


Name:			
Enrolment No:			
UPES End Semester Examination, December 2023			
Course: Design and Analysis of Algorithms Program: BTech-CSE(CSE -IOTSC+BAO+BT) Course Code: CSEG 2021		Semester: III Time : 03 hrs. Max. Marks: 100	
Instructions:			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Output of following program? <pre> #include<stdio.h> void print(int n) { if (n > 4000) return; printf("%d ", n); print(2*n); printf("%d ", n); } int main() { print(2000); getchar(); return 0; } </pre>	4	CO1
Q 2	Time complexity of the recurrence relation $T(m) = T(3m / 4) + 1$ is _____	4	CO1
Q 3	Let G be connected undirected graph of 100 vertices and 300 edges. The weight of a minimum spanning tree of G is 1500. When the weight of each edge of G is increased by five, the weight of a minimum spanning tree becomes _____.	4	CO3
Q 4	If every square of the board is visited, then the total number of knight moves of 4-queen problem is (A) 14 (B) 15 (C) 16 (D) 12	4	CO4
Q 5	If one uses straight two-way merge sort algorithm to sort the following elements in ascending order 20, 47, 15, 8, 9, 4, 40, 30, 12, 17 then the	4	CO2

	order of these elements after the second pass of the algorithm is _____:																
SECTION B (4Qx10M= 40 Marks)																	
Q 6	You are given an array of n elements, and you notice that some of the elements are duplicate; that is, they appear more than once in an array. Write an algorithm to remove all duplicates from the array in O(1) space complexity.	10	CO1														
Q 7	A networking company uses a compression technique to encode the message before transmitting over the network. Suppose the message contains the following characters with their frequency: <table style="margin-left: 20px;"> <tr><td>character</td><td>Frequency</td></tr> <tr><td>a</td><td>15</td></tr> <tr><td>b</td><td>19</td></tr> <tr><td>c</td><td>12</td></tr> <tr><td>d</td><td>13</td></tr> <tr><td>e</td><td>16</td></tr> <tr><td>f</td><td>45</td></tr> </table> <p>Each character in input message takes 1 byte. If the compression technique is Huffman Coding, how many bits will be saved in the message?</p>	character	Frequency	a	15	b	19	c	12	d	13	e	16	f	45	10	CO2
character	Frequency																
a	15																
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c	12																
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Q 8	Let $m=31$ and $W= \{7, 11, 13, 24\}$ draw a portion of state space tree for solving sum of subset problem for the above given problem.	10	CO6														
Q 9	Explain the P, NP, NP-hard, NP-complete classes? Give relationship between them?	10	CO6														
SECTION-C (2Qx20M=40 Marks)																	
Q 10	Let A_1, A_2, A_3, A_4, A_5 and A_6 be five matrices of dimensions $100 \times 50, 50 \times 200, 200 \times 100, 100 \times 50, 50 \times 400$ respectively. Find the minimum number of scalar multiplications required to find the product $A_1A_2A_3A_4A_5$ using the basic matrix multiplication and also find the order of multiplication OR Consider two strings $A = "qpqr"$ and $B = "pqpqrp"$. Let x be the length of the longest common subsequence (not necessarily contiguous) between A and B and let y be the number of such longest common subsequences between A and B . Then calculate the value of $x + y$.	20	CO5														
Q 11	Mr. X wants to construct a map between the major cities of Uttarakhand. The direct distance between the cities is given. Construct the table contains distance between each possible pair of cities. The given direct distance is: a) Dehradun to Nainital = 289km	20	CO3														

	b) Dehradun to Roorkee = 73km c) Dehradun to Haridwar = 53km d) Dehradun to Mussoorie = 34km e) Dehradun to Rishikesh = 45km f) Haridwar to Rishikesh = 20km		
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