

## Homework 4

Amy Murphy

21 April 2002

You will not hand in the answers to this homework assignment. Instead, at the beginning of class on Monday **28 April 2002** you will be asked to solve one of the problems as a closed notes, closed book quiz. The question to be solved will be randomly selected.

1. In a UNIX file system, suppose that `/a/b/c` is a hard link to the file `/x/y/z`. List the inode and data blocks that must be accessed by the file system when a process requests to open `/a/b/c`.  
Suppose instead that `/a/b/c` is a symbolic (soft) link. Answer the same question as before.
2. A filesystem that lays out data in blocks must specify the block size that it will use. Name one advantage and one disadvantage to choosing a large block size.
3. As we discussed in class, FFS tries to achieve both the advantages of large and small block sizes. Briefly describe the technique by which this is achieved, and one of its disadvantages.
4. Suppose that a file system in which an inode has 8 direct pointer, a single indirect pointer and a double indirect pointer. Assume the filesystem block size is 1024 bytes, and a block pointer occupies 4 bytes. How many disk operations will be required if a process reads data from block `N` of a file? Assume that the file is already open, that there are no data blocks cached, and each disk operation reads a single file block. Your answer should be given in terms of `N`.
5. Suppose that the file system in the previous question is modified so that the index node does not contain a double indirect pointer. Instead, if a file is larger than can be represented using the direct and single indirect pointers, the last pointer in the indirect block is used to point to another indirect block containing more pointers to data blocks. If that second indirect block fills up, its last pointer is used to point to another indirect block. This chain of indirect blocks can grow as long as is necessary to accommodate a large file. Under this new indexing scheme, how many disk operations will the file system have to perform if a process reads data from the `N`th block of a file? Use the same assumptions as in the previous question.
6. A professor shares file with the students by placing them in a publically accessible directory on the department's system. One day, he realizes that a file placed there the previous day is world writable. He change the permissions and verifies the file is identical to his master copy. The next day he finds the file has been changed. How could this have happened and how could it have been prevented (by the professor, not by the OS).