

Question:

Problem on Disk Technology.

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Suppose we have a magnetic disk with the following parameters:

| | |
|---------------------|--------------|
| Average seek time | 12ms |
| Rotation rate | 3600 RPM |
| Transfer rate | 3.5MB/second |
| # sectors per track | 64 |
| Sector size | 512 bytes |
| Controller overhead | 5.5ms |

Answer the following:

- What is the average time to read a single sector?
- What is the average time to read 8 KB in 16 consecutive sectors in the same cylinder?
- Now suppose we have an array of 4 of these disks. They are all synchronized such that the arms on all the disks are always on the same sector within the track. The data is striped across the 4 disks so that 4 logically consecutive sectors can be read in parallel. What is the average time to read 32 consecutive KB from the disk array?



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Solution:

a)Average Time to read a single sector:

Disk Access Time = Seek time + Rotational delay + Transfer time + Controller overhead

Given, Seek Time = 12ms

Rotational delay = $1/2r = (0.5*60*10^3/3600) = 8.3333\text{ms}$

Transfer Time = $b/rN = (512/(3.5*2^{20}))*1000 = 0.1395\text{ms}$

Controller Overhead = 5.5ms

Therefore, Average time to read a single sector = 12ms + 8.33ms + 0.1395ms + 5.5ms

= 25.97ms

b) Average time to read 8 KB in 16 consecutive sectors in the same cylinder

Here only the transfer time gets changed.

Disk Access Time = Seek time + Rotational delay + Transfer time + Controller overhead

Given, Seek Time = 12ms

Rotational delay = $1/2r = (0.5*60*10^3/3600) = 8.3333\text{ms}$

Transfer Time = $b/rN = ((8*1024)/(3.5*2^{20}))*1000 = 2.2321\text{ms}$

Controller Overhead = 5.5ms

Therefore, Average time to read 8 KB = 12ms + 8.33ms + 2.2321ms + 5.5ms = **28.07ms**



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c) Since 4 logically consecutive sectors can be read at once. 2 KB can be read off at once. To read 32 KB, 16 sectors has to read on each disk. So the time taken will be 28.07ms

**** End of the Solution ****

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