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1. Give two reasons why caches are useful. What problems do they solve? What problems do they cause? If a cache can be made as large as the device for which it is caching (for instance, a cache as large as a disk), why not make it that large and eliminate the device? (20%)
  
2. 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 algorithms 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 sets of algorithms? (20%)
  - (a) Priority and SJF
  - (b) Multilevel feedback queues and FCFS
  - (c) Priority and FCFS
  - (d) RR and SJF
  
3. Consider a logical address space of eight pages of 1024 words each, mapped onto a physical memory of 32 frames. (8%)
  - (a) How many bits are there in the logical address?
  - (b) How many bits are there in the physical address?
  
4. Some systems automatically delete all user files when a user logs off or a job terminates, unless the user explicitly requests that they be kept; other systems keep all files unless the user explicitly deletes them. Discuss the relative merits of each approach. (10%)

(背面仍有題目，請繼續作答)

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5. Consider a demand-paging system with a paging disk that has an average access and transfer time of 20 milliseconds. Addresses are translated through a page table in main memory, with an access time of 1 microsecond per memory access. Thus, each memory reference through the page table takes two accesses. To improve this time, we have added an associative memory that reduces access time to one memory reference, if the page-table entry is in the associative memory.
- Assume that 80 percent of the accesses are in the associative memory and that, of the remaining, 10 percent (or 2 percent of the total) cause page faults. What is the effective memory access time? (12%)
6. Consider a file currently consisting of 100 blocks. Assume that the file control block (and the index block, in the case of indexed allocation) is already in memory. Calculate how many disk I/O operations are required for contiguous, linked, and indexed (single-level) allocation strategies, if, for one block, the following conditions hold. In the contiguous-allocation case, assume that there is no room to grow in the beginning, but there is room to grow in the end. Assume that the block information to be added is stored in memory. (30%)
- The block is added at the beginning.
  - The block is added in the middle.
  - The block is added at the end.
  - The block is removed from the beginning.
  - The block is removed from the middle.
  - The block is removed from the end.