ASSIGNMENT – I (UNIT – I)

1) a) Why it is difficult to adapt internal sorting methods for external sorting?
   b) Explain the need for external sorting.
   c) What is the key difference between Internal Sorting and External Sorting?
   d) What are the three factors contributing to the read/write time of a disk?

2) a) With a suitable example, show that fixed buffers per run are not enough for continued parallel operation in k-way merging.
   b) Suppose an external sorting method involves merging four runs of lengths 2, 4, 5, and 15 respectively. Present all possible ways of 2-way and 3-way merging for these runs and identify the merge with optimal performance.

3) a) Assume a list containing 4500 records is to be sorted using a computer with internal memory capable of sorting at most 750 records at a time and the input list is maintained on a disk that has block length of 250 records. For this scenario explain how external sorting may be performed to accomplish the task.
   b) Derive an expression for the total time required to perform the external sorting mentioned in the above question, with a detailed note on each operation.

4) a) Explain the steps in buffering algorithm for k-way merge with floating buffers?
   b) Show that Huffman function generates a binary tree of minimal weighted external path length?

5) a) What is k-way merging? What are the pros and cons of having higher k value? How to select a k value to maximize the performance?
   b) Present the algorithm for run generation using a looser tree.

ASSIGNMENT – II (UNIT – II)

1) a) Define a dictionary. Give few examples for dictionaries?
   b) Define the terms key density and loading density.
   c) What are collision and overflow w.r.to hashing?
   d) Define open addressing.

2) a) Show that the hash function *h(k)=k%17* does not satisfy the one-way property, weak collision resistance and strong collision resistance.
   b) Write and explain procedure to insert a dictionary pair into a dynamic hash table that uses a directory.

3) a) With suitable examples, explain about linear probing, quadratic probing and rehashing.
   b) Write and explain procedure to insert a dictionary pair into a dynamic hash table that uses a directory.

4) a) Write and explain procedure to delete a dictionary pair from a dynamic hash table that uses a directory.
   b) Let α=n/b be the loading density of a uniform hashing function h. Then derive expressions for the expected number of key comparisons Un and the average number of key comparisons Sn for linear open addressing and for chaining.

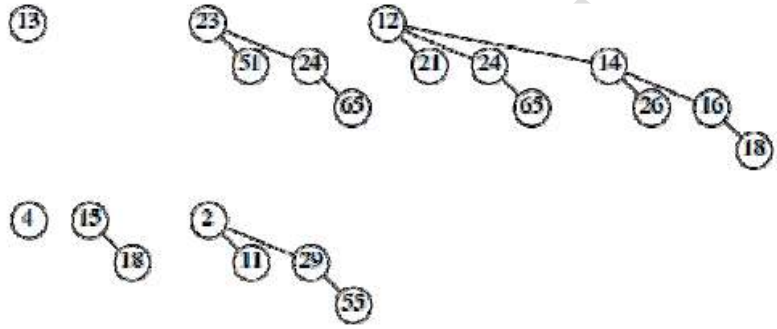
5) a) With suitable examples, discuss about the hash functions: mid-square, folding and digit analysis.
   b) Write and explain procedure to delete a dictionary pair from a directoryless dynamic hash table.

ASSIGNMENT – III (UNIT – III)

1) a) What is a max heap? What are its applications?
   b) How a priority queue is different from normal queues?
   c) Present the basic model of priority queues.
   d) How many trees will be there in a binomial queue of 30 elements?

2) a) Briefly discuss about different implementations of priority queues. Also compare those implementations w.r.to time complexities for basic priority queue operations.
   b) Insert the below list of elements into an initially empty Binomial Queue.
   3, 5, 1, 2, 13, 15, 11, 12, 21, 4, 7, 6

3) a) Write and explain buildHeap algorithm with an example. Also analyze its time complexity.
   b) Merge the two binomial queues given below. Then perform two deleteMin operations.



4) a) Explain the priority queue solution for event simulation problem.
   b) Create a heap from the following elements by inserting all of them at once using buidHeap algorithm: 4, 1, 3, 2, 16, 9, 10, 14, 8, 7.

5) a) Explain the procedure for deleteMin operation in Binomial Queues with an example.
   b) Show the result of inserting 10, 12, 1, 14, 6, 5, 8, 15, 3, 9, 7, 4, 11, 13, and 2 one at a time, into an initially empty binary heap.

ASSIGNMENT – IV (UNIT – IV)

1) a) What is rank of a node in a Red-Black tree?
   b) An extended binary search tree has 40 failure nodes. How many internal nodes does the tree have? Justify your answer.
   c) Define internal nodes and external nodes in an extended binary search tree.
   d) What is an AVL tree?

2) a) If T is a binary tree with n internal nodes, I is its internal path length and E is its external path length, then prove that $E = I + 2n$ for $n \geq 0$.
   b) Compare the worst case height of a red-black tree with n nodes and the worst case height of an AVL tree with same number of nodes.

3) a) In an initially empty AVL tree insert the following keys: DEC, JAN, APR, MAR, JUL, AUG, OCT, FEB, NOV. Draw AVL tree after every insertion and apply rotations where ever necessary.
   b) With suitable examples, explain the procedure for joining two red-black trees.

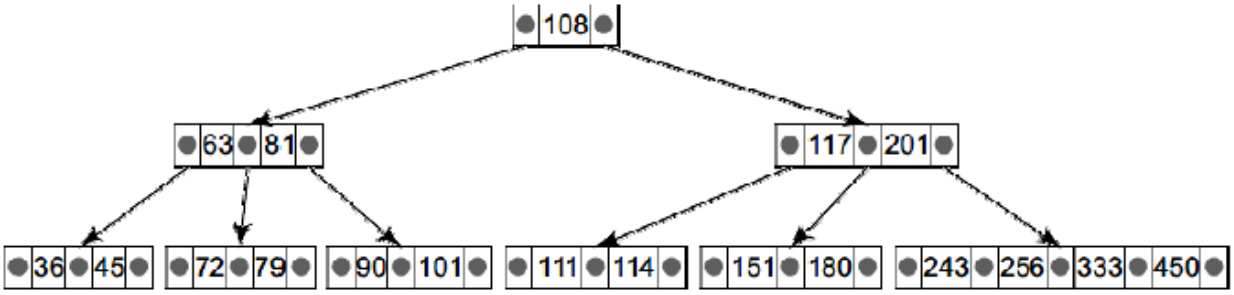
4) a) Construct Optimal Binary Search Tree for the key set (a1, a2, a3, a4) = (5, 10, 15, 20) with p1=1/20, p2=1/5, p3=1/10, p4=1/20, q0=1/5, q1=1/10, q2=1/5, q3=1/20 and q4=1/20.
   b) Briefly discuss about different cases of imbalance that might be caused by a red-black tree insertion and corresponding methods to rebalance the tree.

5) a) With suitable examples, explain different rotations associated with AVL tree insertion.
   b) Start with an empty red-black tree and insert the following keys in the given order: 15, 14, 13, 12, 11, 10, 9, 8, 7, 6. Draw the red-black tree after every insertion and apply rotations & recoloring where ever necessary.

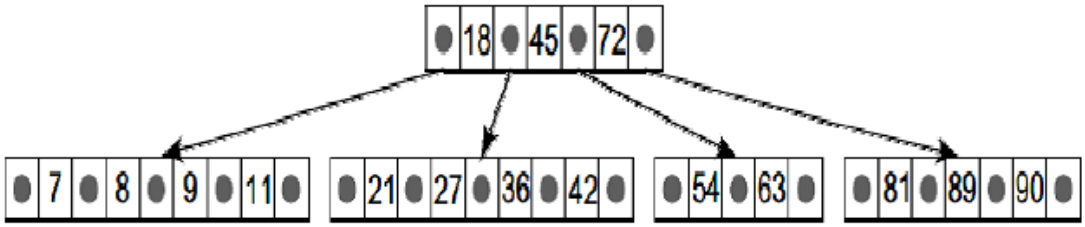
ASSIGNMENT – V (UNIT – V)

1) a) Define an m-way search tree.
   b) Define a B-tree.
   c) What is the maximum number of disk accesses required for B-tree deletion if its height is h and only one node can be retrieved at a time?
   d) Define a B+ tree.

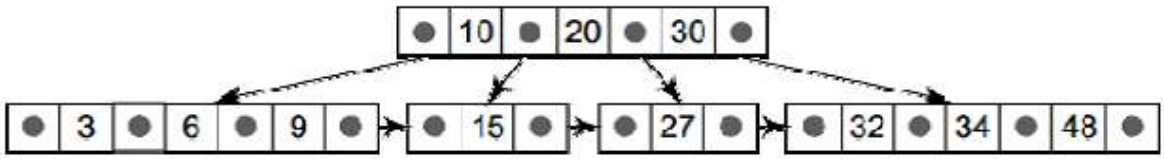
2) a) Give an analysis of the B-tree insertion process.
   b) One after the other delete the keys 201, 180 and 72 from the below B-tree of order 5.



3) a) Discuss the advantage of using m-way search trees over binary search trees.
   b) Identify the type of tree given below. Then insert 39 and 4 into the tree given below and perform necessary restructuring to balance the tree.



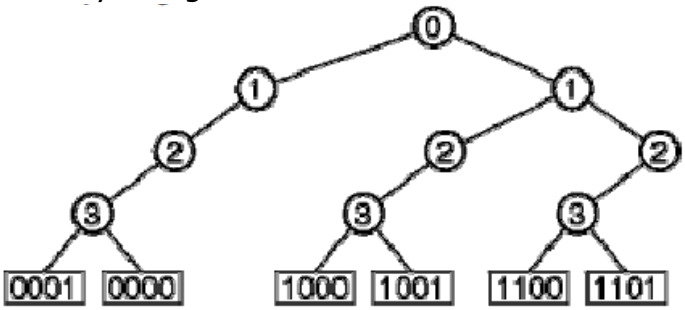
4) a) Provide high level description of algorithm for B-tree deletion.
   b) Identify the type of tree given below. Then insert 33 and 44 into the tree given below and perform necessary restructuring to balance the tree.



5) a) Compare and contrast B-trees and B+-trees.
   b) Create a B-tree of order 5 by inserting the following elements one after the other:
   3, 14, 7, 1, 8, 5, 11, 17, 13, 6, 23, 12, 20, 26, 4, 16, 18, 24, 25, and 19.

ASSIGNMENT – VI (UNIT – VI)

1) a) Compress the binary trie given below:



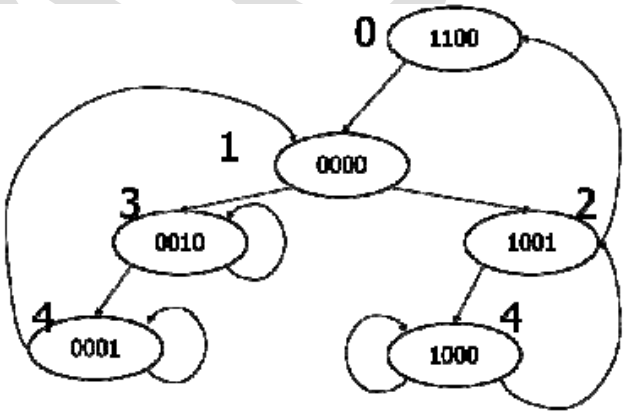
b) Expand and define the term PATRICA.
c) How searching in tries is different from search trees?
d) What is the benefit of compressed binary tries over normal binary tries?

2) a) Explain the procedure to convert a compressed binary trie into Patricia.
b) With an example, discuss about the structure and applications of fixed stride tries.

3) a) What are the limitations of digital search trees? How binary tries can overcome them? Explain about search, insert and delete operations in binary tries.
b) Create a multiway trie that stores names of months in the year. Then search for July and delete May.

4) a) In an empty digital search tree insert the following keys one after the other: 1000, 0010, 1001, 0001, 1100, 0000 and 0111. Then delete 0010.
b) With suitable examples, explain search, insert and delete operations in compressed tries with labeled edges.

5) a) Insert the keys 1010 and 0101 one after the other into the Patricia given below:



b) With suitable examples, explain search, insert and delete operations in compressed tries with skip fields.