Theoretical Exercises 7
File Systems

Please submit solutions on Blackboard by Monday, 21.3.2022 12:00h

7.1 Inode-based file systems

A Unix filesystem has 2 kB (1 kB = 1024 bytes) blocks and 4 byte disk addresses. Each inode contains 10 direct entries, one single-indirect entry and one double-indirect entry.

a. Calculate the maximum possible file size in this file system

b. Suppose half of all files are exactly 1.5 kB in size and the other half of all files are exactly 2 kB. What fraction of the disk space would be wasted? (Consider only the blocks used to store data)

c. Based on the same condition as in the previous item above, does it help to reduce the fraction of wasted disk space if we change the block size to 1 kB? Explain your answer

7.2 Simple file system operations

Consider a file currently consisting of 100 blocks. Assume that the file- control block (and the index block, in the case of indexed allocation) is already in memory. Calculate how many disk I/O operations are required for contiguous, linked, and indexed (single-level) allocation strategies, if, for one block, the following conditions hold. In the contiguous-allocation case, assume that there is no room to grow at the beginning but there is room to grow at the end. Also assume that the block information to be added is stored in memory.

a. The block is added at the beginning

b. The block is added in the middle

c. The block is added at the end

d. The block is removed from the beginning

e. The block is removed from the middle

f. The block is removed from the end

7.3 Free storage management

Why must the bit map for file allocation be kept on mass storage, rather than in main memory?

7.4 File and directory names in Unix

a. Explain why the slash character (/) is not a valid character in Unix file names.

b. What happens when you try to create a file with a slash in the name, e.g. using `creat("my/file", 0777);`?

c. Give the meaning of the parameter `0777` in the call to `creat` above

d. Are there other characters that are not allowed in Unix file names?