

# Operating Systems

## File System & Device Management

DPP 01

**[MCQ]**

1. What is cluster in a disk architecture?
- It is a group of one or more sectors on same track.
  - It is a collection tracks on same cylinder.
  - It is a group of one or more track one same platter.
  - It is a collection of platter on the disk.

**[NAT]**

2. Consider the following disk specifications.
- Number of platters = 8
  - Number of tracks per surface = 512
  - Number of sectors per track = 4096
  - Sector offset = 15
  - Calculates the unformatted capacity (in GB)?

**[NAT]**

3. In a computer system, a disk track can hold 32 sectors each having size of 256 bytes. The relation rate 2000 rpm. The data rate of disk is \_\_\_\_\_KB.

**[MCQ]**

4. A disk rotates at 7200 RPM. It has 500 sectors of 512 bytes each around the outer cylinder. How long does it take to read a sector?
- 14.87  $\mu$  sec.
  - 15.67  $\mu$  sec.
  - 13.87  $\mu$  sec.
  - 16.67  $\mu$  sec.

**[MCQ]**

5. Consider the following disk specifications:
- A 10 GB disk rotates at 10,000 rpm
  - Data transfer rates is  $10^7$  bytes/sec.
  - Average seek time 8 ms.
  - Blocks size is 32 KB.

What is the average services time to access a single disk blocks form a random location on the disk?

- 15.38 ms
- 14.28 ms
- 16.48 ms
- 13.18 ms

**[NAT]**

6. A hard disk has 20 surface with 100 tracks for surface and 16 sectors per track. The disk transfer rate is  $10^6$  bytes/sec, page size is 512 bytes and the process size is 2048 bytes, and seek time is 25 msec. The disk is rotating at 300 rpm. What is the total swap time (in ms) ? [upto three decimal places]

**[NAT]**

7. Consider a typical disk that rotates at 20000 RPM and has a transfer rate of 32KBps. If the average seek time is 6 msec. and the controller's transfer time is twice of the disk transfer time, the average time need to read or write a 1024 bytes sector of disk is \_\_\_\_\_msec. (upto 1 decimal places)

**[MSQ]**

8. Two steps performed by operating system to uses a disk to hold disk its files are\_\_\_\_\_.
- partitioning
  - Logical formatting
  - Caching
  - Swapping

## Answer Key

- |             |                  |
|-------------|------------------|
| 1. (a)      | 5. (b)           |
| 2. (512)    | 6. (70.096)      |
| 3. (273 KB) | 7. (103.5 msec.) |
| 4. (d)      | 8. (a, b)        |



## Hints & Solutions

1. (a)

Cluster is a group of one or more sectors on same tracks.

2. (512)

$$\begin{aligned}\text{Disk capacity} &= 8 \times 512 \times 4096 \times 32 \text{ KB} \\ &= 2^3 \times 2^9 \times 2^{12} \times 2^{15} \\ &= 2^{39} \\ &= 512 \text{ GB}\end{aligned}$$

3. (273 KB)

Here Rotation rate is 2000 RPM means 2000 rotations in 60 sec.

$$\text{So, in 1 sec.} = \frac{2000}{60} \text{ rotations,}$$

$$\text{And time taken by 1 rotation} = \frac{60}{2000} = 0.3 \text{ sec.}$$

$$\text{Track capacity} = 32 \times 256 \text{ bytes}$$

$$\text{Data rate} = 32 \times 256 \times \frac{2000}{60} = 273 \text{ KB (approx.)}$$

4. (d)

Given, Rotation speed = 7200 RPM

60 second  $\rightarrow$  7200 rotation

$$1 \text{ rotation} \rightarrow \frac{60}{7200} = 0.00833 \text{ sec.}$$

$$= 8.33 \text{ m sec.}$$

It 1 rotation, we can read 1 track data, so we can read 500 sectors in one rotation.

$$\text{Time to read a sector} = 8.33/500$$

$$= 16.67 \text{ m sec.}$$

5. (b)

$$T_{\text{seek}} = 8 \text{ ms.}$$

$$\text{Rotational time} = \frac{\text{Rotational Latency}}{2}$$

$$= \frac{1}{2} \left( \frac{60}{10,000} \right) \text{ sec.} = 3 \text{ msec.}$$

$$\text{Transfer time} = \frac{32 \times 1024}{10^7} = 3.2768 \text{ ms.}$$

$$\approx 3.28 \text{ ms}$$

$$\begin{aligned}\text{Strict time} &= 8\text{ms} + 3\text{ms} + 3.28 \text{ ms} \\ &= 14.285\text{ms}\end{aligned}$$

6. (70.096 msec.)

$10^6$  bytes are transferred in second

$$\text{So, 2048 bytes are transferred in } \frac{2048}{10^6} = 2.048 \text{ m sec.}$$

$$\text{Seek time} = 25 \text{ ms}$$

$$\text{RPM} = 3000$$

$$60 \text{ sec.} \rightarrow 3000 \text{ rotation}$$

$$1 \text{ rotation} \rightarrow \frac{60}{3000} = 20 \text{ msec.}$$

$$\text{Thus, average rotational latency} = \frac{20}{2} = 10$$

Swap time =  $2 \times (\text{Seek time} + \text{Average rotational latency} + \text{transfer time})$

$$= 2 \times (25\text{ms} + 10\text{ms} + 2.048\text{ms})$$

$$= 2 \times 37.048 \text{ msec.}$$

$$= 74.096 \text{ msec.}$$

7. (103.5 msec.)

Average seek time = 6 msec.

Q There are 20000 rotations in 60 sec.

$$\text{So, 1 rotation in } \frac{60}{20000} = 3 \text{ msec.}$$

$$\text{Average rotational delay} = \frac{1}{2} \times 3 \text{ msec.} = 1.5 \text{ msec.}$$

Sector size = 1024 byte

Transfer rate =  $32 \times 2^{10}$  bytes per second.

$$1024 \text{ bytes} \rightarrow \frac{1024}{32} \rightarrow 32 \text{ sec.}$$

$$\text{Controller transfer time} = 2 \times 32 = 64 \text{ msec.}$$

$$\begin{aligned}\text{Average time to read/write} &= 6 + 1.5 + 32 + 64 \\ &= 103.5 \text{ msec.}\end{aligned}$$

8. (a, b)

Partitioning of logical formatting are two steps performed by operating system to use a disk to hold its files.



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