2031
M.E. (Computer Science and Engineering)
First Semester
CS-8101: Advance Algorithms
(Common with ME Comp. Sci. Cyber Security)
(For UIET)

Time allowed: 3 Hours   Max. Marks: 50

NOTE: Attempt _five_ questions in all,   selecting atleast two questions from each Part.

x-x-x

Part- A

Q.1   Consider the following algorithm:

(a) If $f(n) = n!$ and $g(n) = 2n$, indicate whether $f = O(g)$, or $f = \Omega (g)$, or both $(f = \theta (g))$.
(b) What do you mean by dynamic programming?
(c) What is the time complexity of the matrix multiplication and Strassen's algorithm?
(d) List various applications of DFS and BFS.
(e) Distinguish between deterministic and non-deterministic algorithms.

[10 marks]

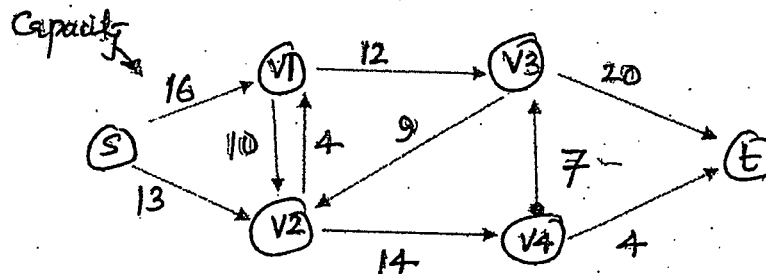Q.2   a) Solve the following Recurrences using Recursion-Tree Method.
       i. $T(n) = 2T(n/2) + n2$
       ii. $T(n) = T(n/3) + T(2n/3) + n$

b.) Why do we perform topological sorts only on DAGs? Explain.

[10 marks]

Q.3   a) Find the maximum flow for the following network using Ford Fulkerson algorithm:

b) Let S= {a,b,c,d,e,f,g} be a collection of objects with benefit-weight values as follows:
a: (12,4), b(10,6), c(8,5), d:((11,7)., e: (14,3), f: (7,1), g: (9,6). What is the optimal
solution to the fractional Knapsack problem for S assuming we have a sack that can hold
objects with total weight 18?

[10 marks]

Q.4

(a) State and Explain Strassen's Matrix Multiplication. Gives time complexity and
Recurrence relation for Strassen's Matrix Multiplication.

(b) Write an algorithm based on divide-and-conquer strategy to search an element in a given list. Assume that the elements of list are in sorted order.

|10 marks|

PART – B

Q.5 a). Explain steps to prove any problem as NP Complete problem.
b). Find a solution to the 4-Queens problem using backtracking strategy. Draw the solution space using necessary bounding function.

|10 marks|

Q.6 Explain string matching with finite automaton. Also, write the state transition diagram and the transition function δ for the string matching automaton that accepts all the strings containing the pattern 'a b a b a c a' and illustrate its operation on the text string 'a b a b a b a c a b a'.

|10 marks|

Q.7 What are non-deterministic problems? Describe in brief the characteristics of NP-hard and NP-complete problems? Write the non-deterministic algorithm for the Clique decision problem.

|10 marks|

Q.8 a). Differentiate the Depth first search and Breadth first search algorithms. How the traversal differs in the two cases? Show by means of an appropriate example.
b). Explain the following:
   i. Floyd-Warshall algorithm
   ii. Traveling salesperson problem

|10 marks|

x-x-x