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TCS/TIT–404

B. Tech. (CSE/IT) (Fourth Semester)
Mid Semester EXAMINATION, 2014

DESIGN AND ANALYSIS OF ALGORITHMS

Time : Two Hours] [*Maximum Marks : 60*

Note : (i) This question paper contains two Sections : Section A and Section B.

(ii) Answer all questions in Section A by choosing the correct option from multiple choices. Each question carries 2 marks.

(iii) Answer any *four* questions from Section B. Each question carries 12 marks.

Section—A **2 each**

1. Attempt all multiple choice questions, choosing the correct option.

(i) 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 and d if n = 1, the order of algorithm is :

(a) n^2

(b) n

(c) n^3

(d) n^n

(ii) Which of the following show the correct relationship among some of the more common computing times for algorithms ?

(a) $O(\log n) < O(n) < O(n \log n) < O(2^n) < O(n^2)$

(b) $O(n) < O(\log n) < O(n \log n) < O(2^n) < O(n^2)$

(c) $O(n) < O(\log n) < O(n \log n) < O(n^2) < O(2^n)$

(d) $O(\log n) < O(n) < O(n \log n) < O(n^2), < O(2^n)$

(iii) The recurrence relation that arises in relation with the complexity of binary search is :

(a) $T(n) = T(n/2) + K$

(b) $T(n) = 2\,T(n/2) + K$

(c) $T(n) = T(n/2) + \log n$

(d) $T(n) = T(n/2) + n$

where K is a constant.

(iv) The way a card game player arranges his cards as he picks them one by one is an example of :

(a) Bubble sort

(b) Selection sort

(c) Insertion sort

(d) Merge sort

(v) Which of the following sorting algorithms does not have a worst case running time of $O(n^2)$?

(a) Merge sort

(b) Selection sort

(c) Insertion sort

(d) Quick sort

(vi) Heap sort is an example of :

(a) Brute Force approach

(b) Transform and Conquer approach

(c) Divide and Conquer Approach

(d) Decrease and Conquer approach

Section—B 12 (6+6) each

Note : Attempt any *four* questions.

2. (a) Write an algorithm for insertion sort, analyze its complexity and sort the array A [] = {2, 5, 3, 0, 1, 4}, show all the steps.

(b) Solve the recurrence $T(n) = 2\,T(\sqrt{n}) + \log_2 n$.

3. (a) What is Greedy Technique ? Write an algorithm for Knapsack problem using greedy technique.

(b) Consider the Knapsack instance n = 4, (w1, w2, w3, w4) = (1, 2, 1, 3) and (p1, p2, p3, p4) = (3, 4, 5, 6), Knapsack capacity is 5. Find the optimal solution using dynamic programming approach.

4. (a) Explain brute force approach. Write an algorithm for bubble sort and show that the best case complexity is O(n).

(b) Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is <5, 4, 6, 2, 7>.

5. (a) Write an algorithm for merge sort using divide and conquer approach and analyze its complexity.

(b) Sort the array using Heap sort and show all the steps. A[] = {3, 4, 5, 2, 1, 9, 8}.

6. (a) State and prove Master's theorem.

(b) Solve the recurrences :

(i) $T(n) = 4\,T(n/2) + n$

(ii) $T(n) = 2\,T(n/2) + n/\log n$

(iii) $T(n) = 4\,T(n/2) + n^3$

7. (a) Discuss the asymptotic notations.

(b) Solve the recurrence using recursion tree metho $T(n) = 3\,T(n/4) + n^2$, $T(1)$ is constant.