CS3230 : Tutorial - 8

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Please drop your answer sheets in Bakh's office or Rahul's CQT office by 1 pm Tuesday, 16th October, 2012.

1. Suppose we are given a sequence of words $W = \{w_1, w_2, \ldots, w_n\}$, where w_i consists of c_i characters, and another number L (representing the maximum number of characters including spaces allowed in a single line). A formatting of W consists of a partition of the words in W into lines. In the words assigned to a single line, there should be a space after each word except the last; and so if $w_j, w_{j+1}, \ldots, w_k$ are assigned to one line, then we should have

$$\left(\sum_{i=j}^{k-1}(c_i + 1)\right) + c_k \leq L.$$

   We will call an assignment of words to a line valid if it satisfies this inequality. The difference $L - \left(\left(\sum_{i=j}^{k-1}(c_i + 1)\right) + c_k\right)$ will be called the slack of the line. Give a dynamic-programming algorithm (idea and pseudocode) to find a partition of W into valid lines, so that the sum of the cubes of the slacks of all the lines (including the last line) is minimized. What is the worst case running time of your algorithm?

2. Write a dynamic-programming algorithm (idea and pseudocode) to determine the length of a longest common subsequence of two given strings. What is the worst case time of your algorithm? A string s is a subsequence of another string t, if it can be obtained by deleting some characters in t. For example a longest common subsequence of 'a b c d e f' and 'c d a b c f' is 'a b c f'. Now write an algorithm (pseudocode) to determine the longest common subsequence itself.

3. Write a dynamic-programming algorithm (idea and pseudocode) to find a longest increasing subsequence of a given sequence of numbers. One approach could be to use what you did in the previous question.

4. Write a dynamic-programming algorithm (idea and pseudocode) to determine a longest common substring of two given strings. What is the worst case time of your algorithm? A substring is a subsequence where all the items are consecutive. For example a longest common substring of 'a b c d e f' and 'c d a b c f' is 'a b c'.