2062
B.E. (Computer Science and Engineering)
Fourth Semester
CS-401: Analysis and Design of Algorithms

Time allowed: 3 Hours   Max. Marks: 50

NOTE: *Attempt* <u>*five*</u> *questions in all, including Question No. I which is compulsory and selecting two questions from each Section.*

x-x-x

1. (a) Describe substitution method with the help of an example.   [5 x 2 = 10]

   (b) Explain the time complexity of selection sort algorithm.

   (c) What are various elements of greedy strategy?

   (d) Explain general method of Backtracking.

   (e) What is Cook's Theorem?

SECTION – A

2. (a) Solve the following recurrences and justify your answers. Assume that T(n) is constant for n $\leq$ 2.   1. $T(n) = 16T(n/4) + n^2$ 2. $T(n) = T(n-1) + n$ [5]

   (b) Use divide and conquer strategy to illustrate the operation of merge sort on array A = (3, 41, 52, 26, 38, 57, 9, 49).   [5]

3. (a) Explain Strassen's matrix multiplication solution. Also perform its time and complexity analysis.   [5]

   (b) Suppose that the graph G = (V, E) is represented as an adjacency matrix. Give a simple implementation of Prim's algorithm for this case that runs in $O(V^2)$ time.   [5]

4. Write a short note on the following: [5 X 2 = 10]

   (a) Binary search   (b) Single source shortest path

SECTION – B

5. (a) What is LCS problem? Write an algorithm to compute length of an LCS. Use the same to determine the LCS of (1,0,0,1,0,1,0,1) and (0,1,0,1,1,0,1,1,0).   [4]

   (b) Let w = [5, 7, 10, 12, 15, 18, 20] and m = 35. Write an algorithm for sum of subsets problem and use the same to find all possible subsets of w that sum to m. Draw the portion of the state space tree that is generated.   [4,1,1]

6. (a) What is 0/1 knapsack problem? Explain its solution using dynamic programming.

[4]

(b) Explain N-Queen's problem using an example and solve the same using backtracking. Also perform the time and space complexity analysis of your solution. [4, 1,1]

7. (a) Explain Graph coloring problem. Using an example solve the same using backtracking. Also perform the time and space complexity analysis of your solution.

[1, 4, 1,1]

(b) Write a note on NP-Completeness and reducibility. [3]

x-x-x