

Last Name: _____, First Initial: _____

COP 4600 Operating Systems
Exam 2
9 November 2016

Instructions

1. Read all instructions. Failure to follow instructions will result in loss of points.
2. This is a closed-book examination.
3. You are permitted one 8.5 by 11 inch sheet of notes (both sides OK) that you have prepared.
4. You are permitted **45 minutes** to complete this examination.
5. **Do not start** the exam until the proctor has told you to start.
6. **Answer one even and one odd question for a total of two (2) questions, and no more.** All questions are of equal value.
7. **Leave sufficient room in the upper left-hand corner for the staple** and staple your answer sheets in the room you have left.
8. Put the **question number in the top center** of each answer page and label each part of the question answer.
9. Include your last name and page number in the upper right hand corner of each answer page.
10. Show your work.
11. Start the answer to each question on a **new page** (i.e., do **not** put the answer to more than one question on the same page).
12. Use exactly one page of paper (both sides is OK, or two pages front side only) to hold the answer to each question, and please write legibly.
13. Assemble your answers in **numerical order** of the questions when you submit them.
14. Print your family name and first initial in the upper right hand corner of this page, and complete the honor statement affirmation below.

Read and sign the following statement. This page **MUST** be attached to your examination answers and **MUST** be completed to obtain credit for this examination.

On my honor, I have neither given nor received unauthorized aid on this examination.

Signed _____

Printed Name: _____

UFID: _____ = _____

1. Memory Management (answer this or Q3)

Consider a data processing center in which MFP memory management is used. That is, memory partitions are fixed, and a process must fit into the smallest partition at least as large as it requires.

- a. (2) How would you use a distribution of job sizes to decide partition sizes? Explain, and give a formula if you can. Assume all jobs last about the same amount of time.
- b. (2) Apply your approach to a total memory size of 30 units, with a job size distribution as follows (where the first element is the size range with open minimum and the second is the frequency, so for example, there were 70 jobs of in the size range of >6 to ≤ 8 units):
(2-4: 250), (4-6: 103), (6-8: 71), (8-10: 54), (10-12: 82)
- c. (2) Repeat (b) with the distribution (0-2: 405), (2-4: 210), (4-6: 61), (6-8: 43), (8-10: 22), (10-12: 43)
- d. (2) Now suppose that, in addition to job size, you also have information on how long jobs take. How would you use this additional information to decide partition sizes? Explain and give a formula if you can.
- e. (2) Apply your approach to total memory size of 30 units, with job size and duration distribution as follows (with the mean duration given as the third element, so 7 jobs in the range of >6 to ≤ 8 units had a mean time of 10)
(2-4: 250: 2), (4-6: 103: 4), (6-8: 71: 10), (8-10: 54: 20), (10-12: 82: 30)

2. Directories (answer this or Q4)

- a. (1) What would the equivalent of a Unix “hard link” be in Windows file system? Justify
- b. (2) Why doesn’t Windows allow multiple “hard links” to files like Unix has? Explain.
- c. (3) If Bill Gates called and asked you to implement “hard links” to files in Windows 13 (compatible with all previous versions of Windows), what are the issues you would have to deal with that Unix does not have to deal with? Explain.
- d. (4) So you have been tasked with implementing “hard links” in the Windows 13 FAT-64 file system – what changes would you make to the system in order to handle the issues? Explain.

3. Virtual Memory (answer this or Q1)

- a. (4) Compare the CLOCK page replacement algorithm to NRU. What are their strengths and weaknesses? (Assume that LRU is pretty good indicator of likelihood of page use soon.)
- b. (4) Now devise a way for the CLOCK algorithm to incorporate the optimization used by NRU that CLOCK lacks – how would you have to modify the CLOCK algorithm to add this optimization while still retaining the spirit of CLOCK? Be specific, and justify your changes.
- c. (2) Why is it that disk block cache systems can implement true LRU, but page replacement systems never do?

4. File Block Management (answer this or Q2)

- a. (4) What types of file block management inconsistencies can occur in a file system that uses a linked list to keep track of the free blocks? Explain how each type of inconsistency can arise.
- b. (1) What type(s) of block management inconsistency are not possible when the free block list is kept as a bitmap? Explain.
- c. (3) What do the ways in which inconsistency can arise suggest that the order of operations should be when deleting a file? Explain why the order matters and how it helps.
- d. (2) How does use of journaling in files systems handle inconsistency? Explain.