

# PRACTICE PROBLEM SET #7

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CSC 261/461 (Database Systems), Spring 2018,  
University of Rochester  
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## Sections to study

### Chapter 16

- 16.1
- 16.2 (16.2.1, 16.2.2)
- 16.3
- 16.4
- 16.5
- 16.6
- 16.7
- 16.8 (Skip 16.8.3)

### Chapter 17

- 17.1
- 17.2
- 17.3 (17.3.1, 17.3.2)

(Note: You need to study sections marked in red thoroughly. Other sections are important for comprehension. The sections that are not included can be skipped (but not recommended))

## Problems

### Chapter 16

#### Problem 1

Consider a disk with the following characteristics (these are not parameters of any particular disk unit): block size  $B=512$  bytes, interblock gap size  $G=128$  bytes, number of blocks per track=20, number of tracks per surface=400. A disk pack consists of 15 double-sided disks.

- What is the total capacity of a track and what is its useful capacity (excluding interblock gaps)?
- How many cylinders are there?
- What is the total capacity and the useful capacity of a cylinder?
- What is the total capacity and the useful capacity of a disk pack?
- Suppose the disk drive rotates the disk pack at a speed of 2400 rpm (revolutions per minute); what is the transfer rate in bytes/msec and the block transfer time btt in msec? What is the average rotational delay  $rd$  in msec?

- (f) Suppose the average seek time is 30 msec. How much time does it take (on the average) in msec to locate and transfer a single block given its block address?
- (g) Calculate the average time it would take to transfer 20 random blocks and compare it with the time it would take to transfer 20 consecutive blocks using double buffering to save seek time and rotational delay.

### Problem 2

A file has  $r=20,000$  STUDENT records of fixed-length. 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, integer), and DEGREEPROGRAM (3 bytes). An additional byte is used as a deletion marker. The file is stored on the disk whose parameters are given in Problem 1 .

- (a) Calculate the record size  $R$  in bytes.
- (b) Calculate the blocking factor  $bfr$  and the number of file blocks  $b$  assuming an unspanned organization.
- (c) Calculate the average time it takes to find a record by doing a linear search on the file if
  - (i) the file blocks are stored contiguously and double buffering is used, and
  - (ii) the file blocks are not stored contiguously.
- (d) Assume the file is ordered by SSN; calculate the time it takes to search for a record given its SSN value by doing a binary search.

### Chapter 17

Study all the examples (Examples 1-7 + Examples of Insertion into and Deletion from B+ trees from the textbook)