**Homework: Indexing Exercises**

**Q1:** Consider a disk with block size B=512 bytes and a record pointer is P R =7 bytes long.

A file has r=30,000 EMPLOYEE records of fixed-length. Each record has the following fields: NAME (30 bytes), SSN (9bytes), 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.

1. Calculate the record size R in bytes.
2. Calculate the blocking factor bfr and the number of file blocks b assuming an unspanned organization.
3. Suppose the file is ordered by the key field SSN and we want to construct a primary index on SSN. Calculate:
4. the index blocking factor bfr i (which is also the index fan-out fo);
5. the number of index entries and the number of index blocks;
6. the number of block accesses needed to search for and retrieve a record from the file given its ssn value using primary index
7. Suppose we want to construct a multi-level index on ID field; calculete
8. the number of levels needed if we make it into a multi-level index;
9. the total number of index entries and number of blocks required by each level,
10. the total number of block required for multi-level index, and
11. the number of block accesses needed to search for and retrieve a record from the file--given its SSN value--using multi-level index.

**Q2:** Suppose we construct B+ index on ID and order of tree is 100. calculate

1. What is the maximum capacity of 4 level B+ tree?
2. How many block accesses needed to search for and retrieve a record from the file--given its SSN value—using the above 4 level B+ tree.

**Q3:** Suppose that a page can contain at most four data values and that all data values are integers. Using only B+ trees of order 5, give examples of each of the following:

1. A B+ tree whose height changes from 2 to 3 when the value 25 is inserted. Show your structure before and after the insertion.
2. A B+ tree in which the deletion of the value 25 leads to a redistribution. Show your structure before and after the deletion.
3. A B+ tree in which the deletion of the value 25 causes a merge of two nodes but without altering the height of the tree.