MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

CS-501

DESIGN AND ANALYSIS OF ALGORITHM

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

1. Answer *all* questions. 10×1 = 10

(i) Given two sorted lists of size "m" and "n" respectively. The number of comparisons needed in the worst case by merge sort will be

(A) m*n (B) Max(m,n)
(C) Min(m,n) (D) m + n – 1

(ii) The running time T(n) where "n" is the input size of a recursive algorithm is given by

T(n) = c + T(n – 1), if n > 1
= d, if n < 1

The order of the algorithm is

(A) n^2 (B) n
(C) n^3 (D) n^0

http://www.makaut.com

CS/B.Tech/CSE/Odd/Sem-5th/CS-501/2015-16

(iii) Tight bound for building a max heap algorithm will be

(A) O(log n) (B) O(n^2)
(C) O(n log n) (D) O(n)

(iv) Traveling salesman problem is

(A) P (B) NP
(C) NP-complete (D) NP-Hard

(v) Complexity of BFS algorithm is_____ if graph is represented as adjacency list.

(A) Θ(n + e) (B) Θ(n^2)
(C) Θ(log n) (D) Θ(n + e log n)

(vi) Ω- Notation provides an asymptotic

(A) upper bound
(B) lower bound
(C) one that is sandwiched between the two bounds
(D) none of these

(vii) The space requirement for the quick sort method depends on the

(A) number of nested recursive calls
(B) size of the stack
(C) both (A) and (B)
(D) none of these

(viii) Kruskal's Algorithm for finding minimum spanning tree is an example of

(A) Dynamic programming (B) Greedy method
(C) Both (A) and (B) (D) None of these

(ix) Which of the following is solved by using Branch and Bound method?

(A) Knapsack Problem (B) Hamiltonian Problem
(C) Travelling Salesman Problem (D) 15-Puzzle Problem

http://www.makaut.com

(x) Time complexity for the Floyd's algorithm to find all pairs of shortest path of a graph G with V vertices and E edges using dynamic programming method is:

(A) $O(V^2)$ (B) $O(V^3)$
(C) $O(E^2)$ (D) $O(E^3)$

GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

2. Find the best and worst case time complexity of Quick Sort. 2+3

3. State Master theorem and find the time complexity for the recurrence relation $T(n) = 2T(n/4) + \sqrt{n}$. 2+3

4. Explain the max-flow min-cut theorem with an example. 5

5. Differentiate between divide and conquer and dynamic programming. 5

6. Write an algorithm for n-queen's problem. Find its time complexity. 3+2

GROUP C
(Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

7. (a) Find the minimum number of operations required for the following matrix chain multiplication using dynamic programming. 5
$A(10 \times 20) * B(20 \times 50) * C(50 \times 1) * D(1 \times 100)$
(b) What is union-find algorithm? Explain with an example. 5
(c) Write Knuth-Morirs-Pratt algorithm for string matching problem. 5

http://www.makaut.com

http://www.makaut.com

CS/B.Tech/CSE/Odd/Sem-5th/CS-501/2015-16

8. (a) Define the following notations with example 2×4
Big-oh (O), Little-oh (o), Ω, Θ
(b) If 7

$$T(n) = \begin{cases} 1, n = 1 \\ 2T(n/2) + 5n, \ n > 1 \end{cases}$$

Then show that $T(n) = O(n \log_2 n)$. Show all steps of derivation.

9. (a) Solve the knapsack problem for given condition: n=3, knapsack capacity (m) = 20, profits (p1, p2, p3) = (25, 24, 15) and weight (w1, w2, w3) = (18, 15, 10). 6
(b) What are the characteristics of Greedy method? 2
(c) What is negative weight-cycle? Write Bellman-Ford algorithm to find single source shortest distance of a directed graph. 2+5

10.(a) Define P-class, NP-class, NP-complete class and NP-hard class of problems. What is the relation between them? 4
(b) What do you mean by deterministic and non-deterministic algorithm? Write a non-deterministic algorithm for searching an element from a given list of real numbers. Also, specify its time complexity. 3+3+1
(c) State satisfiability problem. State Cook's theorem in connection with P and NP problem. 2+2

11. Write short notes on any *three* of the following: 3×5
(a) Recursion tree
(b) External Sorting
(c) Minimum spanning tree
(d) BFS and DFS
(e) Clique Decision problem.

http://www.makaut.com

http://www.makaut.com

http://www.makaut.com

http://www.makaut.com