Course Code : CST 314 **MQNR/MW – 19 / 9607**

Fifth Semester B. E. (Computer Science and Engineering) Examination

DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions carry equal marks.
(2) Solve any **Two** sub – questions from each question.
(3) Mention comments properly before writing the algorithms.

1. (a) Compute the following non – homogeneous recurrence and provide suitable bound :

$$t_n - 2t_{n-1} = (n + 5) \times 3^n \qquad n \geq 1$$ 5(CO1)

(b) With the help of substitution method, provide suitable bound for the following recurrence :

$$T(n) = 4T(n / 3) + n \log n$$ 5(CO1)

(c) Use a recursion tree to determine a good asymptotic upper bound on the following recurrence :

$$\mathbf{T(n) = T(n / 2) + n^2}$$

Use the substitution method to verify your answer. 5(CO1)

2. (a) State any two differences between accounting and aggregate methods. Compare these approaches for computing amortized cost per operation in n – incrementation of a k – bit binary counter. 5(CO1)

(b) Implement sorting and merging network on the following random sequence :

9 , 5 , 7 , 6 , 3 , 8 , 1 , 2

Also, list the importance of bitonic sorter in the process. 5(CO1)

(c) Implement heap sort on the following set of elements :

23 , 45 , 47 , 15 , 16 , 26 , 34 , 35 , 67

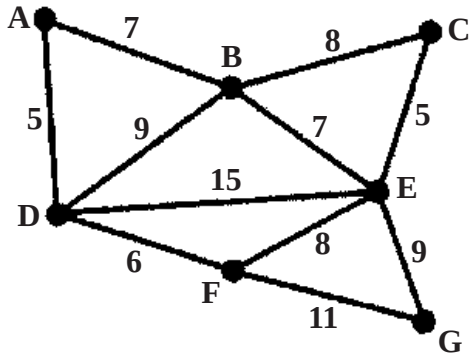
Also, derive the time complexity of the underlaying *adjust* alogirhtm in the heap sort process. 5(CO1)

3. (a) Implement Min–Max algorithm on the following data values and comment on depth of recursion and stack size required for execution.

[– 10 , 50 , 30 , 70 , 90 , – 40 , 150 , 20 , – 90 , 220]

Suggest mechanism to reduce the stack size. 5(CO2)

(b) Implement reverse delete algorithm to compute the minimum cost spanning tree on the following connected graph. How this approach is different than Krsukal's approach ?



5(CO2)

(c) Design the quick sort tree for following data and comment on depth of recursion.

[9 , 14 , 22 , 5 , 88 , 4 , 54 , 50 , 22]

Suggest approximate / randomized solution plan to reduce iteration cost. 5(CO2)

4. (a) Perform String Editing on the following set of string. Determine the total number of Insertion or Deletion operation required in conversion. Demonstrate it by creating editing matrix.

S1 : INTENSION

S2 : EXECUTION

Write the relation for cost [I , J] based on different conditions. 5(CO3)

(b) Propose a dynamic programming algorithm for computing Longest Common Subsequence for two strings. Implement the same on the following two strings : Write Algorithm.

S1 : POLYNOMIAL

S2 : EXPONENTIAL

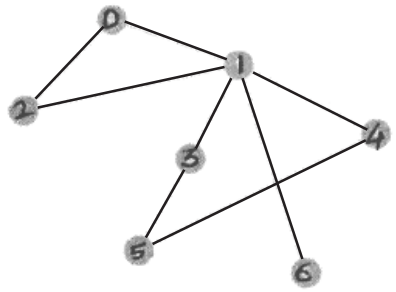
5(CO3)

(c) Compute the cost of optimal BST for the following instance using dynamic programming approach :

i	0	1	2	3	4
p_i		0.25	0.1	0.05	0.2
q_i	0.1	0.15	0.05	0.05	0.05

5(CO3)

5. (a) Compute the articulation points for the following connected graph. State the underlying algorithm.



5(CO3)

(b) Propose a backtracking formulation for graph coloring problem. Also, state the state space tree and solution space tree in the context of this problem. 5(CO3)

(c) Implement the sum of subset problem on the following instance using backtracking formulation :

$w = \{1 , 2 , 3 , 4 , 5 , 6 , 7 , 8\}$, and $m = 24$ 5(CO3)

6. (a) Write an algorithm for clique, reduce the algorithm to solve Vertex cover problem and Graph partitioned into rectangle problem. 5(CO4)

(b) Define independent set problem. Prove that it is an NP complete problem with the help of satisfiability problem. 5(CO4)

(c) Illustrate 2–approximation with the help of vertex cover problem. Also, state the underlying approximate algoirthm. 5(CO4)