PROBLEM SET 1

CSc 335, Spring 2011
Assigned: Tuesday, Week 3
Due: Tuesday, Week 4

Operating System Concepts

1. [From [2], pg. 44, #1.22] What is the purpose of interrupts? What are the differences between a trap and an interrupt? Can traps be generated intentionally by a user program? If so, for what purpose?

2. [From [1], pg. 35, #8] What do multiprogramming and time-sharing have in common? How are they different? Is multiprogramming possible without interrupts? Is time-sharing possible without interrupts?

3. [From [2], pg. 44, #1.27] Discuss, with examples, how the problem of maintaining coherence of cached data manifests itself in the following processing environments:
   (a) Single-processor systems
   (b) Multiprocessor systems
   (c) Distributed systems

Process Interactions

1. [From [1], pg. 67, #8] Consider Peterson’s Solution to the critical section problem.
   (a) Assume process p1 is inside CS1. What are the values of c1, c2, and will_wait that prevent p2 from entering CS2?
   (b) Assume both processes have just entered the while-loop immediately preceding their respective critical sections. What are the values of c1, c2, and will_wait at that point? What guarantees that exactly one process will be able to proceed?
   (c) Assume process p1 terminates somewhere in remainder1. What are the values of c1, c2, and will_wait that allow p2 to continue entering its critical section repeatedly?

2. [From [1], pg. 69, #15] Consider the following two functions, where A and B are arbitrary computations:

   f1() {
   P(s1);
   c1 = c1 + 1;
   if (c1 == 1) P(d);
   V(s1);
   A;
   P(s1);
   c1 = c1 - 1;
   if (c1 == 0) V(d);
   V(s1);
   }

   f2() {
   P(s2);
   c2 = c2 + 1;
   if (c2 == 1) P(d);
   V(s2);
   B;
   P(s2);
   c2 = c2 - 1;
   if (c2 == 0) V(d);
   V(s2);
   }

Assume that initially s1 = s2 = d = 1 and c1 = c2 = 0. Also assume that an unbounded number of processes are invoking either of the functions f1() or f2().
(a) How many invocations of A can proceed concurrently? What are the values of s1, c1, and d at that time?

(b) While A is running, how many invocations of B can proceed concurrently? What are the values of s2, c2, and d at that time?

(c) Can A or B starve? Explain why or why not.

REFERENCES
