This homework is due at the beginning of class on February 13, 2012.

Name: ____________________________________________

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1. Suppose we slightly modified Peterson's solution to be the following:

```java
boolean flag[2] = {FALSE, FALSE};
int turn = 0;

1: void almostPeterson(int i) {
2:     int j = 1-i;
3:     while (1) {
4:         flag[i] = TRUE;
5:         turn = i; // modified
6:         while (flag[j] && (turn == j)) {}  
7:     } [critical section]
8:     flag[i] = FALSE;
9:  }
10: }
```

Would this solution still be correct if two threads are executing `almostPeterson(0)` and `almostPeterson(1)`? If so, argue why it is the case. If not, give a counterexample that results in both threads being in the critical section at once. Your counterexample should be a sequence of instructions `x.y`, meaning process `x` executes line `y`. For example, the first few elements of the sequence may be `{1.1, 1.2, 2.1, 1.3, ... }`. (25 pts)
The following “solution” to the mutual exclusion problem for two processes was published in 1966 in the *Communications of the ACM*. Process 1 invokes `bogusMutex(0)` and process 2 invokes `bogusMutex(1)`. Only individual load and store instructions can be assumed to be atomic.

```java
boolean blocked[2] = {FALSE, FALSE};
int turn = 0;

1: void bogusMutex(int pid) {
2:     while (1) {
3:         blocked[pid] = TRUE;
4:         while (turn != pid) {
5:             while (blocked[1-pid]) {}
6:         
7:         turn = pid;
8:     }
9:     [critical section]
10:     blocked[pid] = FALSE;
11: }
12: }
```

Find a counterexample that demonstrates that this solution is incorrect for two processes on a single processor with preemptive scheduling. Show the exact sequence of events that leads to incorrect behavior. Your counterexample should be a sequence of instructions x.y, meaning process x executes line y. For example, the first few elements of the sequence may be `{1.1, 1.2, 2.1, 1.3, ...}`. (25 pts)
3. A dentist’s office consists of a waiting room with \( n \) chairs and the examination room containing the dentist’s chair. If there are no patients to be served, the dentist goes to sleep. If a patient enters the waiting room and all chairs are occupied, the patient leaves the office. If the dentist is busy, but chairs are available, then the patient sits in one of the free chairs. If the dentist is asleep, an arriving patient wakes up the dentist. The dentist serves patients in the order in which they took seats. When it is a patient’s turn, (s)he vacates a seat in the waiting room, enters the examination room, gets a tooth extracted, then leaves the office. Write a program using either semaphores or a monitor to coordinate the dentist and the patients, which are each represented by a thread. (25 pts)