PH.D. QUALIFYING EXAM (SPRING 2016)
(Area: Data Structures and Operating Systems)

Data Structure and Algorithms

Question 1.

Part A (50%) Implement an algorithm to find the k-th to last element of a singly linked list. Describe your algorithm and code it in your preferred programming language (slightly more specific than pseudo-code).

Part B (50%) Given two very large binary trees: T1, with millions of nodes; and T2, with hundreds of nodes. Create an algorithm to decide if T2 is a subtree of T1 (narrative or psuedo-code).

A tree T2 is a subtree of T1 if there exists a node n in T1 such that the subtree of n is identical to T2. That is, if you cut off the tree at node no, the two trees would be identical.
Question 2.

Part A (50%) What is the difference between a thread and a process? What are typical items shared by all threads in a process? What are typical items that are private to each thread? What are key items in a typical process table entry?

Part B (50%) Write a Producer thread and a Consumer thread that share a fixed-size buffer and an index to access the buffer. The Producer should place numbers into the buffer, and the Consumer should remove the numbers. The order in which the numbers are added or removed is not important. Please code it in your preferred programming language (slightly more specific than pseudo-code).