Course Code : CST 307 **CXDW/RW – 18 / 5504**

Sixth 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) Solve the following recurrence using substitution method and generate suitable upper bound :

$T(n) = 2T(n/3) + cn \qquad n > 1, \quad T(1) = 1$ 5 (CO 1)

(b) Draw the recursion tree for the following recurrence and generate BigOh. Also, show that your provided bound is asymptotically tight :

$T(n) = 3T(n/3) + cn^2$ 5 (CO 1)

(c) Solve the following recurrence relation exactly for n a power of 2 subject to $T(1) = 1$:

$T(n) = 2T(n/2) + n/1gn \qquad n \geq 2$ 5 (CO 1)

2. (a) Implement aggregate method for computing the amortized cost for stack operations. How these costs are different from worst case time complexity ? 5 (CO 1)

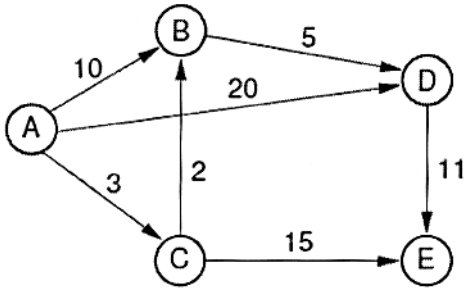
(b) Construct a min–heap from the following data. Also derive the time complexity of the underlying algorithm :

92, 24, 37, 40, 51, 65, 36, 31 5 (CO 1)

(c) What do you mean by bitonic sequence ? Implement the 8 – bit bitonic sorting network for the following sequence :

1, 1, 1, 0, 0, 0, 1, 1 5 (CO 1)

3. (a) Compute the shortest paths from source vertex A to all other vertices of the graph shown below. Use greedy approach.



5 (CO 2, CO 3)

(b) Propose KRUSKAL's algorithm for finding minimum cost spanning tree. Comment on the time and space complexity of the algorithm. Also, state any two applications of this algorithm. 5 (CO 2, CO 3)

(c) Implement the min – max algorithm on the following set of data using divide and conquer approach :

89, 78, 45, 56, 48, 59, 15, 26, 18, 19, 12 5 (CO 2)

4. (a) Implement the matrix chain multiplication on the following set of matrices using dynamic programming approach :

M1 (50 * 1), M2 (1 * 50), M3 (50 * 1), M4 (1 * 50) 5 (CO 2)

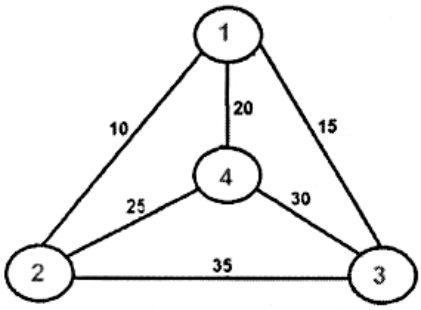
(b) Compute the edit distance for the following two strings using dynamic programming formulation :

String 1 : BDCABACC

String 2 : BCBDAB

Also, State the algorithm for the same. 5 (CO 2)

(c) For the graph shown below, compute optimal travelling cost of a salesman using dynamic programming approach. Use vertex 2 as source vertex.



5 (CO 2, CO 3, CO 5)

5. (a) Propose an algorithm to implement Graph Coloring using backtracking paradigm. Comment on the time and space complexity of algorithm. 5 (CO 2, CO 3, CO 5)

(b) Solve the sum of subset problem using backtracking formulation for the data shown below :

$n = 6$, $m = 35$ and $w = \{5, 10, 12, 13, 15, 18\}$

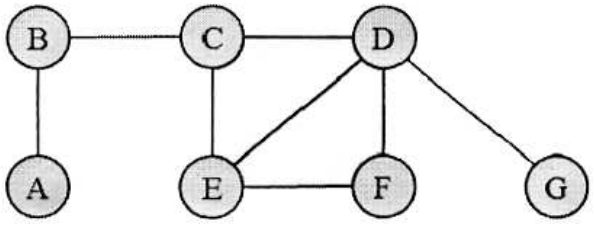
Also, provide two solutions for this problem. 5 (CO 2)

(c) Give any two solutions for 6 queen problem. Write the backtracking formulation for the same. 5 (CO 2, CO 5)

6. (a) Explain the non – deterministic machine with the help of three functions i.e. *Guess*, *Success* and *Failure*. Give an example. 5 (CO 4)

(b) Reduce independent set problem into a clique problem. Also, state the reduction time complexity. 5 (CO 4)

(c) Find the optimal vertex cover for the graph shown below :



Also, find the approximate vertex cover. 5 (CO 4)