Due at the beginning of class in hardcopy.

Sections 5.1–3

1. Race conditions are possible in many computer systems. Consider a banking system that maintains an account balance with two functions: deposit(amount) and withdraw(amount). These two functions are passed the amount that is to be deposited or withdrawn from the bank account balance. Assume that a husband and wife share a bank account. Concurrently, the husband calls the withdraw() function and the wife calls deposit(). Describe how a race condition is possible and what might be done to prevent the race condition from happening.

2. The first known correct software solution to the critical-section problem for two processes was developed by Dekker. The two processes, \( P_0 \) and \( P_1 \), share the following variables:

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

   The structure of process \( P_i \) (\( i = 0 \) or \( 1 \)) is shown below. The other process is \( P_j \) (\( j = 1 \) or \( 0 \)). Prove that the algorithm satisfies all three requirements for the critical-section problem.

   ```java
   do {
   flag[i] = true;

   while (flag[j]) {
   if (turn == j) {
   flag[i] = false;
   while (turn == j)
   ;
   flag[i] = true;
   }
   }

   /* critical section */
   turn = j;
   flag[i] = false;

   /* remainder section */
   }
   ```