

Important Questions

Subject:- Design and Analysis of Algorithm

Unit-1

1. The recurrence $T(n) = 7T(n/2) + n^2$ describe the running time of an algorithm A. A competing algorithm A' has a running time $T'(n) = aT'(n/4) + n^2$. What is the largest integer value for a A' is asymptotically faster than A?
2.
 - i. Solve the recurrence $T(n) = 2T(n/2) + n^2 + 2n + 1$
 - ii. Prove that worst case running time of any comparison sort is $\Omega(n \log n)$.
3. Use a recursion tree to give an asymptotically tight solution to the recurrence $T(n) = T(\alpha n) + T((1 - \alpha)n) + cn$, where α is a constant in the range $0 < \alpha < 1$ and c is also a constant.
4. Explain the concepts of quick sort method and analyze its complexity with suitable example.
5. Explain HEAP SORT on the array. Illustrate the operation HEAP SORT on the array $A = \{6, 14, 3, 25, 2, 10, 20, 7, 6\}$
6. What is the time complexity of counting sort? Illustrate the operation of counting sort on array $A = \{1, 6, 3, 3, 4, 5, 6, 3, 4, 5\}$.

Unit-2

1. Insert the following element in an initially empty RB-Tree. 12, 9, 81, 76, 23, 43, 65, 88, 76, 32, 54. Now delete 23 and 81.
2. Using minimum degree 't' as 3, insert following sequence of integers 10, 25, 20, 35, 30, 55, 40, 45, 50, 55, 60, 75, 70, 65, 80, 85 and 90 in an initially empty B-Tree. Give the number of nodes splitting operations that take place.
3. What is a binomial heap? Describe the union of binomial heap.

OR

Explain the different conditions of getting union of two existing binomial heaps. Also write algorithm for union of two binomial heaps. What is its complexity?

4. What is Fibonacci heap? Explain CONSOLIDATE operation with suitable example for Fibonacci heap.
5. Write a Short note on:
 - a. Trie
 - b. Skip List

Unit-3

1. Discuss convex hull. Give Graham-Scan algorithm to compute convex hull.

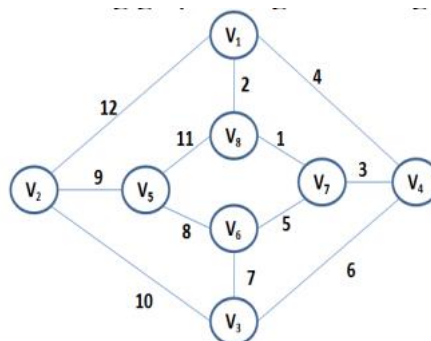
OR

What do you mean by convex hull? Describe an algorithm that solves the convex hull problem. Find the time complexity of the algorithm.

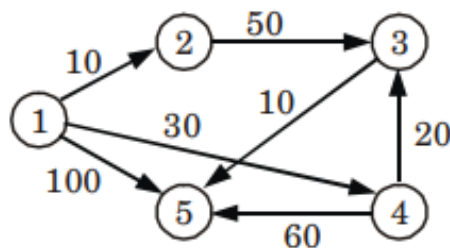
2. Explain "greedy algorithm" Write its pseudo code to prove that fractional Knapsack problem has a greedy-choice property. Consider the weight and values of item listed below. Note that there is only one unit of each item. The task is to pick a subset of these items such that their total weight is no more than 11 kgs and their total value is maximized. Moreover, no item may be split. The total value of items picked by an optimal algorithm is denoted by V_{opt} . A greedy algorithm sorts the items by their value-to-weight ratios in descending order and packs them greedily, starting from the first item in the ordered list. The total value of items picked by the greedy algorithm is denoted by V_{greedy} . Find the value of $V_{opt} - V_{greedy}$.

Item	I_1	I_2	I_3	I_4
w	10	7	4	2
v	60	28	20	24

3. Define minimum spanning tree (MST). Write Prim's algorithm to generate an MST for any given weighted graph. Generate MST for the following graph using the Prim's algorithm.



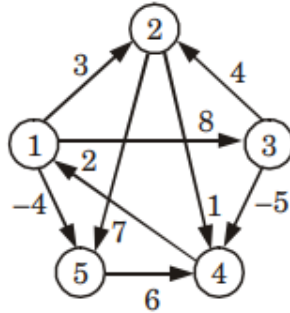
4. Explain Greedy programming in brief. Find the shortest path in the below graph from the source vertex 1 to all other vertices by using Dijkstra's algorithm.



5. Write down the Bellman Ford algorithm to solve the single source shortest path problem also write its time complexity.

Unit-4

1. Discuss knapsack problem with respect to dynamic programming approach. Find the optimal solution for given problem, w (weight set) = {5, 10, 15, 20} and W (Knapsack size) = 25 and v = {50, 60, 120, 100}.
2. What do you understand by Dynamic Programming? Give Floyd-Warshall algorithm to find the shortest path for all pairs of vertices in a graph. Give the complexity of the algorithm. Apply the same on following graph.



3. What is the sum of subsets problem? Let $w=\{5,7,10,12,15,18,20\}$ and $m=35$. Find all possible subsets of w that sum to m using recursive backtracking algorithm for it. Draw the portion of the state-space tree that is generated.
4. Explain Branch and Bound method in brief. What is travelling salesman problem (TSP)? Find the solution of following TSP using Branch & Bound method

0	1	15	6
2	0	7	3
9	6	0	12
10	4	8	0

5. What is backtracking? Explain the method of finding Hamiltonian cycles in a graph using backtracking method with suitable example.

Unit-5

1. Explain and Write the Naïve-String string matching algorithm: Suppose the given pattern **$p = aab$** and given text **$T = a c a a b c$** . Apply Naïve-String Matching algorithm on above Pattern (P) and Text (T) to find the number of occurrences of P in T.
2. What is string matching algorithm? Explain Rabin-Karp method with examples.
3. Write KMP algorithm for string matching? Perform the KMP algorithm to search the occurrences of the pattern **$abaab$** in the text string **$abbabaabaabab$** .
4. Explain approximation algorithm. Explore set cover problem using approximation algorithm.
5. Write a short note on following:
 - i. Randomized Algorithm
 - ii. NP-Complete and NP Hard