MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

IT-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 any *ten* questions. 10×1 = 10

(i) What is the type of the algorithm used in solving the 8 Queens problem?
(A) backtracking (B) dynamic
(C) branch and bound (D) both (B) and (C)

(ii) O-notation provides an asymptotic
(A) upper bound (B) lower bound
(C) light bound (D) none of these

(iii) The running time of heap sort is
(A) O (n log n) (B) O (n)
(C) O (n^2) (D) O (nm)

(iv) Quick sort uses which approach to algorithm design?
(A) divide and conquer (B) greedy
(C) dynamic programming (D) brute force

(v) Fractional knapsack is
(A) greedy approach (B) dynamic approach
(C) backtracking (D) none of these10

(vi) KMP algorithm complexity is
(A) n (B) n^2 (C) n + m (D) n^3

(vii) Minimum spanning tree is an attribute of
(A) arrays (B) weighted graphs
(C) unweighted graphs (D) sets of points
(E) none of these

(viii) Vertex cover problem belongs to
(A) greedy approach (B) dynamic approach
(C) backtracking (D) approximation approach

(ix) Divide and conquer approach is
(A) top-down (B) bottom-up
(C) both (A) and (B) (D) none of these

(x) Binary search algorithm is a
(A) branch and bound (B) greedy method
(C) divide and conquer (D) dynamic programming

(xi) Space complexity of BFS (Breadth First Search) is
(A) O(n) (B) O(n^2) (C) O(log n) (D) none of these

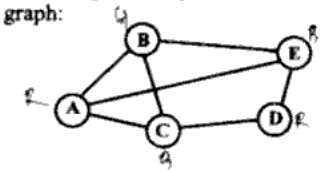
(xii) If minimum 3 colors are needed to proper color a graph then chromatic number is
(A) 1 (B) 2 (C) 3 (D) none of these

GROUP B
(Short Answer Type Questions)

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

2. Write down an algorithm of 8-queens problem. 5

3. Apply backtracking technique to solve the 3-coloring problem for the following graph: 5



4. Write down an algorithm of Breadth First Traversal (BFT). 5

5. Write down difference between 2+2+1
   (i) Prim's Algorithm and Kruskal's Algorithm.
   (ii) Knapsack problem and 0/1 Knapsack problem.
   (iii) Linear Search and Binary Search.

6. Sort the following list in increasing order using quick sort technique and argue upon its running time. 5

$L = < 1, 3, 5, 6, 8, 10, 13, 18>$

GROUP C
(Long Answer Type Questions)

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

7. (a) State divide and conquer principle. Write quick sort algorithm. Analyze quick sort for best case, worst case and average case. 1+4+5

   (b) Determine the number of comparisons required to find the maximum and minimum elements from a given array simultaneously by dividing the array recursively into two halves until each half contains one or two elements. 5

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8. (a) State master theorem. 4

   (b) Solve the following in best possible way 6
   (i) $T(n) = T(\sqrt{n}) + \lg n$
   (ii) $T(n) = T(\sqrt{n}) + 1$
   (iii) $T(n) = 2T(n/2) + n^3$

9. (a) Show that the lower bound for comparison sort is O(n lg n). 5

   (b) What is the different between greedy method and divide conquer method? 2

   (c) Find out the complexity -> 5

$$T(n) = 2\,T(n/2) + c\,n \quad \text{if } n>1$$
$$= 1 \quad \text{if } n>1$$

C is positive constant.

   (d) $T(n) = 5\,n^2 + 2\,n$ what is the worst case complexity? 2

   (e) Prove the CDP (Clique Decision Problem) is NP-Complete. 6

10. (a) Find an optimal parenthesization of a matrix-chain product whose dimensions are: 7
$A(10 \times 20), B(20 \times 50), C(50 \times 1), D(1 \times 100)$.

   (b) Discuss the amortized analysis of Aggregate method. 5

   (c) Write down the definition of space complexity. Just write time complexity of DFS. 2+1

11. Write short notes on any *three* of the following: 3×5
   (a) DFT and FFT algorithm
   (b) Union-Find Algorithm
   (c) BFS and DFS
   (d) Solution of single source shortest path problem
   (e) Strassen's algorithm.

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