Final Exam Review: Fall 2007, OS Class

Chee Yap

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- 1. PLEASE REMEMBER TO PREPARE 2 SHEETS OF 8"x11" NOTES (One of them could, if you wish, be your midterm sheet)
- 2. The main focus of the final will be on the material after the midterm. At most 20% of the questions will cover midterm material.
- 3. The reading list for the text book is posted on the website (please download this if you have not looked at this for the last month or more). For convenience, here is a summary:
  - Chap 8: Main Memory Read Sections 1 to 6
  - Chapter 9: Virtual Memory Read Sections 1 to 5
  - Chapter 10: File System Interface Read Sections 1 to 5
  - Chapter 11: File System Implementation Read Sections 1 to 6
  - Chapter 14: Protection Read Sections 1 to 7
  - Chapter 15: Security Read Sections 1 to 6. Focus on cryptography part.
- 4. The lecture notes have also been updated on the web.
  - Lecture IX: Memory Management Be sure you know how to compute page table sizes, etc. Do problem 8.3 for instance.
  - Lecture X: Virtual Memory Know how to do hand-simulations of the various page replacement algorithms (LRU, OPT, FIFO, etc).
  - Lecture XI: File System What are the four methods for allocation problem? Know the Unix File system (i-nodes, etc)
  - Lecture XII: Protection and Security Know the buffer overflow security issue
  - Lecture XIII: Crypotosystem Know how to use the RSA Cryptosystem (including how to generate your own private/public key)
- 5. Good luck!

1 Sample Questions

- What exactly are we interrupting in an "interrupt"? Why do we need them? There are different kinds of interrupts, and often they have specific names. Name them and describe their functions.

  A: Normally, "interrupts" interrupts the CPU. We need them because software and hardware are running asynchronously, and they need to communicate. These are some of the kinds of interrupts:

  TRAP: a software-generated interrupt caused by user or error

  System Calls: application programs use these to access OS or kernel service.

  Exception: generated by error conditions

  I/O Interrupts: generated by I/O devices to communicate to the CPU.

- What is the Memory Hierarchy, and describe its main characteristics.

  A: The hierarchy refers to a sequence of memory devices, typically: register, cache, RAM, disk, tape. The main characteristic of this sequence is that the speed of the devices decreases as its capacity increases. Thus register (1 μs/100 B), cache (10 μs/1 MB), RAM (1 ms/1 GB), disk (100 ms/1 TB), tape (?/?).

- T/F: there is one i-node per file. Explain.

  A: True in the sense that each physical file has exactly one i-node. If we also view directories as files, then every i-node also corresponds to a file.

  It is not strictly true if we consider links (now, each hard link to the same physical file will have its own i-node). Also, since I/O devices have i-nodes, but strictly speaking they are not regular files.

- How can unix treat I/O devices as files?

  A: Just like files, we first need to open an I/O device for reading or writing. This gives us a file-descriptor (fd). We henceforth use this fd to read and write to the device.

- Describe an i-node.

- Describe a practical technique to lessen the effects of internal fragmentation?

  A: Use two sizes for blocks (or pages). We have regular sizes and fragment sizes. Each allocation is in whole number of regular sized blocks and at most ONE fragment sized block. This is used in FreeBSD file system.

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