

## Written Assignment #1

Due by 6:25PM, Monday, May 13, 2013

(Hardcopy is required)

1. Synchronization: the sleeping-barber problem. [8 points]

A barbershop consists of a waiting room with  $n$  chairs and a barber room with one 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, then customer wakes up the barber. Write the pseudocode program to coordinate the barber and the customers.

2. Consider a demand-paging system with the following time-measured utilizations: [7 points]

CPU utilization	20%
Paging disk	97.7%
Other I/O devices	5%

For each of the following, say whether it will (or is likely to) improve CPU utilization. Explain your answers.

- a) Install a faster CPU
- b) Install a bigger paging disk
- c) Increase the degree of multiprogramming
- d) Decrease the degree of multiprogramming
- e) Install more main memory
- f) Install a faster hard disk or multiple controllers with multiple hard disks
- g) Increase the page size

3. Consider a demand-paging system with a paging disk that has an average access and transfer time of 20 milliseconds. Addresses are translated through a page table in main memory, with an access time of 1 microsecond per memory access. Thus, each memory reference through the page table takes two accesses. To improve this time, we have added an associative memory that reduces access time to one memory reference if the page-table entry is in the associative memory.

Assume that 80% of the accesses are in the associative memory and that, of those remaining, 10% (or 2% of total) causes page faults. What is the effective memory access time? Show your calculation steps to get the answer. [6 points]