MCA 12 Designs and Analysis of Algorithms

SET: 1

Section-A

(Very Short Answer Questions)

1 (i) Define algorithm.
(ii) What is the best case time complexity of insertion sort?
(iii) What is the methodology applied in divide and conquer technique?
(iv) State whether following statement is true or not.
'To solve a problem by dynamic programming, the problem must possess optimal substructure.'
Justify your answer.
(v) 'In job sequencing, a feasible solution is a subset of job such that each job is completed by its deadline.'
Justify that above statement is true.
(vi) What are explicit constraints, with respect to backtracking?
(vii) What does pruning step, in branch and bound technique do?
(viii) Draw the diagram which states the relationship between P and NP.
(ix) Name four techniques, which implements greedy method.
(x) Give an example of problem, which can be classified as NP-complete.

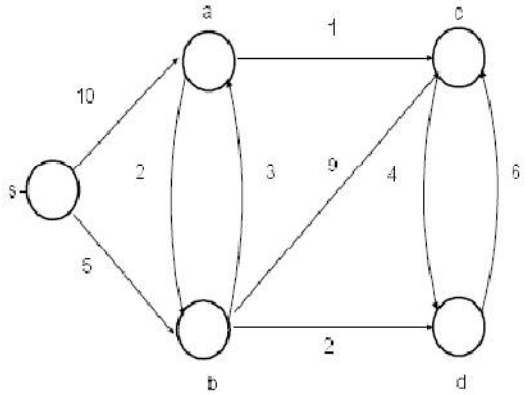
Section-B

(Short Answer Questions)

2. Sort following numbers using Radix sort
765, 321, 280, 987, 211, 609, 888, 432.

3. Sort following numbers by applying Quick sort technique
5, 23, 6, 10, 17, 18

4. Apply Kruskal's algorithm to find Minimum Spanning Tree (MST), for following graph



5. Explain, how dynamic programming paradigm is used to find binary search tree, that minimizes the number of comparisons? (Hint: - Optimal Binary Search Tree)

6. Explain, how branch and bound is applied to solve 0-1 knapsack problem.

7. Illustrate backtracking strategy for 8-Queen's Problem.

8. Write algorithm for counting sort, explain with suitable example.

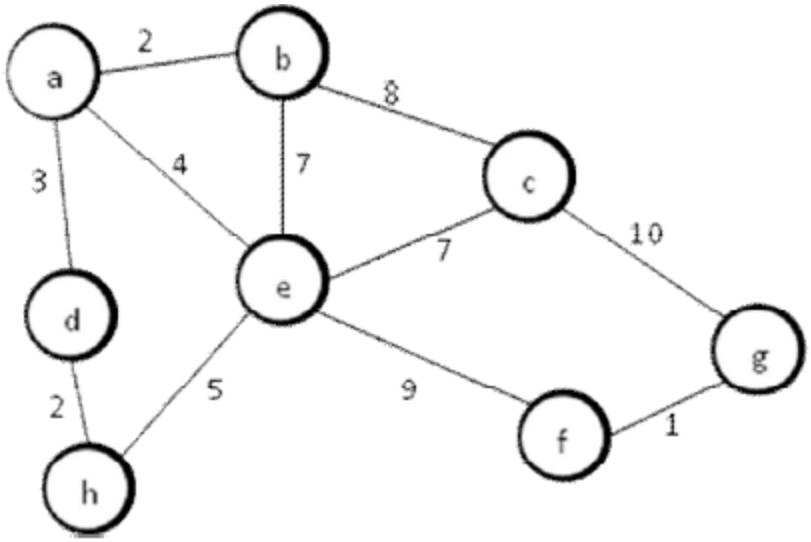
9. Differentiate between deterministic and non-deterministic algorithms.

Section-C

(Long Answer Questions)

10. Explain Theta, Big O and Big Omega notation, with suitable diagrams.

11. Consider the following undirected, weighted graph:



Step through Dijkstra's algorithm to calculate the single source shortest paths from vertex h to every other vertex.

12. Explain with example, implementation of dynamic programming to solve Travelling Salesman Problem.

13. What is branch and bound algorithm design techniques? When (in what conditions) and how this technique is advantageous over other techniques viz backtracking, greedy algorithms, divide and conquer, dynamic programming etc.?

MCA 12 Designs and Analysis of Algorithms

SET: 2

Section-A

(Very Short Answer Questions)

1 (i) Define space complexity.
(ii) Name four algorithms, where divide and conquer technique is applicable.
(iii) How fractional knapsack is different from 0-1 knapsack?
(iv) Why is it not possible to solve all problems using Dynamic programming technique?
(v) What is chromatic number of a graph?
(vi) Which data structure is used for implementing branch and bound technique?
(vii) What is clique in graph?
(viii) What is satisfiablity problem?
(ix) Heap is complete binary tree, having the properties of _____?
(x) In Job sequencing with deadline, is it possible to process more than one job at a time on a machine?

Section-B

(Short Answer Questions)

2. Prove following statements
(a) $3n^3 + 2n^2 + 4n + 3 = \Omega(n^3)$
(b) $3n^3 + 2n^2 + 4n + 3 = O(n^3)$
(c) $7n^3 + 7 = \Theta(n^3)$

3. A knapsack capable of holding 50 Kilograms is available. There are 3 items; weight of Item-1 is 10 Kg and it is of worth 60 Euros, Item-2 weighs 20 Kg and its worth 100 Euros, Item-3 weighs 30 Kg and its value is 120 Euros. Find out the items with maximum profit which the knapsack can carry.

4. Write down characteristics of Dynamic programming. Also write steps involved in design of Dynamic programming.

5. Write and explain, recursive algorithm for general backtracking.

6. How, branch and bound technique is applied to solve travelling salesman problem?

7. Specify the problem statement for 'Job sequencing with deadline'.

8. Explain with example how can we compute a^n (where a and n are integers), using divide and conquer technique:-

a) if n is even
b) if n is odd

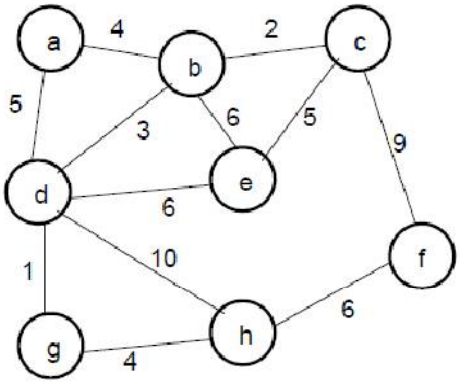
9. Explain with example three functions for non-deterministic algorithms.

Section-C

(Long Answer Questions)

10. Write and explain in detail, algorithm for binary search. Apply the binary search algorithm to search number 20 among following elements
    12, 15, 7, 6, 20, 1, 24, 19, 18, 22, 4, 13

11. Explain Prim's algorithm to find Minimum Spanning Tree (MST). Also apply it to find MST, for following graph



12. Explain with suitable example and diagram, how graph coloring problem can be solved with the help of backtracking.

13. Give statement of Cook's Theorem along with its proof. Explain with suitable example.