

ADB

Sh 1

Q. 13.23

$$\text{Block size (B)} = 512 \text{ B}$$

$$\text{interblock Gap size (G)} = 128 \text{ B}$$

$$\text{no blocks/track} = 20$$

$$\text{no tracks/surface} = 400$$

$$\text{no double-sided disks/Pack} = 15$$

$\leftarrow \text{Platter} \times 2 \rightarrow \text{no surfaces}$

$$\begin{aligned} \text{a) Total track size} &= \text{no blocks} \times (B + G) \\ &= 20 \times [512 + 128] = 12800 \text{ B} \\ &= 12.8 \text{ KB} \end{aligned}$$

$$\begin{aligned} \text{useful track size} &= \text{no blocks} \times B \\ &= 20 \times 512 = 10240 \text{ B} \\ &= 10.24 \text{ KB} \end{aligned}$$

$$\text{b) No of cylinders} = \text{no of tracks} = 400$$

$$\begin{aligned} \text{c) Total cylinder Cap} &= \text{Total track size} \times \text{no of surfaces} \\ &= 12.8 \times 30 = 384 \text{ KB} \end{aligned}$$

$$\begin{aligned} \text{useful cylinder Cap} &= \text{useful track size} \times \text{no cylinders} \\ &= 10.24 \times 30 = 307.2 \text{ KB} \end{aligned}$$

$$\begin{aligned} \text{d) Total disk Pack Cap} &= \text{Total cylinder Cap} \times \text{no cylinders} \\ &= 384 \text{ KB} \times 400 = 153.6 \text{ MB} \end{aligned}$$

$$\begin{aligned} \text{useful} &= \text{useful cylinder Cap} \times \text{no cylinders} \\ &= 307.2 \text{ KB} \times 400 = 122.88 \text{ MB} \end{aligned}$$

$$e) \text{ Rotational delay} = 2400 \text{ RPM} = \frac{1}{25} \text{ rot/ms}$$

$$\begin{aligned} * \text{ Transfer Rate (tr)} &= \text{Total track size} \times \text{time of one disk rev} \\ &= 12800 \times \frac{1}{25} = 512 \text{ b} \end{aligned}$$

$$\begin{aligned} * \text{ Block transfer rate (btt)} &= \text{Block size} / \text{tr} \\ &= 512 / 512 = 1 \text{ ms} \end{aligned}$$

$$\begin{aligned} * \text{ Average Rotational delay (rd)} &= \text{Rotational delay} / 2 \\ 1 \text{ rot} \rightarrow \text{max } 25 \text{ ms} &= 25 / 2 = 12.5 \text{ ms} \end{aligned}$$

$$\begin{aligned} * \text{ Bulk transfer rate (btr)} &= \text{tr} \times \frac{B}{B+G} = 512 \times \frac{512}{512+128} \\ &= 409.6 \text{ b/ms} \end{aligned}$$

$$f) \text{ Avg seek time (s)} = 30 \text{ ms}$$

$$\begin{aligned} \text{Avg time to locate \& transfer a block} &= s + \text{rd} + \text{btt} \\ &= 30 + 12.5 + 1 \\ &= 43.5 \text{ ms} \end{aligned}$$

$$\begin{aligned} g) * 20 \text{ incl blocks} &\Rightarrow 20 \times [s + \text{rd} + \text{btt}] \\ &= 20 \times [30 + 12.5 + 1] = 870 \text{ ms} \end{aligned}$$

$$\begin{aligned} * 20 \text{ Consecutive Blocks only once} \\ \text{Using double buffering} &\Rightarrow \overbrace{s + \text{rd}} + 20 \times \text{btt} \\ &= 30 + 12.5 + 20 \times 1 = 62.5 \end{aligned}$$

13.24 $\times \overbrace{20,000}^r$ records/file, \times records fixed length

record

↳ Name [30b], SSN [9b], Address [40b], Phone [9b],
Birthdate [8b], Sex [1b], Major [4b], Minor [4b]
Class Code [4b, int], Degree [3b] + 1 byte for delation

a) Record size (R) = $\sum \text{Fields} + 1 = 113b$

b) Blocking factor (bfr) = $\lfloor \frac{B}{R} \rfloor = \lfloor \frac{512}{113} \rfloor = 4$ records per block

no file blocks (b) = $\lceil \frac{r}{bfr} \rceil = \lceil \frac{20,000}{4} \rceil = 5000$ blocks
unspanned or f

c) Calc avg linear search time to find a record

\times we search on avg half file blocks = $\frac{5000}{2} = 2500$ blocks

(P) Consecutive blocks $\Rightarrow 5 + rd + 2500 * btt = 30 + 12.5 + 2500 * 1$
 $= 2542.5 \text{ ms}$

(C) Scattered blocks $\Rightarrow 2500 * [5 + rd + btt] = 108.75 \text{ sec}$

d) $\circ\circ$ ordered by SSN \rightarrow Binary search

$\Rightarrow \lceil \log_2 b \rceil * \underbrace{[5 + rd + btt]}_{\text{Access time}}$

$\Rightarrow \lceil \log_2 5000 \rceil * [30 + 12.5 + 1] = 0.5655 \text{ sec}$

13.25 [0.8 has Phone, 0.15 has Minor
0.85 -- Major, 0.9 has Degree

* Variable length record

* Each record \rightarrow 1-byte for each field.
 \rightarrow 1-byte for deletion.
 \rightarrow 1-byte for end-of-record

* Spanned record organization, block has 5-bytes ptr to the next block

\rightarrow not a record storage

a) Avg record length?

$$* R_{\text{fixed}} = [30+1] + [9+1] + [40+1] + [8+1] + [1+1] + [4+1] + 1 + 1 = 100 \text{ bytes}$$

$$* R_{\text{variable}} = [9+1] * 0.8 + [4+1] * 0.85 + [4+1] * 0.15 + [3+1] * 0.9 = 16.6 \text{ bytes}$$

$$* \text{Avg record size } R = R_{\text{fixed}} + R_{\text{var}} = 100 + 16.6 = 116.6 \text{ bytes}$$

$$* \text{Total bytes needed for file} = V * R = 20,000 * 116.6 = 2332000 \text{ Bytes}$$

b) Number blocks for the file?

* \because 5 bytes are Pointers, only 507 [512-5] are for storage

$$* \text{The no. of blocks } (b) = \left\lceil \frac{V * R}{B - 5} \right\rceil = 4600 \text{ blocks}$$

Recall: We needed 5000 blocks for the fixed-length unspanned records

13.26 $S = 20ms$, $rd = 10ms$, $btt = 1ms$, $B = 2400b$
 $G = 600$

* SSN [9b], LastName [20b], FirstName [20b]
 Middle Init [1b], birthDate [10b], Address [35b] 1 del
 Phone [12b], Super [9b], Depart [4b], Job [4b] + Byte

* $V = 30,000$ records, Fixed-length, unspanned blocking

a) $R = \sum \text{fields} + 1 = 125 \text{ Bytes}$

$bfr = \lfloor B/R \rfloor = \lfloor 2400/125 \rfloor = 19 \text{ Records/block}$

$b = \lceil r/bfr \rceil = \lceil 30000/19 \rceil = 1579 \text{ blocks}$

b) wasted space/block = $B - (R * bfr) = 2400 - (125 * 19)$
 $= 25 \text{ Bytes}$

c) $tr = B/btt = 2400/1 = 2400 \text{ bytes/ms}$

d) i) Search on key field \rightarrow if record is found = $b/2 = \frac{1579}{2}$ blocks
 avg no. of blocks \rightarrow if not found = $b = 1579$

ii) Search on non-key \rightarrow all blocks are read = $b = 1579$ blocks

e) to read n -consecutive blocks

$t = S + rd + (n * btt)$
 $\rightarrow n = b/2 \rightarrow 30 + \frac{1579}{2} * 1 = 819.5 \text{ ms}$
 $\rightarrow n = b \rightarrow 30 + 1579 * 1 = 1609 \text{ ms}$

$$f) t = n * [s + rd + btt] \quad \begin{matrix} \nearrow n = b/2 = 24.475 \\ \searrow n = b = 48.949 \end{matrix}$$

$$g) t = \lceil \log_2 b \rceil * [s + rd + btt]$$

$$= \lceil \log_2 1579 \rceil * [20 + 10 + 1] = 11 * 31 = 0.341 \text{ sec}$$