August 2009
Preliminary Exams

Computer Operating Systems (Questions 1-4)

Problem 1

Define an (execution) thread. Explain the need for milti-threaded processes. Give two example applications for each of the following two categories: (a) best suited for multithreading (b) not suited for multithreading. Differentiate user and kernel threads. Explain many-to-one and one-to-one thread execution model and their relative advantages and disadvantages.

Problem 2

Define the mutual exclusion (MX) synchronization problem. Name and explain (provide approximate pseudocode) of any software-only solution to the MX. Explain why such a solution is not useful for multi-process or multi-processor architecture. Name and describe hardware primitives used to help solve synchronization problems on such architectures.

Problem 3

Describe page-based memory management organization. Describe (direct) page table and its use. Explain the need for and the operation of translation lookaside buffers (TLBs). Explain the need for and operation of either hash-based or inverted page tables.

Problem 4

Describe multi-level indexed allocation (draw a diagram) of disk space in a file system. Explain how it manages to provide adequate performance for small and large files. Define extent-based allocation. Describe its advantages and challenges compared to the multi-level indexed allocation.