

CS140 Operating Systems and Systems Programming Final Exam

March 17, 2005

Name: (please print) _____

In recognition of and in the spirit of the Stanford University Honor Code, I certify that I will neither give nor receive unpermitted aid on this exam.

Signature: _____

This examination is closed notes and closed book. You may not collaborate in any manner on this exam. You have 180 minutes (3 hours) to complete the exam. Before starting, please check to make sure that you have all 16 pages.

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11		Total	

Name: _____

- (1) (8 points) Explain why the speed at which a CPU can raise exceptions and return from exceptions could factor into the overheads seen by a virtual machine monitor.

- (2) (12 points) Assume you are given an operating system environment with a workload running on it, a list of physical addresses, and a virtual machine monitor capable of running the operating system environment. Explain how you could modify the virtual machine monitor to record the program counter addresses that wrote into any of the physical addresses on the list.

- (3) (10 points) If you wanted to implement a spoiler/denial of service attack against a machine over a local area network, would you use UDP or TCP? Justify your answer.

- (4) (10 points) Would going from a stop-and-go protocol to one that uses a sliding window likely increase or decrease the number of acknowledgement packets sent for a network session consisting of sending a large file. Justify your answer.

- (5) (8 points) Explain how a machine determines the destination Ethernet address based on the destination IP address.

- (6) (10 points) Explain why the end-to-end argument might suggest that adding useful security features such as encryption to the link-level layer might not be such a good idea.

- (7) (10 points) (a) Would a BSD file system ever put two files created in the same directory in two different cylinder groups? (b) Would a BSD file system ever put files created in different directories in the same cylinder group? Justify your answer. If possible, indicate what would the user of the file system have to do to make it happen.

- (8) (10 points) Your Pintos partner decided to add write ahead logging to your file system. He asked you if the log should be in the beginning, middle, or end of the disk. What do you think? Justify your answer.

- (9) (10 points) A recently published paper reports an attack on the popular message digest algorithm SHA1 that some people believe may lead to SHA1 being broken. What does it mean for a message digest algorithm to be broken? What bad things can happen?

- (10) (12 points) Assume that you are given a file system that used capabilities to protect access to files. Describe an algorithm you could use to convert it into using access control lists. The access control lists should give the users the same access to files as with capabilities.

- (11) (10 points) Assume that you know that exactly one bit of a file system's free block bitmap is incorrect but you do not know which bit that is. Describe an algorithm for computing which bit is incorrect.

- (12) (10 points) (a) What units would you use if you were asked to measure the latency of a file system? (b) How about the units for a measure of bandwidth?

- (13) (10 points) Explain why in a Unix file system deleting a hard link to a file would require updating the file's inode while deleting a soft link would not.

- (14) (10 points) Would an extent based file system or a linked-file file system allow you to use a greater fraction of the capacity of a disk for a workload of small files? (b) How about big files? Justify your answer.

- (15) (10 points) For each of the following attributes of a disk, give the ordering of them (e.g. $X \leq Y < Z < Q$):
- # of heads
 - # of cylinders
 - # of sectors
 - # of platters
 - # of tracks per platter
 - # of bytes of capacity