**Birla Institute of Technology & Science, Pilani**

**Work-Integrated Learning Programmes Division**

**Second Semester 2020-2019**

**M.Tech (DSE)**

**END -Semester Test (EC-3 Make-Up)**

Course No. : DSECLZG519

Course Title : DATA STRUCTURE ALGORITHMS AND DESIGN

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| --- |
| No. of Pages = 2 No. of Questions = 10 |

Nature of Exam : Open Book

Weightage : 40%

Duration : Min

Date of Exam :

Note:

1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
2. All parts of a question should be answered consecutively. Each answer should start from a fresh page.
3. Assumptions made if any, should be stated clearly at the beginning of your answer.
4. Find the recurrence relation of T(n) = [3M]
5. Find an optimal parenthesization of a matrix-chain product whose sequency dimension is (4,10,3,12,20,7) [6M]
6. Fill out the bottom-up dynamic programming table for the 0-1 knapsack program. given a 10 kg sack and the following items [4M]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| I | 1 | 2 | 3 | 4 |
| Vi | 10 | 40 | 30 | 50 |
| Wi | 5 | 4 | 6 | 3 |

1. We want to encode a text which characters T,H,E,C,A,S,O,N,M using Huffman coding, source text S = THE CAT SAT ON THE MAT. [hint: need to consider space]
   1. Construct the Huffman tree based on the frequencies in the source S. [3M]
   2. Create a variable length code table for encoding all the characters present in the source text S using Huffman’s algorithm such that the most frequently used character has a shorter code length. [2M]
2. Use Kruskal’s algorithm, to find a minimum spanning tree of the given graph below. Draw the resulting spanning tree and list the edge in the order they are picked by the Kruskal’s algorithm. [4M]

![Diagram

Description automatically generated]()

Fig-1

1. Get the transitive closure of the relation represented by the digraph below. Use the warshall’s algorithm. All steps needed, and draw the digraph of the transitive closure [4M]

![A picture containing diagram

Description automatically generated]()

1. Finding the median of a sorted array is easy: return the middle element. But what if you are given two sorted arrays A and B. of size m and n respectively, and you want to find the median of all the numbers in A and B? you may assume that A and B are disjoint .
   1. Give a naïve algorithm running is (m+n) time. [2M]
   2. If m =n, give an algorithm that runs in (logn)time. [2M]
2. The input for this problem is a set of n-tasks a1…an the tasks are to be executed by a single processor starting at time t=0.each task ai requires one unit of processing time and has an integer deadline di. moreover, if the processor finishes executing ai at time t, where di t, then a profit pi is earned. Apply a greedy algorithm for maximizing the total profit. [hint: if two tasks have the same profit, then ties are broken by alphabetical order] [4M]

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Task | A | B | C | D | E | F | G | H | I | J | K |
| Deadline | 4 | 3 | 1 | 4 | 3 | 1 | 4 | 6 | 8 | 2 | 7 |
| Profit | 40 | 50 | 20 | 30 | 50 | 30 | 40 | 10 | 60 | 20 | 50 |

1. Construct a KD tree for the following data. (5,8,7,9),( 4,3,2,1), (6,8,3,4), (8,9,6,2), (7,7,6,3), (8,7,8,4), (9,6,9,2), (10,5,7,1). [3M]
2. Suppose that we use a linked list to represent a queue and that in addition to the enqueue and dequeue functions(i.e., functions to add and remove elements from the linked list), you want to add a new operation to the queue that deletes the last element of the queue. Which linked structure do we need to use to guarantee that this operation is also executed in constant time? Justify your answer. [3M]

###All the Best ###