

Best Gate Questions

Q A disk has equidistant tracks. The diameters of the innermost and outermost tracks are 1 cm and 8 cm respectively. The innermost track has a storage capacity of 10 MB.

If the disk has 20 sectors per track and is currently at the end of the 5th sector of the innermost track and the head can move at a speed of 10 m/s and it is rotating at constant angular velocity of 6000 RPM, how much time will it take to read 10 MB contiguous data starting from sector 1 of the outermost track?

Sol

$$\text{Total time} = \text{seek time} + \text{Rotational Time} + \text{Transfer time}$$

(General way (best way))

⇒ Seek Time

Given Innermost track = 1 cm ~~diameter~~
 ie 0.5 cm radius

Outermost track = 8 cm diameter
 ie 4 cm radius



To go from innermost track to outer most track

Head should move a distance of

$$4 - 0.5 = 3.5 \text{ cm}$$

$$\therefore \text{speed of head} = 10 \text{ m/s}$$

For 1 sec $\rightarrow$ 10m

$\therefore$ 10m $\rightarrow$ 1 sec

10 x 100 cm $\rightarrow$ 1 sec

1 cm $\rightarrow \frac{1}{1000}$ sec = 1 msec

$\therefore$ 3.5 cm $\rightarrow$ 3.5 msec

$\therefore$ Seek Time = ~~3.5~~ 3.5 msec

$\Rightarrow$ Rotational Time (Time needed to put the moving head on desired sector)

Given Initially we are at end of 5th sector of innermost track i.e. at 6th sector starting.

If disk is Not rotating

then straightly go to 6th sector of outermost track then rotate the disk (Note: It should not move backward)

6-7, 7-8, 8-9, 10-11, 11-12, 12-13, 13-14,
14-15, 15-16, ... 3-4

i.e. It should cover 18 sectors

But It is Not like that, disk is rotating

So, While going from innermost sector to outermost sector, the disk will ~~move~~ rotated some part

How much?

6000 r $\rightarrow$ ~~60 sec~~ 60 sec

~~3.5 msec~~

$\therefore$ 1 r $\rightarrow$ 10 msec

$\therefore$ For 10 msec It can cover $\rightarrow$ 20 ~~sectors~~ sectors

i.e. 1 track

for 3.5 msec ~~1, 2, 3, 4~~ can cover

$$\frac{10'}{35} \times = \frac{20}{n}$$

$$n = 7$$

$\therefore 7'$ sector will be moved already

$\therefore$ Remaining are '11'

$\therefore$ For those 11 sectors

$$\text{Rotational time} = 11 \times 0.5 = 5.5 \text{ msec}$$

1 sector
rotation
time

$$\therefore \text{Rotation Time} = 5.5 \text{ sec}$$

$\Rightarrow$ Transfer time

Given

W.K.T

~~1 track~~

innermost

Given storage of 1 track = 10 MB

[all tracks are
same
 $\therefore$ angular velocity]

in 10 msec = 1 rotation $\xrightarrow{\text{covers}}$ 10 MB

$\therefore$ To cover 1 MB we need 1 msec

$$\therefore \text{Transfer Time} = 1 \text{ msec}$$

$$\therefore \text{Total time} = 3.5 \text{ msec} + 5.5 \text{ msec} + 1 \text{ msec}$$

$$= \boxed{10 \text{ ms}}$$