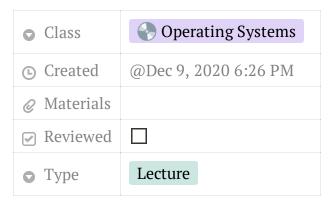


# Operating Systems W15L2 - Final Review



## **Exam Info**

- Same as midterm
- Exam available from December 16th 10 am for 24 hours
- Keep your answers focused
- Submit as PDF → Handwritten is acceptable, just ensure it's legible
- Exam is cumulative Make sure any assumptions you make actually make sense
  - i.e. don't overthink when you might not need to
- View solutions as something that makes sense on the user's end

## **Problem 1**

- The OS virtualizes I/O
- Many ways it does this, but main idea is that processes see something that is not "real"

- Virtualization allows a more efficient way of using devices, i.e. two processes waiting for the actual printer
- Also, it's necessary for security, which is a part of keeping processes separate from each other
- Virtualization is good becuase...
  - 1. More efficient device use
  - 2. Security
  - 3. Compiling and linking much easier

## **Problem 2**

- Yes, in the event the process is removed from the core
  - Could be removed due to timeout, interrupt, a sleep call, exit, error, nad probably some others
- For timing out, it is specifically a process-based function

### **Problem 3**

- No
- In the end, a process is just a bunch of pages
- Given p cores, then how many processes must be in memory at the same time?
  - At least 1 per core
  - Could be just 1 process with p threads
  - Answer: 1 to p, many different possibilities

### **Problem 4**

- Max number of faults that can be causes is 2
  - For one instructino to cause two, that's pretty bad
  - Due to a misalignment of page tables
  - Page table being in memory is taken care of by OS, prior to loading

See recording for an extra version of this problem modified

## **Problem 5**

- Doesn't matter
- Multilevel page tables are to solve excessively sized page tables
  - i7 and i9 chips use 4-level page tables

### Problem 6

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## Problem 7

- A smaller page inplicates that we have more pages, and thus a larger page table
  - This larger page table is bad for performance
- A page is what moves between memory and disk, so the above is bad because more trips to the disk
- Waste of space, also big pages can cause poor fragmentation

## **Problem 8**

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## **Problem 9**

- The *type* of information will be the same
  - i-nodes contain the blocks in the file, the i-node just sees it like that
  - The difference only occurs in the device driver / at that level
  - i-node is independent from disk type (a good example of virtualization)