Assignment 4 Semester: Fall 2025
Deadline: 8/01/26, 11:59 PM Full Marks: 30

CSE 221: Algorithms

1. a.
   String1: <Your ID>
   String2: _____
   i. Create String2 in a way that the following constraints match. Write the string.
   ○ Length of String2 = 8 (eight)
   ○ Length of LCS(String1,String2) = 5 (five)
   ○ There are exactly three distinct LCS (of length = 5)
   ii. Write all three LCS strings (just write, no need to show any work).

   b.
   String1: <Your ID>
   String2: "20251905"
   iii. Find the length of the LCS of these two strings. You can use a memory table or a recursion tree. Show your work.
   iv. Using your work from the previous question, find the LCS string.

2. We are calculating the longest common subsequence (LCS) between two strings,
   S= X1X2X3X4 and T = Y1Y2Y3Y4

   To do this, we fill an array C where Ci,j represents the
   length of the LCS between the prefix of length i from S and the prefix of length j from T.
   Some of the entries in the array C are currently masked using different symbols other than integers as shown below.

	Y_0	Y_1	Y_2	Y_3	Y_4
X_0	0	0	0	0	0
X_1	0	0	0	0	1
X_2	0	0	0	1	1
X_3	0	0	1	1	♡
X_4	0	1	♣	♠	♢

   i. What does the cell C0,1 represent?
   ii. What can be said about the characters X2 and Y3?
   iii. What can be said about the characters X3 and Y3?
   iv. What is the value of ♣?
   v. What is the value of ♠?

vi. When we are filling up the i-th column of our dynamic programming table C, what columns do we need to have access to?
vii. Given the observation above can we optimize our space complexity further?

3. Following are the codes generated from a text for a Huffman tree construction.

H - 1000 *o* - 1001 <*space*> - 1010 *S* - 1011	*u* - 000 *d* - 001 *n* - 010	*e* - 011 *l* - 110 *t* - 111

You are also given the following information:
- The frequency of each leaf node except e, l, and t is 1.
- The left and right child nodes of the root have frequencies 5 and 8 respectively.

Now answer the following questions.
a) Suppose in a Huffman tree, the distances from the root to the pair of leaves denoting the letters k and b are 5 and 2 respectively, which letter between them is more frequent in the original text? Just mention the letter.

b) Draw the Huffman tree from the given coding table above.
c) Continuing on Q(b), what are the frequencies of l, and t in the original text? Just mention the frequencies.

4. Wye is a CSE BracU Student. The pre-advising week is approaching, and he is trying to find the most suitable course combination for next semester. As per his previous academic results, his credit
limit has been set to 9. Different courses have different credits. He came up with values for these courses by consulting with students who have already taken them. He wants to select the most valued courses.
Courses, credits and values are provided below:

Course	PHY112	CSE330	CSE331	CSE370	CSE499
Credit	1	2	3	4	5
Value	10	8	16	13	17

a. Wye wants to try all possible combinations to find the best one. Help him by simulating a suitable dynamic programming approach. Show your work in detail, then write down the selected courses.
b. Zed, a friend of Wye, adopted a slightly different approach and considered the courses based on their per-credit value. Determine whether Zed could select more valued courses than Wye.
Note that, selecting a course still means taking the whole, with full credits.