

Deliverable: Magnetic discs

Submission form

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Exercise 1

A file takes **2,157,969,408** 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	2,157,969.41 <i>kB</i> 2,157.97 <i>MB</i> 2,16 <i>GB</i>
With binary prefixes	2,106,192 <i>KiB</i> 2,056 <i>MiB</i> 2 <i>GiB</i>

Exercise 2

A given hard disk has 2 sides and a linear track density of 550,000 tpi. The innermost diameter is 0.6", and the outermost is 1.75".

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

$$\text{Radio interno: } 0.6 / 2 = 0.3 \text{ in}$$

$$\text{Radio externo: } 1.75 / 2 = 0.875 \text{ in}$$

$$\text{Área Util} = \pi \times (0.875^2 - 0.3^2) = 2.122 \text{ in}^2$$

$$\text{Área total} = 2 \times 2.122 = 4.244 \text{ in}^2$$

Result: 4.244T in^2

2.2 How many cylinders and tracks does the disk contain?

$$\text{Tracks} = 550000 \times (0.875 - 0.3) = 316250$$

$$\text{Cylinders} = 316250$$

$$\text{Total Tracks} = 2 \times 316250 = 632500$$

Result: 316250 cylinders, and 632500 tracks

Exercise 3

Calculate the capacity of the disk of exercise 2 assuming CAV format with 400 sectors/track and a sector size of 4096 bytes.

$$\text{Capacidad} = \text{Total Tracks} \times \text{Sectors per Track} \times \text{Sector Size}$$

$$\text{Capacidad en bytes} = 632500 \times 400 \times 4096 = 1034240000000 = 1.03424 \text{ TB}$$

Result: 1034240000000 *Bytes*

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

$$\text{Densidad area GB / in}^2 = 8273.92 / 4.60125 = 1798.42 \text{ Gb / in}^2$$

$$\text{En Mb / in}^2 = 1798420$$

Result: 1798420 *Mb/in²*

Result: 1798.42 *Gb/in²*

Exercise 4

Calculate the capacity of the disk of exercise 2, assuming a linear density of 550,000 tpi and ZCAV format with the following distribution of sectors of 4096 bytes.

Zone	Limits (ID – OD)	Sectors/track
0	1.4625" – 1.75"	1500
1	1.175" – 1.4625"	1000
2	0.8875" – 1.175"	700
3	0.6" – 0.8875"	400

Calculate the capacity of the disk.

$$\text{Zona 0} = (1.75 - 1.4625) \times 550000 = 0.2875 \times 550000 = 158125 \text{ pistas}$$

$$\text{Zona 1} = (1.4625 - 1.175) \times 550000 = 0.2875 \times 550000 = 158125 \text{ pistas}$$

$$\text{Zona 2} = (1.175 - 0.8875) \times 550000 = 0.2875 \times 550000 = 158125 \text{ pistas}$$

$$\text{Zona 3} = (0.8875 - 0.6) \times 550000 = 0.2875 \times 550000 = 158125 \text{ pistas}$$

$$\text{Sectores totales} = 569250000 \text{ sectores, } \times 2 \text{ caras} = 1138500000 \text{ sectores}$$

$$1138500000 \times 4096 = 4.662 \times 10^{12} \text{ B} \rightarrow \text{GB} = ((4.662 \times 10^{12}) / 10^9) = 4662 \text{ GB}$$

Result: 4662 GB

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

$$((3.025 \times 10^{11}) / 10^6) = 302500 \text{ Mb/in}^2$$

Result: 302500 Mb/in²

Result: 302.5 Gb/in²

Exercise 5

Consider the disk described in exercise 4 rotates at 7,200 rpm. The average seek time is 9 ms, and the track-to-track seek time is 0.15 ms. Calculate:

5.1 The average access time.

$$60000 / 7200 \text{ rpm} = 8.33 \text{ ms} / 2 = 4.17 \text{ ms}$$

$$\text{Tiempo medio de acceso} = 9 + 4.17 = 13.17 \text{ ms}$$

Result: 13.17 ms

5.2 The internal transfer speed for each zone.

$$\text{Zona 0} = (1500 \times 4096 \times 120) / 1000000 = 737.28 \text{ Mb/s}$$

$$\text{Zona 1} = (1000 \times 4096 \times 120) / 1000000 = 491.52 \text{ Mb/s}$$

$$\text{Zona 2} = (700 \times 4096 \times 120) / 1000000 = 344.06 \text{ Mb/s}$$

$$\text{Zona 3} = (400 \times 4096 \times 120) / 1000000 = 196.61 \text{ Mb/s}$$

Results: **Zone 0: 737.28 MB/s Zone 1: 491.52 MB/s**

Zone 2: 344.06 MB/s Zone 3: 196.61 MB/s

- 5.3** The average time it takes to read a **150 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:

$$\text{Zona 0} = 737280000 / 1000 = 737280 \text{ bytes/ms}$$

Result: 737280 ms

Zone 3:

$$\text{Zona 3} = 196610000 / 1000 = 196610$$

Result: 196610 ms

- 5.4** The average time to read a 150 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., $9 / 4 = 2.25$ ms.

Tiempo total = Tbusqueda + Tlatencia + Ttransferencia

$$\text{Tiempo total} = 2.25 + 4.17 + 0.208 = 6.63 \text{ ms}$$

Result: 6.63 ms

- 5.5** The time for reading a 3,000 MB file, assuming it is **optimally** stored in zone 0 (with all the optimisations described in Section 4).

Tamaño del archivo: 3000 MB = $3000 \times 1024 \times 1024 = 3145728000$ bytes

$$\text{Tiempo de lectura} = 3145728000 / 73780 = 4.27 \text{ ms}$$

Result: 4.27 ms