Q1. 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 These two functions are passed the amount that is to be deposited or withdrawn from the bank account balance.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 ().

a) What problem can be occurred?
b) Write a pseudo code using appropriate system calls to prevent that problem.

Q2. Many CPU-scheduling algorithms are parameterized. For example, the RR algorithm requires a parameter to indicate the time slice. Multilevel feedback queues require parameters to define the number of queues, the scheduling algorithm for each queue, the criteria used to move processes between queues, and so on. These algorithms are thus really sets of algorithms (for example, the set of RR algorithms for all time slices, and so on). One set of algorithms may include another (for example, the FCFS algorithm is the RR algorithm with an infinite time quantum). What (if any) relation holds between the following pairs of algorithm sets?

a. Priority and Shortest Job First
b. Multilevel feedback queues and FCFS
c. Priority and FCFS
d. Shortest Job First and Shortest Remaining Time First

Q3. Using Amdahl's Law, calculate the speedup gain for the following applications:

i. 40 percent parallel with (a) eight processing cores and (b) sixteen processing cores
ii. 67 percent parallel with (a) two processing cores and (b) four processing cores
iii. 90 percent parallel with (a) four processing cores and (b) eight processing cores

Q4. Determine if the following problems exhibit task or data parallelism:

a) Using a separate thread to generate a thumbnail for each photo in a collection.
b) Transposing a matrix in parallel
c) A networked application where one thread reads from the network and other writes to the network
d) The fork-join array summation application
e) Sorting an array in ascending order