Deliverable: Magnetic discs

Submission form

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Exercise 1

A file takes 536,870,912 bytes. Give its size using both decimal and binary prefixes. Make sure you apply the recommendations given in Annex *Style matters* at the end of the task instructions.

With decimal prefixes	536.870,91 *kB* 536,87 *MB* 0,536 *GB*
With binary prefixes	2 ^ 19 = 524.288 *KiB* 2 ^ 9 = 512 *MiB* 2 ^ -1 = 0,5 *GiB*

Exercise 2

A given hard disk has 4 sides and a linear track density of 180,000 tpi. The innermost diameter is 1", and the outermost is 3".

2.1 What is the amount of useful surface in the disk? Give the result in square inches (in^2).

$4 * ((3 / 2 * \pi) - (1 / 2 \wedge 2 * \pi)) = 25{,}13$

Result: 25,13 in^2

2.2 How many cylinders and tracks does the disk contain?

$(3 - 1) / 2 * 180.000 = 2 / 2 * 180.000 = 180.000$

Tracks = 180.00 * 4 = 720.000

Result: 180.000 **cylinders, and** 720.000 **tracks**

Exercise 3

The disk of exercise 2 has CAV format with 3000 sectors/track and a sector size of 512 bytes.

Calculate the capacity of the disk.

H * C * S * B = 4 * 180.000 * 3.000 * 512 = 1.105.920.000.000

Result: 1.105,92 * 10 ^ 9 ***Bytes***

What is the areal density of the disk? Give it both in Mb/in^2 and Gb/in^2.

1.105.920.000.000 * 8 / 25,13 = 352.063.668.921,61
352.063.668.921,61 / 10 ^ 6 = 352.063,66892161
352.063.668.921,61 / 10 ^ 9 = 352,06366892161

Result: 352.063,67 ***Mb/in²***

Result: 352,064 ***Gb/in²***

Exercise 4

The disk described in exercise 2 has a linear density of 180,000 tpi and it receives ZCAV format with the following distribution of sectors of 512 bytes.

Zone	Limits (ID – OD)	Sectors/track
0	2.5" – 3.0"	5860
1	2.0" – 2.5"	4688
2	1.5" – 2.0"	3750
3	1.0" – 1.5"	3000

Calculate the capacity of the disk.

4 * (0,25 * 180.00) * (5.860 + 4.688 + 3.750 + 3.000) * 512 = 1.594.183.680.000

Result: 1.594.183,68 * 10 ^ 6 ***Bytes***

What is the areal density of this disk? Give it both in *Mb/in²* and *Gb/in²*.

1.594.183.680.000 Bytes = 12.753.469.440.000 bits / 25.13

507.499.778.750,5 b/in ^ 2

507.499,7787505 Mb/in ^ 2

507,4997787505 Gb/in ^ 2

Result: 507.499,78 ***Mb/in²***

Result: 507,5 ***Gb/in²***

Exercise 5

Consider the disk described in exercise 4 rotates at 10,000 rpm. The average seek time is 6 ms, and the track-to-track seek time is 0.6 ms. Calculate:

5.1 The average access time.

10.000 rpm = 166,66 rps = 6 ms per rotation

6 + 6 / 2 = 9 ms

Result: 9 ***ms***

5.2 The internal transfer speed for each zone.

Z0 : 512 / (0,006 / 5.860) = 500,053

Z1: 512 / (0,006 / 4.688) = 400,043

Z2: 512 / (0,006 / 3.750) = 320,000

Z3: 512 / (0,006 / 3.000) = 256,000

Results: **Zone 0:** 500,05 ***MB/s*** **Zone 1:** 400,04 ***MB/s***

Zone 2: 320,00 ***MB/s*** **Zone 3:** 256,00 ***MB/s***

5.3 The average time it takes to read a 100 kB file stored in correlative sectors of the same track. Consider two cases: when the track is in zone 0 and when it is in zone 3.

Zone 0:

9 + ((0,1 MB / 500,32 MB/s) * 1.000) = 9,199 = 9,2 ms

Result: 9,2 ***ms***

Zone 3:

9 + ((0,1 MB / 256 MB/s) * 1.000) = 9,39 ms

Result: 9,39 ***ms***

5.4 The average time to read a 100 kB file stored in randomly distributed sectors of cylinders located in zone 0. Assume the average seek time within a given zone is the average seek time divided by the number of zones, i.e., 6 / 4 = 1.5 ms.

100kB / 512B = 196 sectors

9 + 195 * (1,5 + 3) + 196 * (512 B / 500,32 MB/s) = 886,5 ms

Result: 886,5 ***ms***

5.5 The time for reading a 10,000 MB file, assuming it is **optimally** stored in zone 0 (with all the optimisations described in Section 4).

10.000 MB / 512B = 19.531.250 sectors / (5.860 * 4)= 834 cylinders

9 + 19.531.250 * (6 / 5.860) + (834 * 0,6 ms) = 20.506,667 ms

Result: 20.506,67 ***ms***