Advanced Data Structures and Algorithms (CSPC-31)

B.Tech, 5th Semester (Computer Engineering)

MM.50

Note: Attempt all the questions.

Q1. a) If the height of AVL tree is *h*, then what will be the level of closest leaf? Justify it. (3)

b) What will the maximum height of AVL tree with *n* elements initially sorted in ascending order? If the order of elements is changed then, what will the effect on height? If it is changed or not. Justify. (3)

c) Will the root of Red-Black tree always be black after performing a deletion operation? Justify with an example. (4)

or

c) Suppose that node x is inserted into the red black tree and then it immediately deleted. Is the resulting red black tree is same as that of initial? Justify your answer. (4)

Q2. a) For Fib-Heap, write an algorithm for cut(H,x,y). Here x is the node in the child list of y. Mention its time complexity and justify. (5)

b) Show how do you decrease the key of a node in a Fibonacci heap in o(1) amortized time and how to delete any node from an n-node Fibonacci heap in O(D(n) amortized time. (5)

or

b) Prove that total number of nodes of binomial heap at depth is ${}^{k}C_{i}$ for i=0,1,...k. (5)

Q3. a) Write the algorithm for Rabin Karp matching and show that the worst case time complexity of the algorithm is O((n-m+1)m). (5)

b) Create a finite automaton to match the pattern ababc over the alphabet Σ={a,b,c} in the string x = caabaabcababababccb. (5)

Q4. a) What do you mean by reducibility? Reduce the Hamiltonian cycle problem to Hamiltonian path problem. (5)

b) Prove that the clique problem belongs to the class NP and also NP-Hard. (5)

or

b) The salesman wishes to make a tour, or Hamiltonian cycle, visiting each city exactly once and finishing at the city he starts from. There is an integer cost c(i, j) to travel from city i to city j, and the salesman wishes to make the tour whose total cost is minimum, where the total cost is the sum of the individual costs along the edges of the tour. Prove that the travelling salesman problem is NP-complete. (5)

Q5. a) Give the definition of a polynomial time approximation scheme (PTAS) for a maximization problem. (3)

b) What is set cover problem. Write the polynomial time approximation solution to the set cover problem. Also, mention its approximation ratio. (7)

or

b) What is weighted vertex cover problem? Write the approximation solution to the weighted vertex cover problem using linear programming. Also, mention its approximation ratio. (7)