Operating Systems - Review Questions 4

Deadline: Dec. 9, 2022

1. Consider a disk queue with requests for I/O to blocks on cylinders 183, 98, 14, 122, 37, 67, 124, 65, in that order. If the disk head is initially at cylinder 30, what would be disk scheduling using FCFS, SCAN, and C-SCAN scheduling?

   Answer.

   - FCFS: (183 - 30) + (183 - 98) + (98 - 14) + (122 - 14) + (122 - 37) + (67 - 37) + (124 - 67) + (124 - 65) = 153 + 85 + 84 + 108 + 85 + 30 + 57 + 59 = 661
   - SCAN: (30 - 14) + (14 - 0) + (37 - 14) + (65 - 37) + (67 - 65) + (98 - 67) + (122 - 98) + (124 - 122) + (183 - 124) = 16 + 14 + 23 + 28 + 2 + 31 + 24 + 2 + 59 = 199
   - C-SCAN: (37 - 30) + (65 - 37) + (67 - 65) + (98 - 67) + (122 - 98) + (124 - 122) + (183 - 124) + (199 - 183) + (14 - 0) = 7 + 28 + 2 + 31 + 24 + 2 + 59 + 16 + 14 = 183
     or
     (37 - 30) + (65 - 37) + (67 - 65) + (98 - 67) + (122 - 98) + (124 - 122) + (183 - 124) + (199 - 183) + (199 - 0) + (14 - 0) = 7 + 28 + 2 + 31 + 24 + 2 + 59 + 16 + 199 + 14 = 382

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2. Consider a system that supports 5000 users. Suppose that you want to allow 4990 of these users to be able to access one file. How would you specify this protection scheme in UNIX-like (e.g., Linux) OS?

   Answer: There are two methods for achieving this:

   1. Create an access-control list with the names of all 4990 users.
   2. Put these 4990 users in one group, and set the group access accordingly. This scheme cannot always be implemented, since the number of user groups and the number of members per group can be limited by the system.

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

   Answer: In case of a system crash (memory failure), the free-space list would not be lost, as it would be if the bit map had been stored in main memory.

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4. Consider a system that supports the strategies of contiguous, linked, and indexed allocation. What criteria should be used in deciding which strategy is best utilized for a particular file?

   Answer:

   - Contiguous: if the files are usually accessed sequentially, and if the files are relatively small.

- Linked: if the files are large and usually accessed sequentially.
- Indexed: if the files are large and usually accessed randomly.

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5. Explain how the VFS layer allows an operating system to support multiple types of file systems easily.

   Answer: VFS introduces a layer of indirection in the file system implementation. In many ways, it is similar to object-oriented programming techniques. System calls can be made generically (independent of file system type). Each file system type provides its function calls and data structures to the VFS layer. A system call is translated into the proper specific functions for the target file system at the VFS layer. The calling program has no file-system-specific code, and the upper levels of the system call structures likewise are file system-independent. The translation at the VFS layer turns these generic calls into file-system-specific operations.