Department of Electrical and Computer Engineering

Computer Engineering

Course ECSE-322B

Problem Set 11

April 3, 2008

1. Simulate the traffic at an intersection of two one-way streets using semaphore operations. In particular, the following rules should be satisfied:

> Only one car can be crossing at any given time
> When a car reaches an intersection and there are no cars approaching from the other street, it should be allowed to cross
> When cars are arriving from both directions, they should take turns to prevent indefinite postponement of either direction.
>
> Use diagrams to show how the semaphores would work.

2. **Sleeping Barber Problem**:

> A barbershop consists of a waiting room with *n* chairs, and the barber room containing the barber chair. If there are no customers to be served, the barber goes to sleep. If a customer enters the barbershop and all chairs are occupied, then the customer leaves the shop. If the barber is busy, but chairs are available, then the customer sits in one of the free chairs. If the barber is asleep, the customer wakes up the barber.

Write the pseudo-code to coordinate the barber and the customers processes using semaphores.

3. What values can a semaphore have? Name the operations on a semaphore and describe what they do. Demonstrate that the current value of the semaphore is dependent on its starting value and the number of operations of each type done on it.

4. Explain what is meant by *deadlock*. What are the necessary conditions for deadlock to occur?