CSCI 315 Operating Systems Design
Final Exam Study Guide

Fall 2021

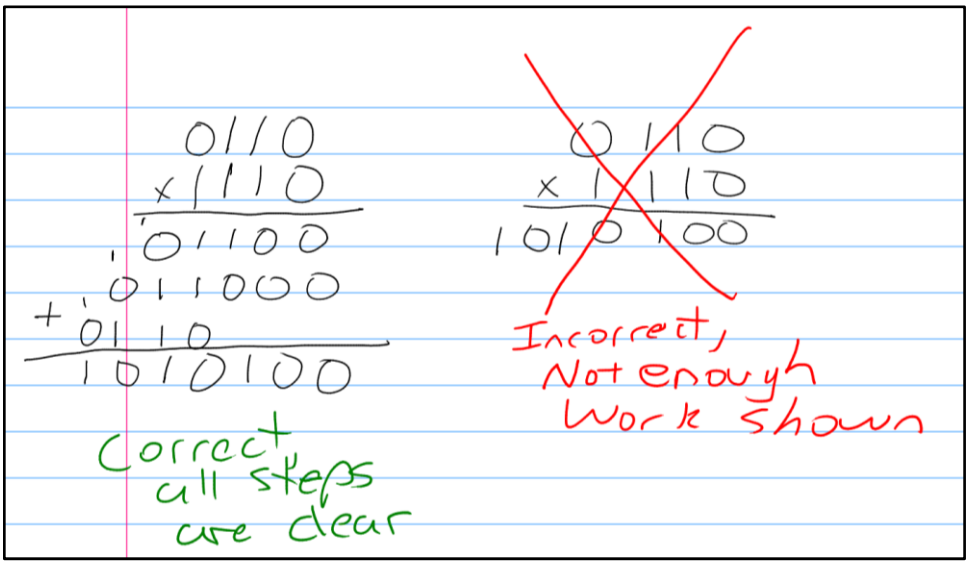
Exam Instructions

This exam is a timed "take-home" exam. The exam will be made available through course Moodle on Friday December 10th 11:00 am and due Monday December 13th 11:00 am. You will have a 3-hour block to complete the exam. That is, as soon as you open the exam, you must finish it within the three-hour block.

The exam will be posted in the **Exams** section on the course Moodle site. You will submit it through that site as well. Make sure to follow the submission guideline given in the exam.

https://moodle.bucknell.edu/course/view.php?id=42960

The exam will be open notes and open book. As such, when there is any calculation, or code comprehension, or writing of any code in the exam, you must show the detailed steps you followed to arrive at your answer. For example, below shows two ways to compute 6 x 14 in binary. One will receive full credit, the other will receive no credit. When in doubt, error on the side of showing more work than you think you need. (This is a random sample question, not CSCI 315 question.)



You must work on your own. Do not discuss the exam with anyone else. The instructor will be available online to answer any questions. The instructor contact information is available on the course Moodle site.

Exam Study Guide

- The final exam is cumulative. This document only lists the content covered since Exam 2. In order to prepare thoroughly for this exam, you should review the material for the two midterm exams (see their respective study guides on course website).
- Review all assigned readings from the textbook.
- Go through the past two mid-term exams, labs, quizzes, and activities. Make sure that you have a solid understanding of the topics they address. The concepts in C systems programming covered in labs are also important for this exam.
- This document doesn't mean to give an exhaustive coverage of what might appear in the exam, but it will be useful as a self-check list for your preparation.

I. Identify the following concepts.

- file
- file system
- directory
- attributes of a file such as owner, dates, protection bits, and others
- contiguous allocation of file space
- linked allocation of file space
- indexed allocation of file space
- free space management (bit vector and linked list)
- symbolic link
- hard link
- disk buffer
- block devices
- character devices
- virtual file system
- networked file system
- virtual machines
- major components of a virtual machine
- important building blocks of a virtual machine

II. General questions

1. File system organization: compare the pros and cons of single-level, two-level, tree, and graph structured systems.
2. In the context of Linux file systems, what do the file attributes for *owner*, *group*, and *other* express? How do they relate to protection?
3. How are numeric values of user ID and group ID resolved when one runs the command **ls** to see the attributes to a file?
4. What problems can occur if links to directories are allowed in a directory structure?
5. List three methods for space allocation for files, and explain for each how the operating system keeps track of the blocks in a file. What are the advantages and drawbacks of each method?
6. How can free space for a file system be organized? Explain how the various methods work.

7. If an application program reads a word of text from a disk file, does the file system read that word or read a block of bytes? Why?
8. How does **inode** in Linux keep track of file information and its data?
9. Given a fixed block size, how to compute the maximum size a Linux file through the use of **inode**?
10. How does Linux maintain information of all open files by different processes?
11. Compare and contrast FCB (File Control Block) with PCB (Process Control Block).
12. Compare and contract disk buffers with cache that is in the context of memory.
13. How to compute the overhead needed to main free list?
14. What method is used in Linux file system **ext3** (or **ext2**) to keep track of block allocation?