Response DW N° 05 (Hard Disk Drive)

Exercice 01 : A/-

1- Platters
2- Rotary Engine
3- Reading Head
4- Electromagnetic Arm
5- Interface Card
6- Power Supply
7- IDE Connector

B/-

1- Sector 2- Cylinder 3- Track 4-Platters

C/-

Size of Disk Drave = Size of Platter x Number of Platters

= S.Track x Number of Track x 2x Number of Platters

= S.Sector x Number of Sectors x Number of Track x 2x Number of Platters

= 8x4x6 x2x2 = 768 Bytes

D/-

Block size = capacity / (number of surfaces * number of tracks * number of sectors) Block size = 2^{30} / (2^3 x 2^8 x 2^6) Bytes = 2^{13} bytes or 8 KB.

E/-

240 Turns per minute = 4 revolutions per second.
Time of Turn =60/240=1/4 second

Average Read Time = Head Movement Time + Half Rotation Time + Sector Read Time (Time for 1 rotation / Number of sectors) x2(Time of read tow sectors)

=100ms +(¼)/2s +((¼)/5)x2 = 100ms + 125ms + 100ms = 325ms

F/-

Average Read Time = Head Movement Time + Half Rotation Time + Sector Read Time (Time for 1 rotation / N sectors)

16ms = 10ms + 5ms + 10ms/N sectors → N sectors = 10 sectors.

Exercise 02 :

Number of cylinders = 1020

Size of one cylinder = number of sectors per track * number of bytes per sector * number of heads

= 63 * 512 * 250 = 8,064,000 bytes = 8 MB

Platter size = number of sectors per track * number of bytes per sector * number of tracks * 2

= 63 * 512 * 1020 * 2 = 65,802,240 bytes

Disk capacity = size of one cylinder * number of cylinders = size of one platter * number of platters
Capacity of Disk Drive = 8 GB

Exercise 03 :

Latency time = duration of a half-turn Latency time
= (60/7200)/2 = 4.16 ms Sector read time = (60/7200)/63 = 0.13 ms
Average Access Time = Head Movement Time + Half Rotation Time + Sector Read Time (Time for 1 rotation / N sectors)
Average Access Time = 8.5+4.16+0.13 = 12,79 ms

Exercise 04 :

Disk 1

Throughput: $\frac{7200}{60} \times 32 \times 512 = 1966080$ bytes/s
Latency Time: 4.16 ms (latency time = half-rotation duration = $\frac{32}{2} \times 0.26$)
Sector Read Time: 0.26 ms (rotation duration / number of sectors = $\frac{1}{120 \times 32} = 0.26$)
Access Time: $9 + 4.16 + 0.26 = 13.42$ ms
File Read Time: average head movement time + latency time + block read time (file)
File size is 5 MB.
The throughput is 1966080 bytes/s, so the time to read 5 MB is $\frac{5 \times 10^6}{1966080} = 2.54$ s
Read time = average head movement time for 1000 blocks + latency time for 1000 blocks:
File read time: $1000 \times 9 + 1000 \times 4.16 + \frac{5 \times 10^6}{1966080} = 15.7$ s

Disk 2:

Throughput: $\frac{5400}{60} \times 32 \times 512 = 1474560$ bytes/s
Latency Time: 5.55 ms
Sector Read Time: 0.36 ms
Access Time: $4 + 5.55 + 0.36 = 9.91$ ms
File Read Time: $1000 \times 4 + 1000 \times 5.55 + \frac{5 \times 10^6}{1474560} = 12.94$ s

Exercice 05 :

The sequential file is placed on two adjacent cylinders (using the minimum seek time).

There is a significant difference between access times. Reading a sequential file is much faster than reading a direct access file.

The size of the sequential file is fixed, and its reading must be done in order.

We want to compare the performance of the two disks for both file recording methods, etc.

The number of sectors required for file storage is $\frac{6047744}{512} = 11812$ sectors for Disk 1.

Sector read time = $\frac{60}{7200} \times 32 = 0.26$ ms

Direct access time: $9 + 4.16 + 0.26 = 13.42$ ms

Sequential access time: $3 + 4.16 + 0.26 = 7.42$ ms

For Disk 2:

Sector read time = $\frac{60}{5400} \times 32 = 0.34$ ms

Direct access time: $4 + 5.55 + 0.34 = 9.89$ ms

Sequential access time: 2 (minimum seek time) + $5.55 + 0.34 = 7.89$ ms

There is a significant difference between access times. Reading a sequential file is much faster than reading a direct access file.