Comp 3411 - Assignment 3 - Mass Storage

1. Consider a disk queue holding requests to the following cylinders in the listed order

   - 116, 22, 3, 11, 75, 185, 100, 87

What is the order that the requests are serviced, for the algorithms below, assuming the disk head is at cylinder 88.

(a) FCFS scheduling

→ Just moves in order through the queue.

88 → 116 → 22 → 3 → 11 → 75 → 185 → 100 → 87

(b) SCAN scheduling: (arm is moving up from cylinder 88)

→ will scan and service requests as the head moves up and down across the disk

88 → 100 → 116 → 185 → 87 → 75 → 22 → 11 → 3

(c) C-SCAN scheduling: (arm is moving up from cylinder 88)

→ similar to SCAN but head will return to beginning of disk

88 → 100 → 116 → 185 → 3 → 11 → 22 → 75 → 87

(d) FCFS total movement = 421
SCAN " = 239
C-SCAN " = 369

∴ SCAN services all the requests with the minimum amount of movement.

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2. Consider a disk queue holding requests to the following cylinders in the listed order:

116, 22, 3, 11, 75, 185, 100, 87

∴ What is the order the requests are serviced, for the algorithms below, assuming the disk head is at cylinder 88.

(a) FCFS scheduling

88 → 116 → 22 → 3 → 11 → 75 → 185 → 100 → 87

(b) SCAN scheduling: (arm is moving down from cylinder 88)

88 → 87 → 75 → 22 → 11 → 3 → 100 → 116 → 185

(c) C-SCAN scheduling: (arm is moving down from cylinder 88)

88 → 87 → 75 → 22 → 11 → 3 → 185 → 116 → 100

(d) FCFS : 427
SCAN : 267
C-SCAN : 358

∴ SCAN is the best algorithm with minimum movement.

3. Consider a disk with a sector size of 512 bytes, 2000 tracks per surface, 50 sectors per track, five double-sided platters, and average seek time of 10 msec.

(a) i) Calculate capacity of a track in bytes

$$\frac{\text{bytes}}{\text{track}} = \frac{\text{bytes}}{\text{sector}} \times \frac{\text{sectors}}{\text{track}} = 512 \cdot 50 = \frac{25{,}600}{1.024} = 25\,000 \approx 25\text{kB}$$

ii) What is the capacity of each surface?

Surface Capacity = track capacity · tracks per surface

$= 25\,000 \times 2000$

$= 50\,000\,000$ ≈ 50 MB

iii) What is the capacity of the disk?

Disk Capacity = surface capacity $\times$ (5 × 2) ← double sided sectors

$= 50\,000\,000 \times 5 \times 2$

$= 500\,000\,000$ ≈ 500 MB

b) How many cylinders does the disk have?

- Cylinders are the set of tracks, therefore the number of cylinders = tracks per platter

$= 2000$

(c) Give examples of valid block sizes. Is 256 bytes a valid block size? 2048? 51200?

- Block sizes should be a multiple of the sector size. In this question that could be any multiple of 512.
- Therefore 256 is not valid block size
  2048 is valid
- Block size cannot exceed track size
  4550 51200 is not valid.

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4. Suppose we have a 10000 RPM disk has 8 heads and 480 cylinders. It is divided into 120-cylinder zones with the cylinders in different zones containing 200, 240, 280, and 320 sectors. Assume each sector contains 4096 bytes and a seek time between adjacent cylinders of 2 msec. What is the total disk capacity?

- Total sectors = Sum of cylinder zones and sectors/zone.
  $= 120(200 + 240 + 280 + 320)$
  $= 124,800$
- Disk Capacity = Total Sectors × Sector size
  $= 124\,800 \times 4096$
  $= 511,180,800$ bytes