

Operating Systems: Homework #6

Due on April 11, 2016 at 11:59pm

Professor Qu

Monday & Wednesday 3:30pm — 5:17pm

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Problem 1

For each part of this question, assume that the disk has a total of 100 cylinders.

- a) Suppose that the disk head scheduling policy is shortest seek time first (SSTF). The disk heads are currently positioned over cylinder 42 and requests are queue for data on cylinders

27, 40, 90, 37, 15, 67

What will be the total distance (in cylinders) traveled by the disk heads to serve the six queued requests?

- b) Suppose instead that the disk head scheduling policy is SCAN (elevator). The disk heads are initially positioned over cylinder 42 and the current direction of travel of the heads is 'up', i.e., towards higher numbered cylinders. For the same set of queued requests given in part (a), what will be the total distance (in cylinders) traveled by the disk heads to service the requests?

SOLUTION

- a) SSTF

Read order: 40, 37, 27, 15, 67, 90

distance: $2 + 3 + 10 + 12 + 52 + 23 = 102$

- b) SCAN

Read order: 90, 67, 40, 37, 27, 15

distance: $48 + 23 + 27 + 3 + 10 + 12 = 123$

Problem 2

Consider a File system that maintains unique index node for each file in the system. Each index node includes 8 direct pointers, a single indirect pointer, and a double indirect pointer. The file system block size is 1024 bytes, and a block pointer occupies 4 bytes.

- a) What is the maximum file size that can be supported by the index node?
- b) How many disk operation will be required if a process read data from the Nth block of a file? Assume that the file is already open, the buffer cache is empty, and each disk operation read a single file block. Your answer should be given in terms of N.
- c) How much space (including overhead) does a file that is 1025 bytes long?
- d) How much space (including overhead) does a file that is 65536 (64KB) bytes long?

SOLUTION

- a) $2^{13} + 2^{18} + 2^{26}$
- b)
 - If $0 \leq N < 8$ One operation is needed
 - If $8 \leq N < 256 + 8$ Two operations are needed
 - If $256 + 8 \leq N < 2^{13} + 2^{18} + 2^{26}$ Three operations are needed
- c) $128 + 1024 = 1152$ bytes
- d) $128 + 65536 = 66688$ bytes

Problem 3

Suppose a file system can have three disk allocation strategies, contiguous, linked, and indexed. We have just read the information for a file from its parent directory. For contiguous and linked allocation, this gives the address of the first block, and for indexed allocation this gives the address of the index block. Now we want to read the 10th data block into the memory. How many disk blocks (N) do we have to read for each of the allocation strategies? *For partial credit, explicitly list which block(s) you have to read.*

SOLUTION

Contiguous allocation : 1 block

Linked allocation : 10 blocks

Indexed allocation : 2 blocks