Problem Set 1

OUT: 26 JANUARY, 1993
DUE: 4 FEBRUARY, 1993

1. Extend Dekker's algorithm to negotiate N processes competing for the same resource.

2. Use P/V Semaphores to implement a Monitor.

3. Use a Monitor to implement a P/V Semaphore.

4. Solve the "Bakery Problem." There is a bakery with n sales people. Entering customers take a number. When a sales person becomes free, then next number is called. You should use Semaphores or Monitors to write procedures (in pseudo-code) for both the customers and sales people.

5. Name five resources which are shared by users on a computer system.

6. Many users share the same CPU by "time slicing": the operating system allocates the CPU to each user in turn for a duration of Δt seconds. Suppose that there are k users and that the Operating System takes δ seconds to switch from one user to another.

   (a) Give a formula in terms of $\Delta t, k$ and δ for the percentage of time the CPU is doing "useful work", that is, is allocated to a user process and not to the switching of users.

   (b) Give a formula in terms of $\Delta t, k$ and δ for the worst-case delay a user must endure before the CPU is allocated to his/her process.

   (c) Suppose there are 10 users, $k = 10$, and that switching from one user to another takes 200 microseconds, $\delta = .0002$. What is an acceptable range of Δt so that CPU usage (by the first formula you gave) is above 20% and user wait time (by the second formula you gave) is below .05 seconds.