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Administrivia

- Reminder (as if you needed one!): Final December 13. Review sheet on the Web.
- Solutions to homework problems and midterm distributed in hardcopy; ask me if you missed one. (I will also put copies in the folder on Google Drive I shared earlier.)
- Grade summaries sent by e-mail.
- Final deadline for turning in homework (including revisions) the day before the exam at 11:59pm.
- Expanded list of extra-credit problems posted. (I may add others in the next few days.) Can only help your grade. Turn in no later than 12/14 at noon.
- Office hours as announced in e-mail: "Open lab" 12/05; office hours 12/10 and 12/11. Also e-mail is usually a good way to reach me.

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Homework 7 Essays

- Most people found the problems relatively straightforward (but more than one person who said this got at least one wrong).
- One person said the questions "made me think" without being too challenging. A good result!
- Another was somewhat bothered by the question about the layering scheme — seems like the answers were not well-defined. Yeah, kind of, though my take is that with a little thought they are?

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Exam Review

- (Topic by topic through the review sheet.)

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Course Recap

- Four key areas (the gospel according to former chair Pitts):
 - Process management.
 - Memory management.
 - Filesystem management.
 - I/O management.
- Two views of operating systems:
 - “Virtual machine” that provides useful abstractions for applications programs, end users.
 - Resource manager.
- Also a little about history, a little about security.

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Process Management

- O/S as virtual machine: Process abstraction, “concurrent” execution, IPC, concurrent algorithms.
- O/S as resource manager: Implementation of above, including interrupts and context switches, CPU scheduling.

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Memory Management

- O/S as virtual machine: “Address space” abstraction, memory protection, virtual memory, “multiprogramming”.
- O/S as resource manager: Implementation of above, including page replacement algorithms.

Filesystem Management

- O/S as virtual machine: Filesystem abstractions (files, file attributes, directory structures).
- O/S as resource manager: Implementation of above, disk-space management, reliability and consistency.

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I/O Management

- O/S as virtual machine: Layered abstractions for working with I/O devices (user-level s/w, device-independent s/w, etc.).
- O/S as resource manager: Implementation of above, plus a little about lower-level interaction with devices (programmed versus interrupt-driven I/O versus DMA).

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Recap, Continued

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- Some recurring themes:
 - Interaction between h/w and s/w: Some h/w features are there to support O/S features; O/S influenced by what's available in h/w.
 - Trade-offs: Often the answer to “which is best?” is “it depends”.
- We didn't cover the whole book, but I think we addressed the topics most crucial for an undergraduate course in operating systems. I haven't looked at recent ACM guidelines, but the ones in effect a few years ago — we pretty much did what they said about this subject.

Recap, Continued

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- A very smart person I know once said the only interesting part of an O/S course was concurrent algorithms, and the rest is “just details”.
A student a few years ago said “a lot of this just seems like common sense” (once you understand the basic ideas).
Both sort of right . . .
- Goal of this course is to learn/retain basic ideas. Details may help with that — and can be interesting in themselves — but should not be the focus.

Minute Essay

- None really — just sign in (unless you have parting remarks?).
- And best wishes for a successful end of semester and a good holiday!

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