CS4321 Homework 6

Due Tuesday, Dec. 11 at the beginning of class.

(88 points)

1. (10 points) Let u and v be two strings of characters. We want to transform u to v with the smallest possible number of operations of the following three types: delete a character, add a character, or change a character. For instance, we can transform $abbac$ into $abcbc$ in three stages:

$$\begin{aligned} abbac &\rightarrow abac \quad (delete \quad b) \\ &\rightarrow ababc \quad (add \quad b) \\ &\rightarrow abcbc \quad (change \quad a \quad into \quad c) \end{aligned}$$

   Show that this transformation is not optimal. Write a dynamic programming algorithm that finds the minimum number of operations needed to transform u into v and tells us what these operations are. As a function of length of u and v, how much time does your algorithm take?

2. (10 points) There are n trading posts along a river. At any of the posts you can rent a canoe to be returned at any other post downstream. (It is next to impossible to paddle against current.) For each possible departure point i and each possible arrival point j the cost of a rental for i and j is known. However, it can happen that the cost of renting from i to j is higher than the total cost of a series of shorter rental. In this case, you can return the first canoe at some post k between i and j and continue your journey in a second canoe. There is no extra charge for changing canoe in this way. Given an efficient algorithm to determine the minimum cost of a trip by canoe from each possible departure point i to each possible arrival point j. In terms of n, how much time is needed by your algorithm.

3. (10 points) Problem 15.2-1, P.338. You need to show the dynamic programming table with split points as shown in my notes, as well as the final parenthesizing result.

4. (10 points) Problem 15.4-5, P.356. You need to write a pseudo-code of your algorithm and argue that the cost is $O(n^2)$.

5. (10 points) Problem 25.2-1, P.634. You do not need to care about the meaning of the negative weights. Just treat them as the numbers for calculation and comparison purpose.

6. (8 points) Problem 22.2-1, P.538.

7. (10 points) Problem 22.3-2, P.547. Your answer can be just one figure in the style of Figure 22.4(p), but you need further classify non-tree edges to back edges, forward edges, and cross edges if they exist.

8. (6 points) Problem 22.4-1, P.551.

9. (4 points) Problem 26.2-1, P.663.

10. (10 points) Problem 26.2-2, P.663.