

12.8

Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is

86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk-scheduling algorithms?

- a. FCFS
- b. SSTF
- c. SCAN
- d. LOOK
- e. C-SCAN
- f. C-LOOK

Ans :

- a. The FCFS schedule is 143, 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130.
The total seek distance is 7081.
- b. The SSTF schedule is 143, 130, 86, 913, 948, 1022, 1470, 1509, 1750, 1774.
The total seek distance is 1745.
- c. The SCAN schedule is 143, 913, 948, 1022, 1470, 1509, 1750, 1774, 4999, 130, 86.
The total seek distance is 9769.
- d. The LOOK schedule is 143, 913, 948, 1022, 1470, 1509, 1750, 1774, 130, 86.
The total seek distance is 3319.
- e. The C-SCAN schedule is 143, 913, 948, 1022, 1470, 1509, 1750, 1774, 4999, 86, 130.
The total seek distance is 9813.
- f. (Bonus.) The C-LOOK schedule is 143, 913, 948, 1022, 1470, 1509, 1750, 1774, 86, 130.
The total seek distance is 3363.

12.18

None of the disk-scheduling disciplines, except FCFS, is truly fair (starvation may occur).

- a. Explain why this assertion is true.
- b. Describe a way to modify algorithms such as SCAN to ensure fairness.
- c. Explain why fairness is an important goal in a time-sharing system.
- d. Give three or more examples of circumstances in which it is important that the

operating system be unfair in serving I/O requests.

Ans :

- a. New requests for the track over which the head currently resides can theoretically arrive as quickly as these requests are being serviced.
- b. All requests older than some predetermined age could be “forced” to the top of the queue, and an associated bit for each could be set to indicate that no new request could be moved ahead of these requests. For SSTF, the rest of the queue would have to be reorganized with respect to the last of these “old” requests.
- c. To prevent unusually long response times.
- d. Paging and swapping should take priority over user requests. It may be desirable for other kernel-initiated I/O, such as the writing of file system metadata, to take precedence over user I/O. If the kernel supports real-time process priorities, the I/O requests of those processes should be favored.

12.28

Compare the throughput achieved by a RAID level 5 organization with that achieved by a RAID level 1 organization for the following:

- a. Read operations on single blocks
- b. Read operations on multiple contiguous blocks

Ans : 1) The amount of throughput depends on the number of disks in the RAID system. A RAID Level 5 comprising of a parity block for every set of four blocks spread over five disks can support four to five operations simultaneously. A RAID Level 1 comprising of two disks can support two simultaneous operations. Of course, there is greater flexibility in RAID Level 1 as to which copy of a block could be accessed and that could provide performance benefits by taking into account position of disk head.

2) RAID Level 5 organization achieves greater bandwidth for accesses to multiple contiguous blocks since the adjacent blocks could be simultaneously accessed. Such bandwidth improvements are not possible in RAID Level 1.