736 Midterm Exam
(Old School Style)

The Times are a Changin'
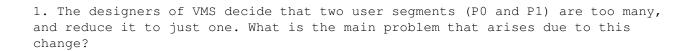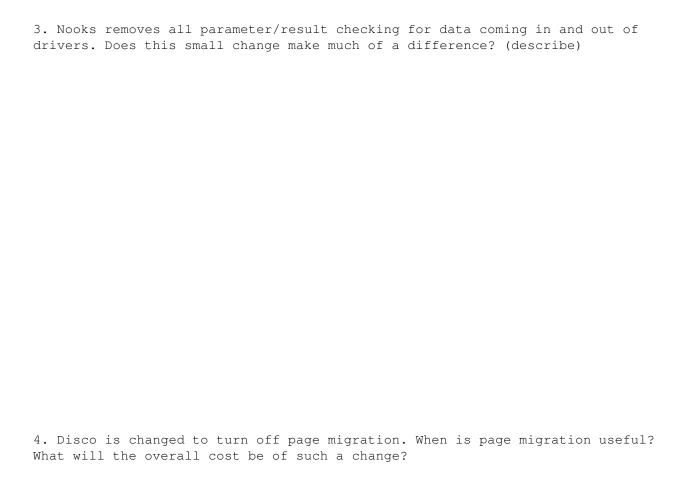

Name: _____

This exam contains 9 old-school pages.

What difference does it make? Sometimes, a small difference makes no difference, as in "I just won a million dollars!" as compared to "I just won a million and one dollars!"; sometimes a small difference makes all the difference, as in "I just DIDN'T win a million dollars!"

In this exam, we'll examine some small differences in systems, and determine whether a small difference makes a small or large difference overall.

Either way, you won't be winning a million dollars, but you might get a good grade on this exam, which of course is priceless.

1. The designers of VMS decide that two user segments (P0 and P1) are too many, and reduce it to just one. What is the main problem that arises due to this change?
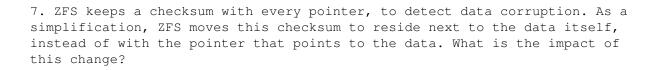
2. FFS no longer spreads large files across cylinder groups, but rather places all of such a file within one cylinder group. On a modern 1TB disk, does this make much difference? (explain)

3. Nooks removes all parameter/result checking for data coming in and out of drivers. Does this small change make much of a difference? (describe)

4. Disco is changed to turn off page migration. When is page migration useful? What will the overall cost be of such a change?

5. On a system with a software-managed TLB, Exokernel usually provides some kind of interface to modify the contents of the TLB. What harm would come from removing this ability? How would the resulting system work?

6. The IRON file system paper presents an analysis of file-system failure handling that shows the failure handling is often implemented quite poorly. To remedy this, a small change in the lower layers of the I/O code is made to panic (crash) any time a disk failure occurs. When is this good? When is it bad? What do you think of this change?

7. ZFS keeps a checksum with every pointer, to detect data corruption. As a simplification, ZFS moves this checksum to reside next to the data itself, instead of with the pointer that points to the data. What is the impact of this change?

8. LFS is changed to write the entire inode map to the checkpoint region, immediately after each segment is written. How is this different from what LFS usually does? What performance impact does it have?

9. Journaling file systems are careful to order updates to ensure correct recovery in the case of a system crash. Describe how ext3, in ordered (metadata) journaling mode, carefully orders updates to disk. Can any of these ordering points be removed, thus changing the system to make it simpler?

10. Assume that you have an AutoRAID, and that you configure the system to use only two disks. How could you simplify AutoRAID in order to take advantage of the fact that it is running on a two-disk system?

11. As we all know, Multics solves every problem with indirection. Each code or data segment is referred to by a name, similar to a pathname in a Unix directory tree, basically something like "/a/b/foo" or whatever. To simplify this, Multics changes to a flat namespace with numbers for each segment. Discuss what this improves; discuss what it makes worse.

12. The designers of the VMware ESX memory manager decide it will be simpler to avoid all the trouble of maintaining a balloon driver, and thus remove it. What will the result of this removal be? Will the system still work?

13. THE and Nucleus are old systems. Remzi thus tries to change
the 736 class by skipping all old papers like these. What is the most
important lesson that would be lost by skipping these papers?