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HMWK 7

1. Consider a hard disk with the following specifications.

* 6000 RPM
* 32 double-sided platters
* # of cylinders = 128
* B (block size) = 2 megabytes (2 MB)
* # of blocks per track = 64
* average seek time = 15 ms
* assume no interblock gap and 0 microcontroller overhead

A. total capacity of one track

T = 64 \* (2MB + 0)

= 128 MB

B. total capacity of one cylinder

32 \* 2 \* 128MB = 8192 MB

=> 8.192 GB

C. total capacity of this disk

128 \* 2= 256 MB

= 256 MB

D. time to read one track

6000 RPM / 60 min => 100

=> 100 / 1000

=> 1 rotation / 10ms

= 10ms

E. transfer rate in bytes/msec

64 \* 2 MB = 128 MB

6000 RPM/ 60 min => 1 rotation / 10 ms

tr = track size / time for one disk revolution = 128 MB / 10 ms => 1.28^8 bytes / 10 msec

= 1.28 ^ 7 bytes / msec

F. block transfer time (transfer only)

btt = B/tr = 2MB / 1.28^7 bytes/msec => 2^6 / 1.28^7

= .156 msec

G. bulk transfer rate

btr = tr \* (B/(B+G))

= 1.28^7 bytes/msec \* (2MB/ (2MB + 0))

= 1.28^7 bytes/ msec \* 1MB => 1.28^7 bytes/msec

H. time to read 5 adjacent blocks

TTR = seek + rotational delay + time to transfer 1 block + overhead

= 15ms + 5ms + .156ms + 0 => 20.156ms \* 5 => 100.78 msec = 1 sec

2. A file has r = 20,000 EMPLOYEE records of fixed length stored in a disk with the following disk parameters:

- B (block size) = 1024 bytes

- btr (bulk transfer rate) = 896 bytes/msec

- latency (rotational delay) = 5ms

- btt (block transfer time) = 1ms

- seek time = 10 ms

- microcontroller overhead = 2ms

Each record has the following fields:

- name: 64 bytes

- ssn: 9 bytes

- address: 128 bytes

- phones : 10 bytes

- birthdate: 8 bytes

- sex: 1 byte

- an additional byte is used as a deletion marker for each record (to indicate this record as deleted)

A Calculate the record size R in bytes

R = 64 + 9 + 128 + 10 + 8 + 1 + 6 =226 bytes

B Calculate the blocking factor bfr and the # of file blocks b, assuming an unspanned organization

bfr = B/R = 1024/226 = floor(4.53) = 4

b = r/bfr = 20000/4 = 5000

C. What is the wasted space (internal fragmentation) in each block?

B - bfr \* R = 1024 - 4 \* 226 = 230520 bytes = 230.52 KB

D. Calculate the average time it takes to find a record by a linear search on the file if the file blocks are stored contiguously

Linear search only uses half of the file blocks => 5000/2 = 2500

s + rd + (2500 \* (B/btr)) = 10 + 5 + (2500 \* (1024 / 896)) = 2872.14 msec

= 2.87 sec

E. Calculate the average time it takes to find a record by a linear search on the file if the file blocks are not stored contiguously

2500 \* (s + rd + btt) = 2500 \* (10 + 5 + 1) = 40000 msec

= 40 sec

F. Calculate the worst time it takes to find a record by ssn if the file is ordered by ssn