Course Code : CST 314 **ITSJ/RW – 17 / 1054**

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) Solve the following recurrence using recurrence tree method :-

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

(b) Solve the following recurrence using substitution method :-

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

(c) Solve the following recurrence using master method :-

$T(n) = 2T(n/4) + n^{0.5} + 5$

Assume $T(4) = 1$ 5 (CO 1)

2. (a) Show the following Asymptotic notations :-

$T(n) = 4n^2 + 5n + 2$

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

(b) Describe various components involved in design of bio-tonic sorting networks. Implement bio tonic sorting on following set :

1, 1, 0, 0, 0, 0, 1, 1 5 (CO 3)

(c) Implement the Heap sort algorithm to sort the following array. Write various algorithms used in Heap Sort process :-

10, 7, 44, 56, 22, 19, 95 5 (CO 3)

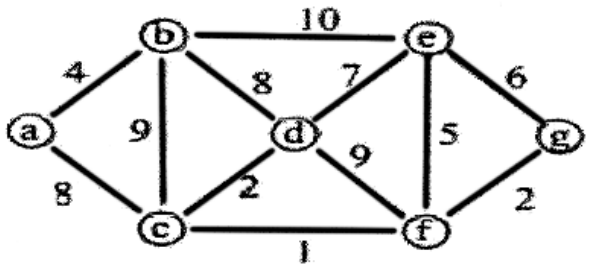
3. (a) Demonstrate the significance of Knapsack problem. Write the algorithm and complexity equation. Capacity = 16, n = 7

Object	1	2	3	4	5	6	7
Profit	12	8	15	20	9	11	7
Weight	5	3	2	4	2	5	2

5 (CO 2)

(b) Compute the minimum cost spanning tree using Prim's algorithm for the graph shown below :

Demonstrate the various versions of near array. Write any two applications of Prim's algorithm



5 (CO 2)

(c) Derive the complexity equation of Quick Sort in Average and Worst case. With suitable example, explain why it is called as "Advantage Sorting". 5 (CO 2)

4. (a) Design optimal binary search tree for following set of probabilities. Justify the correctness of solution :-

		K1	K2	K3	K4
Pi	–	0.15	0.10	0.15	0.20
Qi	0.10	0.10	0.05	0.05	0.10

Write any two applications 5 (CO 2, CO 3)

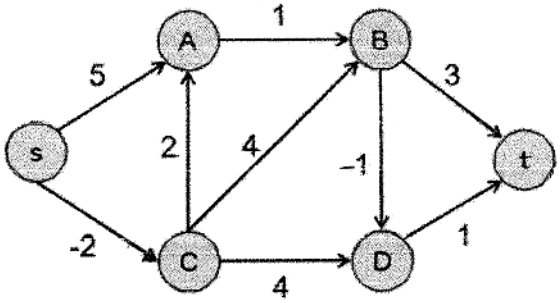
(b) An application requires to find out similar component of longest size between two data sets. Formulate a suitable strategy and algorithm and implement on following data set :-

Data Set 1 : E X T E N T S I O N

Data Set 2 : R E T E N S I O N

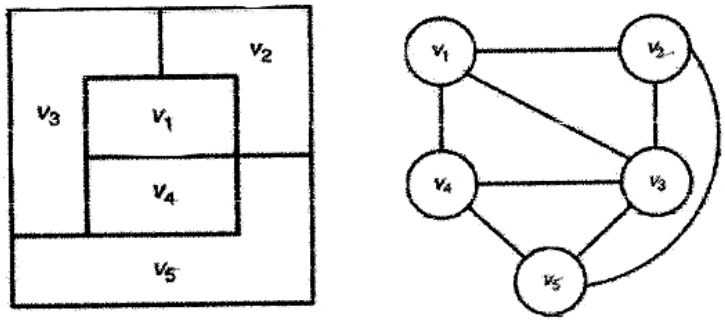
Also find second longest common component. 5 (CO 5)

(c) Implement Bellman Ford algorithm on the following graph. Explain significance of negative edges. Write four steps for computing distance matrix. Comment on size of matrix.



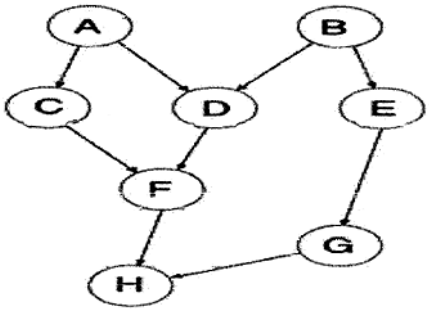
5 (CO 2, CO 5)

5. (a) Why backtracking is suitable to design solution for Graph Coloring problem? Design solution space tree for following graph :-



5 (CO 2, CO 3)

(b) Implement topological sorting on following graph and explain matrix logic to derive the sorted sequence.



5 (CO 3)

(c) Derive two solutions of 8 Queen problem. Illustrate with example, condition used to discard the cells of board. 5 (CO 2, CO 3)

6. (a) Define NP-Hard and NP-Complete. Using reduction principle, write algorithm for clique and graph partitioned in triangle problem. 5 (CO 4)

(b) Write a non-deterministic algorithm for sorting. Comment on complexity of algorithm. Prove P is subset of NP with suitable example. 5 (CO 4)

(c) Define approximation algorithm. Write an algorithm for "Vertex Cover problem" and prove approximation. 5 (CO 4)