May-25-0780

CSPC-413 (Design and Analysis of Algorithm)

[AI&ML, CSE, AI&DS]

B.Tech. 4th (NEP)

Time : 3 Hours   Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt one question each from sections A, B, C and D. Section E is Compulsory.

SECTION - A

1. (a) How does the Divide and Conquer Strategy work with Merge Sort? Explain with proper example and illustrate the best, average and worst complexity.   (6)

   (b) What do you understand by max-heapify and min-heapify with respect to Heap Sort? Provide examples to support the assertions.   (6)

OR

2. (a) Find the tight asymptotic notation bounds for the recurrence

   $$T(n) = 2T(n/2) + \Theta(1).$$ (6)

   (b) Compare the two functions n^2 and $\dfrac{2^n}{4}$ for various values of $n>0$. Determine when the second becomes larger than the first.   (6)

SECTION - B

3. Suppose the letters a,b, c, d, e and f have probabilities $\dfrac{1}{2}, \dfrac{1}{4}, \dfrac{1}{8}, \dfrac{1}{16}, \dfrac{1}{32}$, and $\dfrac{1}{32}$, respectively. Construct the hufman tree and determine the huffman code for each the letters namely, a, b, c, d, e and f.   (12)

OR

4. Given 9 tasks $T_1, T_2, ..., T_9$ and the execution of each tasks requires one unit of time. The task can be executed one at a time. Consider, each task T_i has a profit P_i and a deadline d_i as shown in Table 1. Find the profit P_i earned if the task is completed before the deadline of the dth unit of time.

Table 1: Details of task, profit and deadline

Task	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
Profit	15	20	30	18	18	10	23	16	25
Deadline	7	27	5	3	4	5	2	7	3

(12)

SECTION - C

5. Explain a dynamic programming paradigm based approach to solve the single source sortest path for a given graph G = (V,E). Find the shortest path from Node A to every other node in the graph of Figure 1 using the dynamic programming paradigm based algorithm. Also, provide the sum of all edges found.   (12)
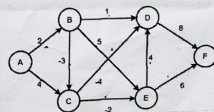

Figure1: Weighted directed graph G.   [P.T.O.]

OR

6. Find the optimal parenthesization of a matrix-chain product whose sequence of dimensions is (5, 10, 3, 12, 5, 50, 6). Also find the optimal cost of multiplication of the matrices.   (12)

SECTION - D

7. Explain the P, NP, NP-Hard and NP- complete classes with suitable examples. Provide proper examples to support the assertions.   (12)

OR

8. Explain Travelling salesman problem in terms of LC branch problem. Provide proper examples to support the assertions and illustrate the complexity.   (12)

SECTION - E (Compulsory)

9. Write short note on:

   (a) Quick sort

   (b) Recurrence.

   (c) Breath First Search

   (d) Hamiltonian Cycle

   (e) Greedy Algorithm

   (f) Space Complexity   (6×2=12)