

Tutorial 4

Question 1 Consider a file which has $N = 20000$ STUDENT records. Each record has the following fields:

NAME (30 bytes), SSN (9 bytes), ADDRESS (40 bytes), PHONE (9 bytes), BIRTHDATE (8 bytes), SEX (1 byte), MAJORDEPTCODE (4 bytes), MINORDEPTCODE (4 bytes), CLASSCODE (4 bytes), and DEGREEPROGRAM (3 bytes)

Now suppose that only 80% of the STUDENT records have a value for PHONE, 85% for MAJORDEPTCODE, 15% for MINORDEPTCODE, and 90% for DEGREEPROGRAM, and we use a variable-length record file. Each record has a 1-byte field type for each field occurring in the record, plus a 1-byte deletion marker and a 1-byte end-of-record marker. Suppose we use a spanned record organization, where each block is of size 512 bytes and has a 5-byte pointer to the next block (this space is not used for record storage).

- A. Calculate the average record length R in bytes.
- B. Calculate the number of blocks b needed for the file.

Question 2 Suppose that a disk has the following parameters:

- Seek time (s) = 20 msec
- Rotational delay (rd) = 10 msec
- Block transfer time (btt) = 1 msec
- Block size (B) = 2400 bytes

An EMPLOYEE file has the following fields:

SSN (9 bytes), LASTNAME (20 bytes), FIRSTNAME (20 bytes), MIDDLE INIT (1 byte), BIRTHDATE (10 bytes), ADDRESS (35 bytes), PHONE (12 bytes), SUPERVISORSSN (9 bytes), DEPARTMENT (4 bytes), JOBCODE (4 bytes), deletion marker (1 byte).

The EMPLOYEE file has $N = 30000$ records, fixed-length format, and unspanned blocking. Write down appropriate formulas and calculate the following values for the above EMPLOYEE file:

- A. Calculate the record size R (including the deletion marker), the blocking factor bfr , and the number of disk blocks b needed for the file.

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- B.** Calculate the wasted space in each disk block because of the unspanned organization.
- C.** Calculate the transfer rate tr .
- D.** Calculate the average number of block accesses needed to search for an arbitrary record in the file, using linear search.
- E.** Calculate the average time in msec needed to search for an arbitrary record in the file, using linear search, if the file blocks are stored on consecutive disk blocks.
- F.** Calculate the average time in msec needed to search for an arbitrary record in the file, using linear search, if the file blocks are not stored on consecutive disk blocks.
- G.** Assume that the records are ordered via some key field. Calculate the average number of block accesses and the average time needed to search for an arbitrary record in the file, using binary search.