B.TECH/IT/4TH SEM/INFO 2202(BACKLOG)/2021

DESIGN & ANALYSIS OF ALGORITHMS
(INFO 2202)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) How many sub arrays does the quick sort algorithm divide the entire array into?
(a) one (b) two (c) three (d) four

(ii) We use dynamic programming approach when
(a) It provides optimal solution
(b) The solution has optimal substructure
(c) The given problem can be reduced to the 3-SAT problem
(d) It's faster than Greedy

(iii) To implement Dijkstra's shortest path algorithm on unweighted graphs so that it runs in linear time, the data structure to be used is
(a) Queue (b) Stack (c) Heap (d) B-Tree

(iv) In an unweighted, undirected connected graph, the shortest path from a node S to every other node is computed most efficiently, in terms of time complexity by
(a) Dijkstra's algorithm starting from S (b) Warshall's algorithm
(c) Performing a DFS starting from S (d) Performing a BFS starting from S

(v) Choose the correct statement from the following.
(a) branch and bound is more efficient than backtracking
(b) branch and bound is not suitable where a greedy algorithm is not applicable
(c) branch and bound divides a problem into at least 2 new restricted sub problems
(d) backtracking divides a problem into at least 2 new restricted sub problems

(vi) Which of the following algorithm design techniques is used in the quick sort algorithm?
(a) Dynamic programming (b) Backtracking
(c) Divide and conquer (d) Greedy method

(vii) If a problem can be broken into subproblems which are reused several times, the problem possesses _____ property.
(a) Overlapping subproblems (b) Optimal substructure
(c) Memoization (d) Greedy

(viii) Ω-Notation provides an asymptotic
(a) upper bound
(b) lower bound
(c) one that is sandwiched between the two bounds
(d) none of these

(ix) Which one is true of the following
(a) All NP hard problems are NP complete
(b) All NP complete problems are NP hard
(c) Some NP complete problems are NP hard
(d) None of these

(x) Time complexity of non-deterministic algorithm is always
(a) Less than deterministic algorithm
(b) Greater than deterministic algorithm
(c) Equal to deterministic algorithm
(d) None of these

Group – B

2. (a) State master's theorem and find the time complexity for the following recurrences:
(i) $T(n) = 2T(n/2) + n$
(ii) $T(n)= 8T(n/4) + n^2$
(iii) $T(n) = T(2n/3) + \log n$.

(b) Define Big-Oh(O), Omega(Ω) and Theta(Θ) notation.

(2 + 2 + 2) + (2 × 3) = 12

3. (a) Write an algorithm of Merge Sort and deduce its' time complexity.

(b) Using divide and conquer method solve the following set of unsorted elements using quicksort algorithm.
33 41 52 19 62 77 75 39 67.

(c) Deduce the time complexity of Strassen's matrix manipulation algorithm.

(4 + 2) + 4 + 2 = 12

Group – C

4. (a) Using permutation tree explain the 4 Queens problem and find out the possible no of solutions.

(b) Write an algorithm of graph coloring problem.

(c) Explain the two different properties of flow graph and define Ford-Fulkerson algorithm.

4 + 4 + (1 + 3) = 12

5. (a) Write an algorithm of Depth First Search and deduce its' time complexity.

(b) Write short notes of the following
(i) Residual networks
(ii) Augmenting path
(iii) Max-flow min-cuts theorem.

(4 + 2) + (3 × 2) = 12

Group – D

6. (a) Using Greedy method find out the solution generated by the Job Sequencing with Deadline algorithm when n=6, (p1, p2, p3, p4, p5, p6) = (15, 7, 20, 18, 11, 6) and (d1, d2, d3, d4, d5, d6) = (3, 4, 1, 2, 5, 2). Explain each step of solution to process job.

(b) Using dynamic programming approach find out an optimal solution to multiply a chain of matrices of the following order 3, 5, 3, 5, 4, 6. Show how many minimum scalar multiplications required and parenthesize the order.

4 + 8 = 12

7. (a) Find out all possible feasible solutions including optimal one of the knapsack problem using greedy method where n=5; m=45; (p1, p2, p3, p4, p5)=(20, 30, 25, 15, 40) and (w1, w2, w3, w4, w5)=(15, 15, 5, 15, 20).

(b) Compare Prim's and kruskal algorithm and deduce time complexity for both.

6 + (3 + 3) = 12

Group – E

8. (a) Explain how you attempt to solve 15-puzzle problem using Branch and Bound strategy.

(b) Write a non deterministic algorithm to search an element X on A[1:n] where n>=1.

8 + 4 = 12

9. (a) Describe approximate algorithm for TSP & calculate the performance ratio for that.

(b) Show that 2SAT is in P but 3SAT is NP-complete.

7 + 5 = 12

Department & Section	Submission Link
IT	https://classroom.google.com/c/Mzc0MjIwNTk4NzYx/a/Mzc0MjIwNTk4NzY3/details