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### Administrivia

- Reminder: Homework 7 due today. Final deadline for partial credit — noon Friday. I will make sample solutions available then.
- Review sheet for final on Web.
- Extra-credit problems possible — would be available by Wednesday, due the day of the final.
- Office hours this week to be announced by e-mail.
- Should we have a review session? (Yes. Monday at noon, probably in HAS 340.)
- Questions about grading, final, anything else?

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### Course Recap

- Four key areas (the gospel according to Pitts):
  - Process management.
  - Memory management.
  - I/O management.
  - Filesystem 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 — memory protection, virtual memory, “multiprogramming”.
- O/S as resource manager — implementation of above, including page replacement algorithms.

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## 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).
- 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).

### 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 if you look at the ACM's guidelines for an undergrad o/s course — we pretty much did what they said.

### 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

- How did the course compare to your expectations/goals? Did you learn what you hoped to learn?

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