

## Exercise 2.

Thursday 21<sup>st</sup> April 2022.

1) What is useful capacity of a track in bytes? What's capacity of each surface?

$$\begin{aligned}\text{capacity of a single track} &= \text{no of blocks in track} \times \text{block size} \\ &= 50 \times 512 = 25600 \text{ bytes} \\ &= 25600 / 1000 = 25.6 \text{ kb}\end{aligned}$$

$$\begin{aligned}\text{capacity of a single surface} &= \text{no of tracks per surface} \times \text{track size} \\ &= 2000 \times 25.6 \text{ kb} \\ &= 51200 \text{ kb}.\end{aligned}$$

2) What is capacity of a disk?

$$\begin{aligned}\text{capacity of disk (double-sided)} &= \text{no of sides of disk} \times \text{surface size} \\ &= 2 \times 51200 \\ &= 102400 \text{ kb}.\end{aligned}$$

How many cylinders does disk have?

$$\begin{aligned}\text{no of tracks} &= \text{no of cylinders} \\ &= 2000.\end{aligned}$$

3) Examples of valid block sizes. Is 256 bytes a valid block size? 2048? 51200?

Block size ranges from 512 bytes - 4096 bytes

Hence the valid block size is 2048.

If the disk rotates at 5400rpm, maximum rotational delay?

$$\begin{aligned}5400 \text{ rotations} &- 60000 \text{ ms} = 1 \times 60000 \\ 1 \text{ rotation} &- ?\end{aligned}$$

$$\begin{aligned}&= \frac{60000}{5400} \\ &= \frac{100}{9} = 11.11 \text{ s}\end{aligned}$$

$$\begin{aligned}\text{rotation delay} &= \text{half a revolution} = 11.11 / 2 = 5.55 \text{ ms} \\ &= \underline{5.56 \text{ ms}}\end{aligned}$$

f) One track transferred per revolution, transfer rate?

$$\text{transfer rate} = \frac{\text{total track size}}{\text{time for one rotation.}}$$

$$= \frac{25600 \text{ bytes}}{11.11 \text{ ms}} = 2304.23 \text{ bytes/ms.}$$



### Exercise 3

File has  $r = 10000$  student records of fixed length.

Each record: Name (60 bytes), SSN (10 bytes), Address (30 bytes), Phone (5 bytes), Birth-date (4 bytes), Sex (1 byte), Major-dept-code (4 bytes), Minor-dept-code (4 bytes), Class-code (6 bytes), Integer and degree-prog (10 bytes), additional byte as a deletion marker.

a) Calculate record size  $R$  in bytes.

$$\begin{aligned} & (60 + 10) + (30 + 5 + 4 + 1) + 4 + (4 + 6 + 10) + 1 \\ &= 70 + 40 + 20 + 5 \\ &= 110 + 25 = 135 \text{ bytes.} \end{aligned}$$

b) Calculate blocking factor  $bfr$ , and no file blocks  $b$  assuming unspanned organization.

$$bfr = \frac{B}{R} = \frac{512}{135} = 3 \text{ blocks}$$

$$b = \text{ceiling} \left( \frac{r}{bfr} \right) = \frac{10000}{3} = 3333 \text{ blocks.}$$

c) Average time it takes to find a record by linear search on the file if records are contiguous (access time for linear search  $b/2$ )

$$\frac{3333}{2} = 1666.5 \text{ ms}$$

d) Assume file is ordered by SSN, by doing a binary search, calculate time it takes to search record by SSN (access time for binary search  $\log_2 b$ )

$$\log_2(3333) = 3 \text{ ms}$$