

Operating Systems PhD Qualifying Exam

Fall 2004

1. [5 %] Describe the interactions among CPU, DMA controller, and memory during a DMA operation.
2. [15 %] Propose a deadlock free approach to solve the dining philosophers problem.
3. [15 %] Describe the use of working set model.
4. [15%] Propose an approach to schedule soft real-time processes.
5. Virtual Memory:
 - A. [10 %] What is virtual memory? How is a virtual address translated to physical address? What kind of hardware can be used to speed up the translation process?
 - B. [10 %] Consider a virtual memory system with the following properties: 40-bit virtual byte address, 32-KB pages, and 32-bit physical byte address. What is the total size of the page table for each process on this machine, assuming that the valid, protection, dirty, and use bits take a total of 4 bits and that all the virtual pages are in use? (Assume that disk addresses are not stored in the page table.)
6. [10%] What are the similarities and differences between general-purpose operating systems and embedded real-time operating systems?
7. [10%] Explain why spinlocks are not appropriate for uniprocessor systems, yet may be appropriate for multiprocessor systems.
8. [10 %] Discuss the differences between multiprogramming, multi-threading, and multiprocessing.