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M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

SEMESTER END EXAMINATIONS – JUNE 2015

Course & Branch	:	**B.E.- Computer Science & Engg.**	**Semester**	:	**IV**
Subject	:	**Design and Analysis of Algorithms**	**Max. Marks**	:	**100**
Subject Code	:	**CS413**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

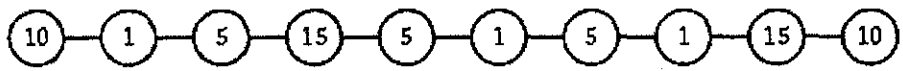
- Answer one full question from each unit.

UNIT – I

1. a) Give an algorithm for Gale shapley stable matching problem. (07)

   b) Prove that every execution of gale shapley algorithm for a given set of men M and set of women W results in the set S* where S*denote the set of pairs {(m,best(m),:m∈M}. (08)

   c) In the given graph, consider two players P1 and P2 where they select nodes alternately with P1 moving first. Each node has a value b_i, represented inside the node. At all times, the set of all selected nodes must form an independent set in G. If the target bound B=20 is to be achieved by P2 is it possible? (05)



2 a) Find the stable matching set of men and women for the preference list given below (06)

Men's preference list

	1st	2nd	3rd
Victor	Bertha	Amy	Diane
Wyatt	Diane	Bertha	Amy
Xavier	Bertha	Diane	Amy

Women's preference list

	1st	2nd	3rd
Amy	Xavier	Victor	Wyatt
Bertha	Xavier	Wyatt	Victor
Diane	Victor	Xavier	Wyatt

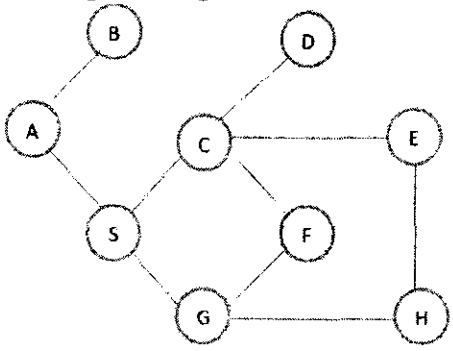
b) Prove the transitivity property of asymptotic growth rate. (08)
   a. If f = O(g) and g = O(h), then f = O(h)
   b. If f = Ω(g) and g = Ω(h), then f = Ω(h).

c) With an example explain the running time for $O(n^k)$ (06)

UNIT – II

3. a) Write DFS algorithm and find its worst case efficiency when graph is given by adjacency list representation. (04)

b) Solve the below graph using DFS algorithm with A as source vertex (08)



c) Explain the below approaches to solve recurrences (08)
   a. Unrolling the Mergesort recurrence
   b. Substituting a solution into the mergesort recurrence

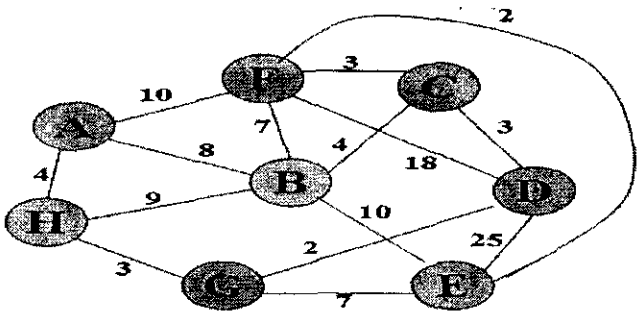
4. a) Write BFS algorithm and find its worst case efficiency when graph is given by adjacency list representation. (06)

   b) Discuss the merge sort algorithm and its efficiency. Apply the same algorithm to sort the list {4,6,1,3,9,5,2,7} and count the number of inversions. (10)

   c) Prove the following "let T be a BFS tree, let x and y be nodes in T belonging to layers L_i and L_j respectively, and let (x,y) be an edge of G. Then i& j differ by at most 1". (04)

UNIT – III

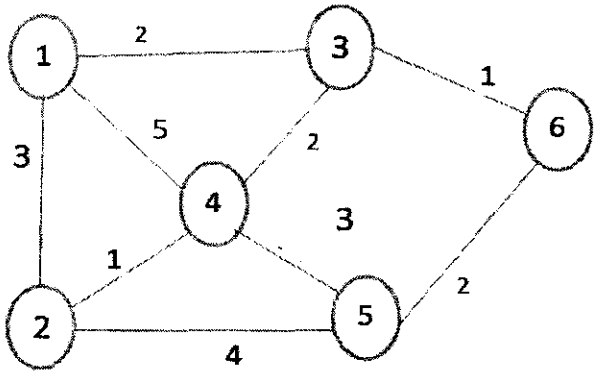
5. a) Apply Prims algorithm to find minimum spanning tree of the graph shown below (08)



   b) Give an algorithm for single source shortest path for a given graph G=(V,E). What is its worst case running time? (06)

   c) Design a greedy algorithm for interval scheduling for the given set of n requests with their start time and finish time. What is the disadvantage of this approach? How can we overcome it? (06)

6. a) Solve the below graph using dijkstras algorithm with 1 as source vertex (08)



b) Construct a Huffman tree for the following problem and construct the prefix code for each alphabet in the set S. (06)

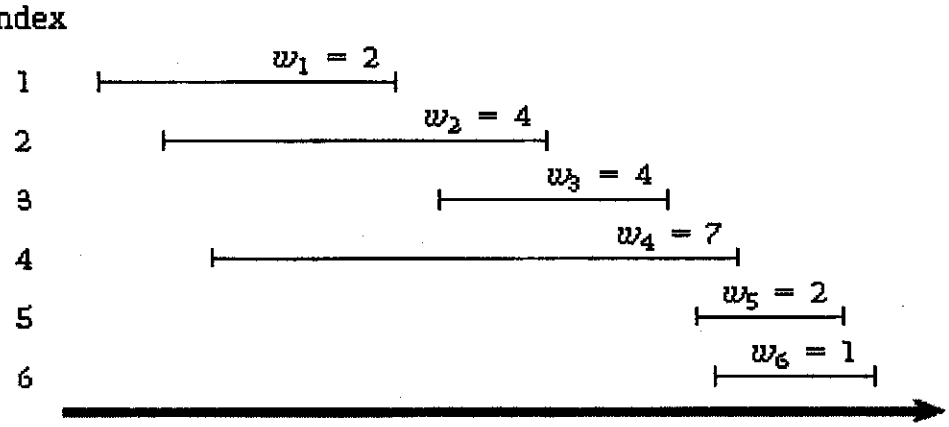
S	A	B	C	D	E	F
frequency	10	35	5	6	11	40

c) Assume that all edge costs are distinct. Let S be any subset of nodes that is neither empty nor equal to all of V, and let edge e = (v, w) be the minimum cost edge with one end in S and the other in V – S. Then prove that every minimum spanning tree contains the edge e. (06)

UNIT – IV

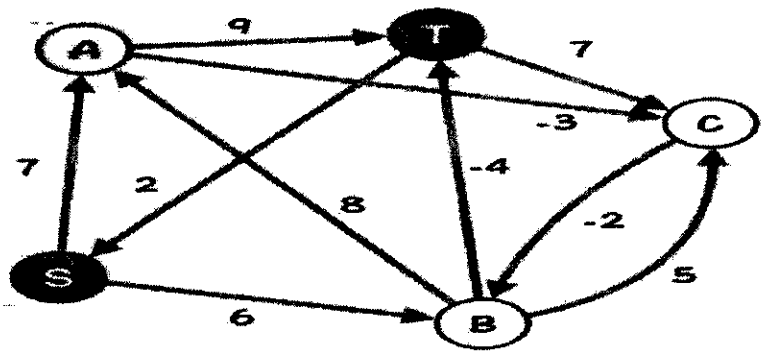
7. a) Design an algorithm to find the shortest path for a given graph G using Bellman ford algorithm and compute the time complexity for the same. (07)

b) What are the intervals that needs to be selected so that maximum weight of the intervals is achieved for the following set of intervals? (07)



c) Discuss survey-design problem for a given set of customers and products with an algorithm. (06)

8. a) Apply bellman ford algorithm to find the shortest path and distance from source vertex S to destination vertex T in a weighted digraph. (10)



b) Design a memorization procedure to determine the maximum weight for a given set of n intervals, and each interval having a weight w. (04)

c) Compute the maximum subset-sum that can be achieved for the following items with maximum capacity W=6. (06)

Item	Weight
1	2
2	3
3	4

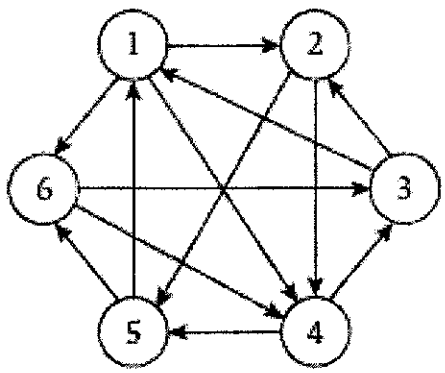
UNIT – V

9. a) What do you mean by polynomial time reduction? Give a corelation between vertex-cover and independent set problem. (10)

   b) Discuss Travelling salesman problem. Prove that travelling salesman problem is NP-Complete. (10)

10. a) What is the general strategy to prove NP-Complete problems? Explain. Give some examples that are NP complete problems. (10)

    b) Compute **Hamiltonian** cycle for the following graph. How can we prove that TSP is complete using Hamiltonian cycle problem? (10)



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