JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- APRIL-2023

COURSE CODE (CREDITS): 18B11CI412 (3)   MAX. MARKS: 25

COURSE NAME: DESIGN & ANALYSIS OF ALGORITHMS

COURSE INSTRUCTORS: DHA, SGL, RKI, AMN   MAX. TIME: 1 Hour 30 Minutes

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

Q1. A message is made up entirely of characters from the set X = {P,Q,R,S,T}. The table of probabilities of each character is shown below: [CO- 2, Marks: 3+1.5+1+1.5]

Character	Probability
P	0.22
Q	0.34
R	0.17
S	0.19
T	0.08
Total	1.00

A message of 100 characters from the given set of characters is encoded using Huffman Encoding.

a) Trace the creation of Huffman tree using the greedy algorithm for Huffman Coding.
b) Find the mean length of the encoded message for 100 characters in bits.
c) Give the Huffman Code for message: PPQRRSST.
d) Give the time complexity analysis of the above encoding using Greedy approach.

Q2. a) How does Dynamic Programming help to reduce complexity of a problem?
                                        [CO- 4, Marks: 1+4+1+3]
b) Find the Longest Common Subsequence (LCS) for the following strings using Dynamic Programming: "pqprqrp" and "qpqrr"
c) Let x be the length of the Longest Common Subsequence (not necessarily contiguous) and let y be the number of such Longest Common Subsequences between the above two strings. Then find out the value of x + 10y?
d) Give the pseudo code for LCS using Dynamic Programming.

Q3. Consider prices & taxes of items (divisible) in the table below.   [CO- 2, Marks: 2+1.5]

Note that there is only one unit of each item. The task is to pick a subset of these items such that the sum of their prices becomes 19. The objective of the problem is to minimize the total tax (Sum of tax of all the chosen items). Items can be split into fractions. The total tax of items picked by the most optimal greedy algorithm is denoted by Tax_{greedy}.

a) Trace the steps for the greedy approach giving the optimal solution and find out the value of Tax_{greedy}

Item	Price	Tax
1	10	60
2	7	28
3	4	20
4	2	24

b) Perform the time complexity analysis of the greedy algorithm used to solve the above fractional problem.

Q4. a) Compare Greedy and Dynamic Programming approach.   [CO- 2,3,4, Marks: 2+1.5+2]
   b) Give the recurrence relation for finding Maximum Subarray using Divide and Conquer.
   c) Give the recurrence relation for Merge Sort and solve it using any method applicable.