Operating Systems** Test 1

Name: Maximum Points: 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.

1. [6 pt] In a multiprogramming and time-sharing environment, several users share the system simultaneously. This situation can run in various security problems. Name two such problems. How does the distinction between monitor mode and user mode function as a rudimentary form of protection system?

2. [5 pt] What is the difference between system calls and system programs? What is the purpose of each of them?

3. [5 pt] A secretary is trained on CMS and insists on using that machine for all the typing, especially when it has to do with programs. I gave her a C program listing and asked her to type it in. Unfortunately, CMS editor knows only upper case letters and when I transferred the file to Unix, it did not compile. I had not used any upper case letters in the program. Is it possible for me to quickly change the case of all letters? How? (There are multiple ways of doing it and I'll be satisfied with any one of them).

4. [4 pt] What is the command to get a recursive directory listing? Can you use it to determine the number of instances of the file `paper.tex` in my home directory?

5. [5 pt] How can I read characters from the terminal in a shell script? If the line you just read is a blank line, echo a message to the screen to indicate the fact.

6. [6 pt] Consider the following implementation of critical section problem for two processes:

```
while ( true )
{
   flag[i] = true;
   while ( flag[j] )
      if ( turn == j )
      {
         flag[i] = false;
         while ( turn == j );
         flag[i] = true;
      }

   critical section;

   turn = j;
   flag[i] = false;
```