

Final Exam

Started: Jun 7 at 8:26am

Quiz Instructions

This is the final exam that will be due on Saturday 12th (11:59am i.e., **before NOON**). The exam should not take more than a couple of hours at most to complete, and for many of you may likely take less than that time.

This exam will differ slightly for each student and covers all material from the course (with the exception of the final week's "authentication"/"distributed systems" lectures). This randomization is used to help make the exam a more secure experience for everyone, and discourage collaboration on answering specific questions (but all students will be presented with an exam of identical structure and topic coverage). While I am sure this is not necessary, I would like to remind everyone that while the final, like the midterm, is a take-home, open book, exam, I still expect all who attempt it to adhere to the honor code and offer only their own individual work in their submissions. Your performance and conduct so far, and your perseverance through these difficult conditions, leave me confident that this caution is unnecessary.

When you start the final exam, please attempt all questions.

Question 1

2 pts

Shortest Job First scheduling **may possibly** result in starvation.

☐ True

☐ False

Question 2

2 pts

Only one thread can be executing in a monitor at a time.

- ☐ True
- ☐ False

Question 3

2 pts

Multi-threaded code is multiple pieces of code that **can** run at the same time, i.e., running seemingly in parallel.

- ☐ True
- ☐ False

Question 4

2 pts

Implementing multiprogramming typically requires multiple processes to be resident in memory at the same time.

- ☐ True
- ☐ False

Question 5

2 pts

Deadlock [Select] takes more effort (i.e., requires more overhead) than deadlock [Select].

Question 6**2 pts**

The ability to have more than one program in memory and ready to use the CPU is known as ...

- ☐ multiprogramming
- ☐ admission scheduling
- ☐ time sharing

Question 7**2 pts**

When experiencing starvation, e.g., due to the unavailability of a resource, it is possible for processes to make progress if they simply wait long enough.

- ☐ True
- ☐ False

Question 8**2 pts**

For the table below, what value of X (available unallocated resources) is the state considered "safe."

Resource Units Free (unallocated) = X

Process	has	max
A	2	9
B	0	8
C	0	8

- ☐ 7 or more
- ☐ 6 or more.
- ☐ 9 or more
- ☐ 8 or more

Question 9

2 pts

An index-node based file system can always allow files of a maximum size that is limited only by the capacity of the disk.

- ☐ True
- ☐ False

Question 10

2 pts

If an index node is 2KB in size, and 1KB is used for attributes, and the rest is used

for single-indirect data block pointers, what is the maximum file size that can be represented (assume pointers are 4 bytes each)?

- ☐ 256KB
- ☐ 1MB
- ☐ 512KB
- ☐ 2MB

Question 11

2 pts

In a file system implementation, an index node can be used to store more than just pointers to blocks. It could, for example, include the size of the file and other useful metadata.

- ☐ True
- ☐ False

Question 12

2 pts

A file allocation table is a representation of allocated disk space that tracks file blocks in a manner similar to that of a linked list.

- ☐ True
- ☐ False

Question 13**2 pts**

A file system allocation table can be larger than the capacity of the device it describes (i.e., the disk upon which it is used as part of a filesystem implementation).

☐ True☐ False**Question 14****2 pts**

I/O that is based around polling (e.g., repeatedly checking if a device is ready) is better for overall system performance than doing I/O using an interrupt mechanism (i.e., where running code is interrupted when a device is ready).

☐ True☐ False**Question 15****2 pts**

How many page faults would occur with LRU page replacement, and memory with a capacity of 8 pages?

Assume the following page access sequence: 0, 1, 2, 3, 4, 5, 6, 7, 0, 1, 2, 3, 4, 5, 6, 7, 0, 1, 1, 2, 2, 2, 3, 3, 3, 3, 4, 4, 4, 4, 4, 5, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6, 7, 7, 7,

7, 7, 7, 7, 7, 6, 5, 4, 3, 2, 1, 0.

Question 16**2 pts**

How many page faults would occur with LRU page replacement, and memory with a capacity of only 1 page?

Assume the following page access sequence: 0, 1, 2, 3, 4, 5, 6, 7, 0, 1, 2, 3, 4, 5, 6, 7, 0, 1, 1, 2, 2, 2, 3, 3, 3, 3, 4, 4, 4, 4, 4, 5, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6, 6, 7, 7, 7, 7, 7, 7, 7, 7, 6, 5, 4, 3, 2, 1, 0.

Question 17**2 pts**

How many page faults would occur with second chance page replacement with a memory capacity of 80 pages?

Assume the following page access sequence: 0, 1, 2, 3, 4, 5, 6, 7, 0, 1, 2, 3, 4, 5, 6, 7, 0, 1, 1, 2, 2, 2, 3, 3, 3, 3, 4, 4, 4, 4, 4, 5, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6, 6, 7, 7, 7, 7, 7, 7, 7, 7, 6, 5, 4, 3, 2, 1, 0.

Question 18**5 pts**

In what way is RAID 5 "better" than RAID 4?

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**Question 19****4 pts**

What can be done to reduce a high page fault rate (assuming you are the operating system and have noted the increase in this rate)? Explain your answer.

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Question 20

6 pts

A colleague grows frustrated with delays entering and exiting a classroom. They notice that the unnecessary delays are caused by students pausing at the exit, and waiting for each other to proceed through the door first. While this is an admirable display of courtesy and thoughtfulness, it leads to a great deal of frustration for our efficiency-obsessed colleague who proposes the following solution: when two people reach the door at the same time, the person with alphabetical name precedence (whose name shows up earlier on the class roster)

will always assume they have the right of way, and will go through the door first.

This colleague claims that he was inspired to propose this solution by taking COEN 283.

What possible topic of discussion in this course could have inspired this solution?

Is it in fact a valid solution?

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Question 21

3 pts

Operating systems designers attempt to implement the best possible page replacement algorithms. Name one metric other than "page fault rate" that you

might conceivably consider when evaluating competing algorithms for the title of "best."

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Question 22

4 pts

What would be the best synchronization primitive to offer if you were designing a new operating system (or threads library) (i.e., would you offer semaphores, binary semaphores, monitors, etc.)? Explain your answer.

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**Question 23****4 pts**

If you were to implement virtual memory, then on a computer system with a memory capacity of 40MB how many entries (at a minimum) would be needed in an inverted page table for such a system?

Assume you are using 1KB page sizes.

Quiz saved at 10:40pm

Submit Quiz