Operating Systems  
V22.0202 Fall 2008  

Final Exam  

1. **True/False.** Circle the appropriate choice on this sheet.  

   (a) **T** **F** The size of the FAT is inversely proportional to the block (cluster) size, assuming a constant disk size.  

   (b) **T** **F** The size of the FAT is inversely proportional to the disk size.  

   (c) **T** **F** The number of tracks on one side of a disk is the same as number of cylinders in the disk drive.  

   (d) **T** **F** The ROM BIOS determines which operating system a PC runs.  

   (e) **T** **F** The only reason to have a clock device in a computer is to support round-robin process scheduling.  

   (f) **T** **F** The only way to break the circular wait condition for deadlock is to have each process request all the needed resources at once.  

   (g) **T** **F** The dining philosophers problem is an example of shared resource management.  

   (h) **T** **F** Page tables in Unix are implemented using I-nodes.  

   (i) **T** **F** A trap is an interrupt generated by a process, rather than by an external event.  

   (j) **T** **F** For a machine with 32-bit addresses, the use of a two-level page table allows for a larger virtual address space than a single-level page table.  

2. **Deadlock**  

   (a) Is the following state safe with respect to deadlock? Explain your answer completely.  

   **Existing Resources:** 3 tape drives, 4 CD-ROM drives, 3 printers, 2 plotters.  

   Resources already allocated:  
   Process A: 1 tape drive, 2 CD-ROMs, 1 plotter  
   Process B: 1 tape drive, 1 CD-ROM, 1 printer  
   Process C: 1 CD-ROM, 1 printer  

   Maximum additional resources needed to finish computation:  
   Process A: 1 tape drive, 1 printer  
   Process B: 2 tape drives, 1 CD-ROM  
   Process C: 2 CD-ROM, 2 printers  

   (b) If the above state is not safe, what resource could you buy that would make the state safe (assuming you could plug in resources while the processes were running – which, of course, you generally can’t). Explain your answer.  

   (c) If the state in part (a) is safe, then what additional resource could which process request – in addition to what the resources the process is already holding, and assuming the resource is available – to make the state non-safe (in which case the OS would not grant the request). Explain your answer.  

Please turn this page over.
3. Files
What is the size of the largest possible file in a Unix system where the block size is 4K bytes, a disk address is 64 bits, and an I-node contains the disk addresses of:

- the first 10 blocks of file,
- a single indirect block,
- a double indirect block, and
- a triple indirect block.

4. I/O
(a) Define the following terms: I/O Device, Device Driver, Device Controller.
(b) In a monoprogramming system (where each process must finish executing before another can start), which one of the following statements is true?
   - A disk controller that uses DMA is better.
   - A disk controller that does not use DMA is better.
   - DMA doesn’t matter in this case.

   Explain your answer.
(c) Answer the above question, but for a multiprogramming system (such as Unix).

5. Misc.
(a) What are the two major functions that a modern operating system provides?
(b) Prove that shortest job first gives the shortest average turnaround time of all the batch scheduling algorithms (remember, an example is not a proof).