



System Architecture 2008/09 Assignment 15

Question 15.1: Indexed Sequential Files

Most modern operating systems offer unstructured files as persistently stored byte-streams with random access to individual bytes. However, some applications can profit from more structured files. For now, assume that such applications work with fixed-sized records.

1. Describe the *sequential* file structure. What is sequential? Is there any order applied to the records?
2. Describe the *indexed sequential* file structure. What data needs to be stored in an index?
3. Describe the *tree-indexed sequential* file structure. Can you think of a data structure that can easily be used to implement this structure on top of sequential files?
4. In how far do variable-sized records, such as text fields or names, change the properties of sequential, indexed sequential, or tree-indexed sequential files? Estimate the impact on performance (extremely high, high, low, negligible).

Question 15.2: Extensible Hashing

1. Given an empty extensible hash with block size 5, develop the state of the hash after inserting data with keys 8, 17, 25, 33, 51, 14, 73, 83, 2, 40, 52, 41, and 62 in the given order.
2. What happens if you now insert data for the key 81?
3. Find the criteria for shrinking an extensible hash, i.e., (1) *when* to combine two containers and (2) *when* to reduce the base vector.

Question 15.3: Details of the ext2 Filesystem

1. Which of the following data are stored in an inode: (a) filename, (b) name of containing directory, (c) file size, (d) file type, (e) number of symbolic links to the file, (f) name/location of symbolic links to the file, (g) number of hard links to the file, (h) name/location of hard links to the file, (i) access rights, (j) timestamps (last access, last modification), (k) file contents, (l) ordered list of blocks occupied by the file?

For each item state whether it is required or optional. For items not stored in inodes, state where the information is stored (if at all).

2. How are directories implemented in ext2? What information is stored in them?
3. What are hard links?
4. What are symbolic links?