requirement was changed to print the line numbers of all lines where the string occurred at the end of line. What will need to be changed to print such lines? Now, I also want to find out the number of lines that matched the pattern in either case at the same time as the lines are printed. I also want to list my directory such that all files appear one on a line. Can I do it without invoking the `-l` option of `ls`.

7. [5 pt] Assume that each of the five philosophers, i, in the dining philosophers problem executes the following segment of code:

```
P(mutex);
   P(fork[i]);
   P(fork[(i+1) mod 5]);
V(mutex);
   eat;
V(fork[i]);
V(fork[(i+1) mod 5]);
```

   Does this code satisfy all requirements of the dining philosophers problem?

8. [5 pt] Write a procedure using `cobegin/coend` to compute the dot product $\sum_{i=1}^{5} a_i b_i$ of two vectors in parallel.

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. [10 pt] Consider a computer that does not have a `test-and-set` instruction, but does have an instruction to swap the contents of a register and a memory word in a single indivisible instruction. Can that be used to write a routine to implement binary semaphores? If yes, write one. If no, explain why not.

2. (a) [3 pt] How does Unix generally tell whether the path name for a file is absolute or relative to the current working directory?

   (b) [3 pt] What is the essential difference between a block special file and a character special file?

3. [6 pt] Consider the following solution for the critical section problem.

```
while (TRUE) {                    while (TRUE) {
   while (turn != 0);                 while (turn != 1);
   critical_section();                critical_section();
   turn = 1;                          turn = 0;
   remainder_section;                 remainder_section;
```

   This solution is implemented on a machine with two CPUs, sharing a common memory such that each process runs on a different CPU. Does the solution work? Explain your answer.

4. [5 pt] Synchronization within monitors uses condition variables and two special operations, `wait` and `signal`. A more general form of synchronization would be to have a single primitive, `waituntil` that had an arbitrary Boolean predicate as a parameter. Thus, one could say, for example,

   `waituntil` $x < 0$ `or` $y + z < n$

   The `signal` primitive would no longer be needed. This scheme is clearly more general than the one we have discussed in class, but is not used. Why not?

5. [8 pt] I accidently created a file in my directory that is named `f1* test&y`. (Yes, there is a blank space between * and t). I cannot seem to be able to access this file to delete it. Can you suggest a method to do so? To make the matters worse, I just found out that I had created another file that contains just four spaces in the name. I also forgot the directory name where I created this file with four spaces in the name. Suggest a way to find it and then delete it.

6. [6 pt] I want to print the line numbers of all lines in a set of files that contain a specified string starting in column 1 of the line. What will be the command to do that? Supposing the