BCS401(2022 Scheme) SIMP Questions

-TIE REVIEW TEAM

Module -1 SIMP Questions

1. Explain the analysis framework of algorithms. Explain the worst case, best case and average case efficiencies, with an algorithm.
2. Explain the concept of asymptotic notations and basic efficiency classes, with examples. Explain O, θ, and Ω, with examples.

   express the following assertions using asymptotic notations with proof from its $\frac{1}{2}n(n-1)$ $6*2^n+n^2$
3. What is an algorithm? Explain the notion of an algorithm with an example, Write an algorithm to find the maximum element in an array of n elements. Give the mathematical analysis of this non recursive algorithm.
4. If t1(n) ϵ 0 (g1(n)) and t2(n) ϵ 0(g2(n)), prove that t1(n) + t2(n) ϵ0(max {g1(n), g2(n)}).
5. Design a recursive algorithm for solving the tower of hanoi problem and give the general plan of analyzing that algorithm. Show that the time complexity of the tower of hanoi algorithm is exponential in nature.

   OR

   Explain the mathematical analysis of fibonacci recursive algorithms.
6. Design an algorithm to search an element in an array using sequential search. discuss the worst case, best case and average case analysis of this algorithm
7. Give the mathematical analysis of non recursive Matrix Multiplication Algorithms.
8. Consider the following algorithm

```
Algorithm GUESS(A[][])
        for i←0 to n-1
        for j← 0 to i
            A[i][j] ← 0
```

   a.What does the algorithm compute and explain basic operation and efficiency

Module -2 SIMP Questions

9. Explain divide and conquer algorithm with its advantages and disadvantages, Compare straight forward method and divide and conquer method for finding max and min elements of the list
10. Design merge sort algorithm. Write a descriptive note on its best case, average case, and worst-case time efficiency.
11. Explain Binary Search as an Iterative and recursive algorithm - 16M
12. What is a Quick Sort Algorithm? Apply a quick sort algorithm to sort the list E, X, A, M, P, L, E in alphabetical order. Draw the tree of recursive calls made(Practice similar type questions/problems)
13. Explain Strassen's Algorithm and derive its time complexity.-14M
14. Explain in detail about the Travelling Salesman Problem using exhaustive search- 12m
15. Explain in detail about the knapsack problem and closest pair problem

Module -3 SIMP Questions

16. Define heap, explain the notion of the heap with illustrations also explain the properties of heap
17. Define Heap Sort. Consider the array: arr[ ] = {4, 10, 3, 5, 1}.Build a complete binary tree from the array.
18. Explain the principles for constructing a heap- explain bottom up and top down heap construction in detail with appropriate algorithms for each
19. Explain (i) New key insertion (ii)Deletion of a key (iii)Maximum key deletion and (iv)The efficiency of deletion in heap with appropriate illustrations and algorithmic examples - 16M
20. Discuss with examples (i)Horspool's algorithm (ii)Boyle moore algorithm
21. Define AVL trees? Explain different rotation types in AVL trees with sketches-12M

Module -4 SIMP Questions

22. Explain given Algorithms with an example i)HeadBottomUp ii)Kruskal iii)Huffman
23. What is Dijkstra's algorithm used for? Apply Dijkstra's algorithm for the following graph, Given 1 is the source node, What are the distances of shortest paths from source node to all other nodes
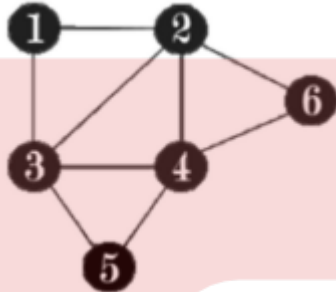
24. Define minimum cost spanning tree & Prim's algorithm . Write Prim's algorithm to find minimum cost spanning tree for the given weighted connected graph
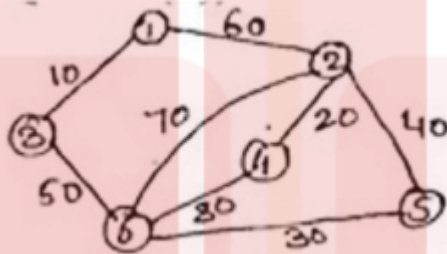
25. Solve the following instance of greedy knapsack problem where n=4, m=10, p = (40, 42, 25, 12) and w = (4, 7, 5, 3) (Practice similar type questions/problems)
26. Write the problem statement for job sequencing with a deadline? Let n=5, profits (10, 3, 33, 11, 40) and deadlines (3, 1, 1, 2, 2). Find the optimal sequence of execution of job solution using greedy algorithm (Practice similar type questions/problems)
27. Obtain the Huffman tree and the code for the following data

Character	A	B	C	D	-
Probability	0.35	0.1	0.2	0.2	0.15

28. Discuss Warshall's Algorithm with suitable diagrams?
29. Explain how Floyd's Algorithm works.

Module -5 SIMP Questions

30. Explain the use of Decision Trees for Searching a Sorted Array- 16M
31. Explain the following with examples
    i) P problem ii) NP Problem iii) NP- Complete problem iv) NP – Hard Problems
32. Explain backtracking in detail by explaining - General method, General Algorithm (Recursive and Iterative)
33. What is backtracking, list out its advantages, Considering 4-queen problem, provide two possible solutions to this problem using backtracking
34. Apply branch and bound method for knapsack problem C=10(Practice similar type questions/problems)

Items	1	2	3	4
Weights	4	7	5	3
Values	$40	$32	$25	$12

35. Apply backtracking to solve the following instance of the subset sum problem: A = {1, 3, 4, 5} and d = 11.
36. Write a note on each with an example: i) Hamiltonian Cycle ii)Graph coloring iii) N – Queen problem
37. Explain LC branch & bound, FIFO branch & bound.n

38. With the help of a state space tree. Solve the Traveling Salesman Problem for the following graph using branch and bound concepts.