1. Suppose we have a B+ tree index consisting of 50,000 entries. Only 30 such entries fit in a block. Create a multilevel index such that the highest level index fits in one block.

2. (a) Assume that an extendible hashed file has nine records with the following nine hashed addresses:
   1111 0101 1001 0101 0001 1111 1000 1101 0011
   Suppose that the nine records are entered in the above order, using the most significant bits to determine the directory address. Assuming that a bucket can hold at most two records each, give the resulting directory organization after all the records are inserted.
   (b) Will the directory structure be different if the records are inserted in a different order? Justify your answer.
   (c) If the record with hash value 1101 is deleted, what will be the resulting directory structure? Assume that the buckets are to be merged whenever possible to maximize bucket utilization.

3. Assume that each non-leaf node may contain up to 2 keys and 3 pointers, each leaf node may contain a maximum of 2 keys. Construct a B+ tree for the following set of keys: 110,50,445,325,230,135,119,88

4. Suppose that a page can contain at most four data values and that all data values are integers. Using only B+ tree of order 2, give examples of each of the following:
   (a) A B+ tree whose height changes from 2 to 3 when the value 25 is inserted. Show your structure before and after the insertion.
   (b) A B+ tree in which the deletion of the value 25 leads to a redistribution. Show your structure before and after the deletion.
   (c) 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.
   (d) An ISAM structure with four buckets, none of which has an overflow page. Further, every bucket has space for exactly one more entry. Show your structure before and after inserting two additional values, chosen so that an overflow page is created.

5. Consider the Linear Hash entries shown in Figure 1. Show the hash structure after inserting an entry whose hash value is 51. Assume that the buckets get split whenever an overflow page gets allocated.

6. Describe the commands that are used in PostgreSQL to create indexes.

7. What types of indexes are supported in PostgreSQL?

Please keep in mind:
- This assignment is to be done individually. The honor code is in effect.
- Assignments must be submitted by 5 p.m. on April 9, 2014 through RamCT.
- No late work will be accepted except in exigent situations.
- Your answers must be typed.
Figure 1: Figure for Question 5