CS 405G: Introduction to database systems
Assignment 5

Out: Nov 17th
Due: Dec 1st

Submission instructions: Please try to prepare the assignment in word. Print and bring them to class on the due date. Put the course number and your name at the top left corner of the first page of your homework. Please follow the rules in the course syllabus regarding late homework and plagiarism.

Problem 1. Consider a disk with block size B=512 bytes. A block pointer is P=6 bytes long, and a record pointer is R =7 bytes long. A file has r=300,000 EMPLOYEE records of fixed-length. Each record has the following fields: NAME (30 bytes), SSN (9 bytes), DEPARTMENTCODE (9 bytes), ADDRESS (40 bytes), PHONE (9 bytes), BIRTHDATE (8 bytes), SEX (1 byte), JOBCODE (4 bytes), SALARY (4 bytes, real number). An additional byte is used as a deletion marker.

(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 where records are not allowed to cross block boundaries.

(c) Suppose the file is ordered by the key field SSN and we want to construct a **primary index** on SSN. Calculate
> (i) the index blocking factor bfr i (which is also the **index fan-out**);
> (ii) the number of first-level index entries and the number of first-level index blocks;
> (iii) the number of levels needed if we make it into a multi-level index;
> (iv) the total number of blocks required by the multi-level index; and
> (v) the number of block accesses needed to search for and retrieve a record from the file--given
its SSN value--using the primary index.

Problem 2. A PARTS file with Part# as key field includes records with the following Part# values: 23, 65, 37, 60, 46, 92, 48, 71, 56, 59, 18, 21, 10, 74, 78, 15, 16, 20, 24, 28, 39, 43, 47, 50, 69, 75, 8, 47, 33, 38.

(a) Suppose the search field values are inserted in the above given order in a **B + -tree** of order with maximum **fan-out** size as 4, show how the tree will expand and what the final tree looks like. **Please note that the final tree is dependent upon the order of the values being inserted.**

(b) Suppose parts # 8, 10, 15, 16, 20, 24 have to be deleted from the tree, show how the tree will shrink and what the final tree looks like.