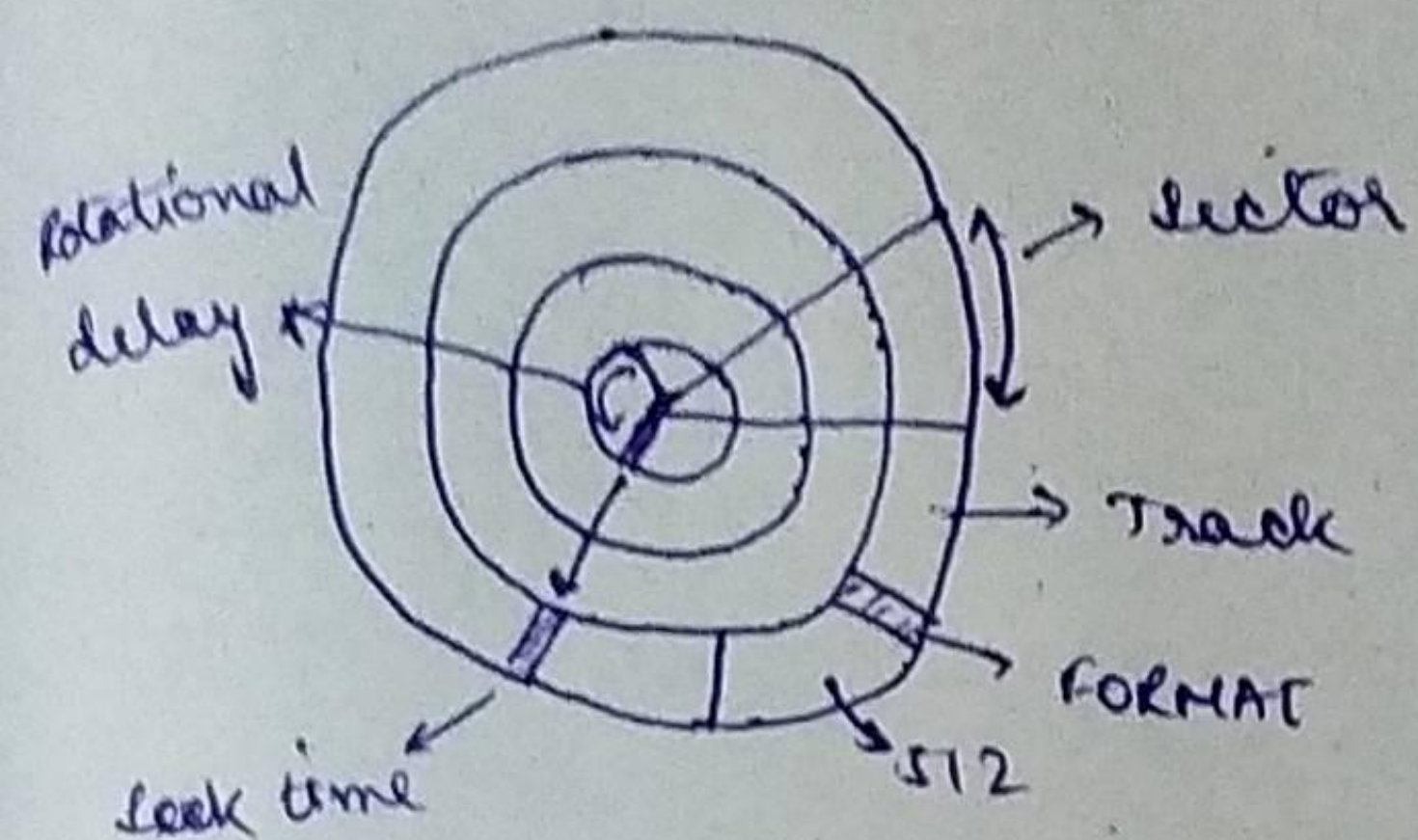


SECONDARY

MEMORY



Average Access Time

$$= \text{Seek Time} + \text{Rotational latency} + \text{data Transfer time} + \text{controller delay}$$

Q. Consider a disk pack with following specifications
16 surfaces, 128 track/surface, 256 sectors/track and
512 bytes/sector

→ a) what is the capacity of disk pack?

$$\text{Capacity} = 16 \times 128 \times 256 \times 512 = 2^{28} \text{ B} = 256 \text{ MB}$$

b) No. of bits required to address the sector.

$$\text{No. of sectors} = 16 \times 128 \times 256 = 2^{19} \text{ sectors}$$

$$\text{No. of bits required} = 19$$

c) The format overhead is 32 Bytes / sector. What is formatted disk space?

Formatted disk space

$$= \text{Total} - \text{Format area}$$

$$= 16 \times 128 \times 256 \times 512 - 16 \times 128 \times 256 \times 32$$

$$= 240 \text{ MB}$$

d) Let diameter of innermost track is 21 cm, what is the maximum recording density?

$$\text{Perimeter} = 2\pi r = \pi D = \frac{22}{7} \times 21 = 66 \text{ cm}$$

$$66 \text{ cm} \rightarrow 1 \text{ track capacity}$$

$$1 \text{ cm} \rightarrow \frac{1}{66} \text{ track}$$

$$C = \frac{1}{66} \times 256 \times 512 \text{ B/cm}$$

$$= \frac{128}{66} \text{ KB/cm} = 1.9 \text{ KB/cm}$$

e) disk is rotating at 3600 RPM, what is the data transfer rate!

$$\rightarrow D = \frac{\text{No. of bytes}}{\text{second}}$$

$$3600 \text{ rotations} \rightarrow 1 \text{ sec} = 60 \times 10^3 \text{ msec}$$

$$1 \text{ rotation} \rightarrow \frac{60000}{3600} = 16.66 \text{ msec}$$

$$16.66 \text{ msec} \rightarrow 1 \text{ track} = 16 \times 256 \times 512 \text{ B}$$

$$\text{Data Transfer Rate} = \frac{16 \times 256 \times 512 \times 1000}{16.66} = 125 \text{ Mbps}$$

f) Rotational speed is 3000 RPM & seek time is 11.5 msec.
What is average access time?

$$\rightarrow 3000 \text{ rotation} \rightarrow 1 \text{ sec} = 60000 \text{ msec}$$

$$1 \text{ rotation} \rightarrow 20 \text{ msec}$$

$$T_{\text{rotation}} = \frac{1}{2} \times 20 = 10 \text{ msec}$$

$$T_{\text{avg}} = T_{\text{rot}} + T_{\text{seek}} = 10 + 11.5 = 21.5 \text{ msec}$$

Q. A certain moving armed disk storage with one head has:-

No. of tracks / ~~each~~ surface = 200

disk rotation speed = 2400 RPM

track storage = 62500 B / track

avg latency = P msec

data rate = Q B/sec

what is P & Q?

$$\rightarrow 2400 \rightarrow 60000 \text{ msec}$$

$$1 \rightarrow \frac{60000}{2400} = 25 \text{ msec.}$$

$$P = \frac{1}{2} \times 25 = 12.5 \text{ msec. } \textcircled{\text{Ans}}$$

$$25 \text{ msec} \rightarrow 62500$$

$$1 \text{ sec} \rightarrow \frac{1000}{25} \times 62500 = 2.5 \times 10^6 \text{ B/sec}$$

$$Q = 2.5 \times 10^6 \text{ bits/sec. } \textcircled{\text{Ans}}$$

Q. A disk pack has 19 surfaces, inner diameter 22 cm & outer diameter 33 cm, Maximum storage density is 2000 bits/cm and minimum spacing is 0.25 mm.

a) What is the capacity of disk ~~pack~~ pack?

$$\rightarrow \text{ } \textcircled{\text{Ans}} \rightarrow P = \frac{22}{2} \times 22 = 69.14 \text{ cm.}$$

$$1 \text{ cm} \rightarrow 2000 \text{ bits}$$

$$69.14 \text{ cm} \rightarrow 2000 \times 69.14 \text{ bits.}$$

$$\text{Track capacity} = \frac{2000 \times 69.14}{8} \text{ Bytes} = 17.28 \text{ KB.}$$

$$\text{Width} = \frac{88 - 22}{2} = 5.5 \text{ cm}$$

$$\text{No. of track} = \frac{5.5 \text{ cm}}{6.25 \text{ mm}} = 220 \text{ tracks}$$

$$C = \frac{19 \times 220 \times 17.28}{2^{10}} = 70.5 \text{ MB.}$$

Q. A hard disk has 63 sectors/track, 10 platters each with 2 recording surface and 1000 cylinders. The address of a sector is given as $\langle c, h, s \rangle$ where

$c \rightarrow$ cylinder no., $h \rightarrow$ surface no.; $s \rightarrow$ sector no.

Thus the 0th sector is addressed as $\langle 0, 0, 0 \rangle$ &

1st sector is $\langle 0, 0, 1 \rangle$.

a) Address $\langle 400, 16, 29 \rangle$ correspond to sector —

$$400 \text{ cylinder} = 400 \times 2 \times 10 \times 63 \text{ sectors} = 504000$$

$$16 \text{ surfaces} = 16 \times 63 \text{ sectors} = 1008$$

$$\text{Sector no.} = 504000 + 1008 + 29 = 505037 \quad \text{Ans}$$

b) Address of 1039 sector is —

$$\# \text{ cyl} = \frac{1039}{(400 \times 2 \times 10)} = 0$$

~~# sector~~

$$\# \text{ surface} = \frac{1039}{63} = 16$$

$$\# \text{ sector} = 1039 - 16 \times 63 = 31$$

$$\text{Address} = \langle 0, 16, 31 \rangle \quad \text{Ans}$$