Course Code : CCT 206 **QVRU/RS – 22 / 1165**

Fourth Semester B. Tech. (Computer Science and Engineering / Cyber Security) Examination

DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) Due credit will be given to neatness and adequate dimensions.

(2) Assume suitable data wherever necessary.

(3) Illustrate your answers wherever necessary with the help of neat sketches.

1. (a) Solve the recurrence relation using master method :

$$T(n) = 3T(n/4) + n\log n \qquad n > 1$$
$$= 1 \qquad n = 1$$

3 (CO 1)

(b) Show that the following equalities are correct :

(i) $35n^3 + n^2 = \theta(n^3)$

(ii) $33n^3/(\log n + 1) = O(n^3)$.

3 (CO 1)

(c) Solve the recurrence relation using substitution method :

$$T(n) = 4T(n/4) + n\log n \qquad n > 1$$
$$= 1 \qquad n = 1$$

4 (CO 1)

2. (a) Discuss the drawback of divide-conquer approach for matrix multiplication. Multiply the given matrices A and B using Stassen's matrix multiplication algorithm.

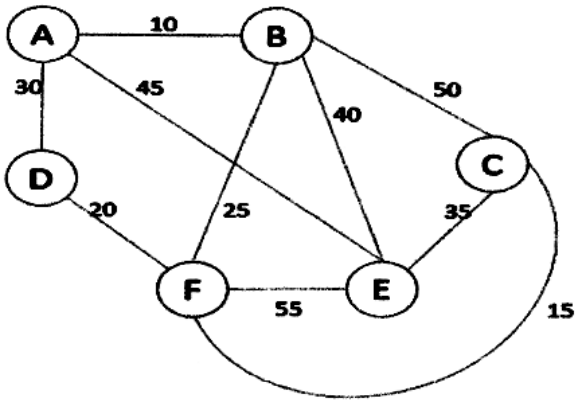
$$A = \begin{pmatrix} 1 & 3 \\ 5 & 7 \end{pmatrix} \qquad B = \begin{pmatrix} 8 & 4 \\ 6 & 2 \end{pmatrix}$$

5 (CO 2)

(b) Write the algorithm to show how the merge function merges the two sorted parts of the array A = [36 26 37 40 29 38 73 70 75 45]. The values of lower, middle and upper are 1, 5 and 10 respectively.

5 (CO 2)

3. (a) Find minimum length of cable required to connect all the locations in the below network by using Prims algorithm. Show the results of intermediate steps and also comment on complexity.



5 (CO 2)

(b) Find out the following for the given string :

"ABABBCCDDCCDDDCDDEEEEEEFFFFFFFFFFFFFEEE"

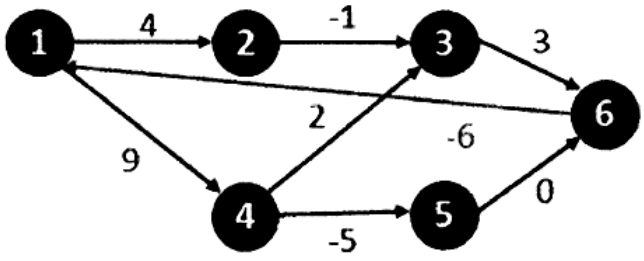
(a) Huffman code for each character.

(b) Total size of the message in Huffman encoding.

(c) Total size of the message in fixed length encoding.

5 (CO 2)

4. (a) Given a source vertex s from a set of vertices V in a weighted digraph, find the shortest path weights d(s, v) from source s for all vertices v present in the graph using Bellman algorithm. Show the results of intermediate steps and also comment on complexity.



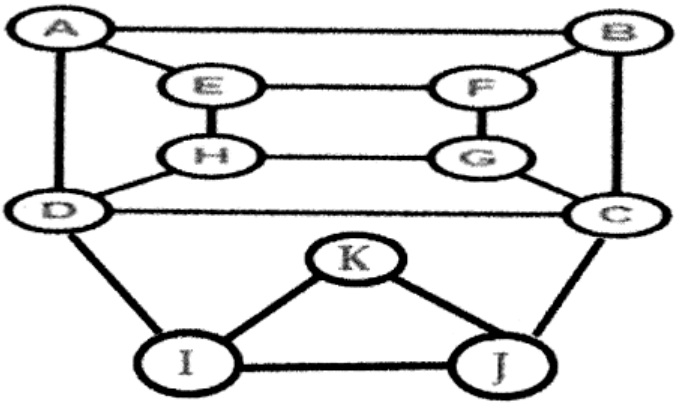
5 (CO 3)

(b) Find the solution to the travelling salesman problem for the graph and its adjacency matrix shown below. For the travelling salesman problem, explain the formulation of constrain equation and application of this problem.

Vertex	**1**	**2**	**3**	**4**
1	0	15	20	25
2	10	0	14	15
3	11	18	0	17
4	13	13	14	0

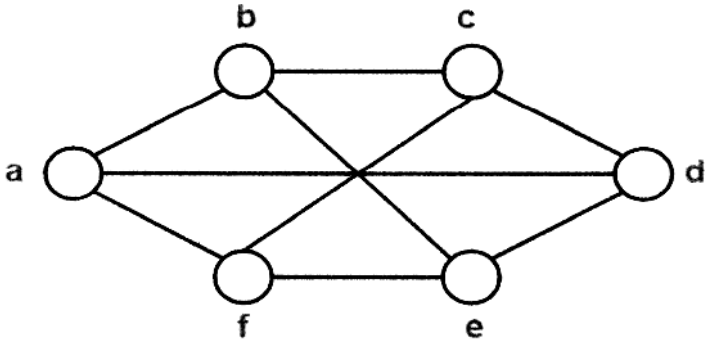
5 (CO 3)

5. (a) Explain the constraints used in backtracking solutions for Hamiltonian cycle problem. Write the formulation to find the cycle and make a state space tree with explanation for below graph.



5 (CO 3)

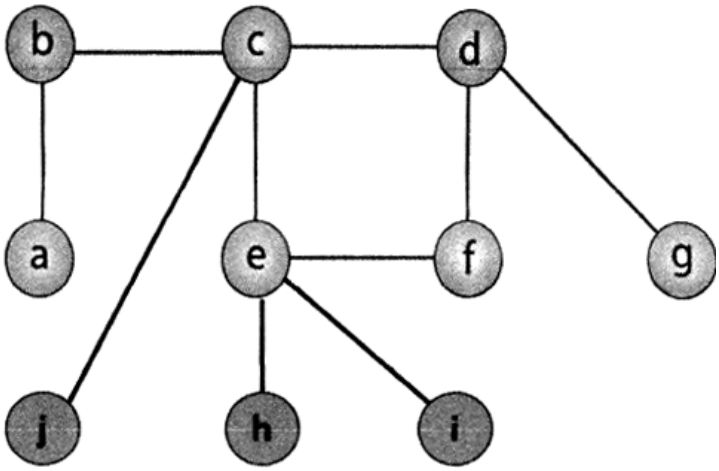
(b) Illustrate the role of Graph Coloring in computing chromatic number. Write the formulation to compute maximum number of colors required for implementing graph coloring algorithm. Comment on time complexity of algorithm.



5 (CO 3)

6. (a) Explain NP-complete problem. How to prove any problem as NP-Complete ? Show that the satisfiability problem is NP Complete. 5 (CO 4)

(b) Discuss vertex cover problem. Write the approximation algorithm for vertex cover problem. Also find the minimum size vertex cover in given graph.



5 (CO 4)