53 (IT 504) DAAL

2017

DESIGN AND ANALYSIS OF ALGORITHM

Paper : IT 504

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions out of* ***seven***.

1. *(a)* Define and differentiate asymptotic notations $(0, \Theta, \Omega)$. 6

   (b) Draw the recursive tree for the following recurrence relation and solve it :

   $$T(n) = T(n/3) + T(2n/3) + n$$ 7

   (c) Solve the recurrence relation using substitution method :

   $T(n) = 2T(\sqrt{n}) + 1$, when $T(1) = 1$. 7

2. *(a)* Illustrate the operation of PARTITION in the context of the quicksort algorithm on the following array :

$A = < 13,19,9,5,12,8,7,4,21,2,6,11 >$

Assume that the last element is chosen as the pivot element (here 11). 10

(b) Prove that the average case time-complexity of quick sort is $O(n \log n)$. 10

3. *(a)* Show how the merge sort algorithm will sort the following array in increasing order :

40, 50, 60, 10, 90, 20, 10, 80, 70 8

(b) Write an algorithm to merge two sorted array into a final sorted array. 8

(c) Which one of the following array represents a binary max-heap and draw the heap tree ? 4

(i) {25,12,16,13,10,8,14}

(ii) {25,14,13,16,10,8,12}

(iii) {25,14,16,13,10,8,12}

(iv) {25,14,12,13,10,8,16}

4. Show steps of Kruskal's and Prim's algorithm to find a minimum spanning tree of the graph shown in the *Figure 1.* 10+10

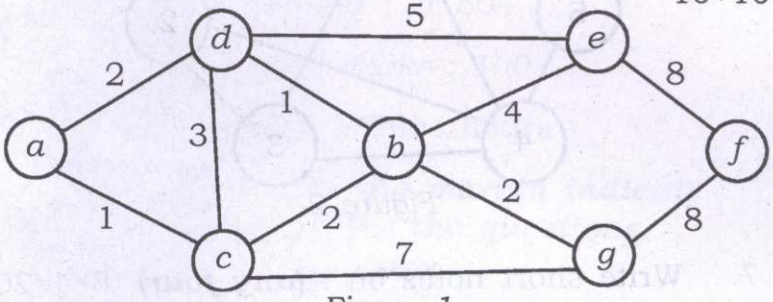

Figure 1

5. *(a)* Compare dynamic programming and greedy approach.

(b) Find the optimal parenthesization of a matrix-chain product whose sequence of dimensions is < 5, 10, 3, 12, 5, 50, and 6 > 10+10

6. *(a)* Trace the steps to solve the 4–Queens problem by backtracking method. For each step draw the 4×4 matrix showing the position of queens in it. Show where you apply backtracking. 10

(b) Apply backtracking technique to solve the 3–coloring problem for the graph given in *Figure 2*. Also generate the state space tree. 10

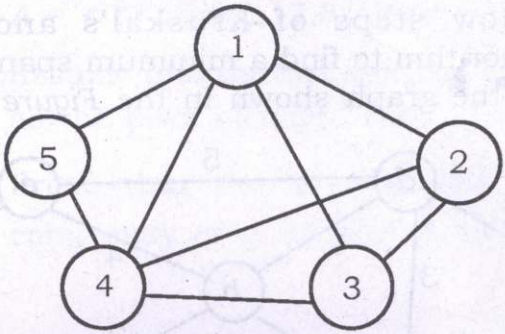

Figure 2

7. Write short notes on : ***(any four)*** 5×4=20

(a) 0/1 knapsack problem

(b) NP–Hard and NP–Complete problem

(c) Amortized Analysis

(d) Solution of Travelling Sales Person (TSP) problem using Branch and Bound

(e) Hamiltonian cycles

(f) Game Tree.