

CSE331 homework 8

Due by the class on 12/5/2013 (Thursday)

1. (10 pts) We used dynamic programming to solve the longest common subsequence (LCS) problem in class. This algorithm needs to use a 2 dimensional array with size $|x| * |y|$ given that x and y are two input sequences. Now, modify the dynamic programming algorithm so that we only need to use a linear table with size either $|x|$ or $|y|$. Describe your idea (or modification) and then write your pseudocode.

Note: you don't need to find the longest common subsequence between x and y . You only need to find the size of an LCS.

2. (10 pts) Textbook (the 3rd version) problem 10.28. Please use the following pseudo-code to fill in the matrix M when $s = 1, 2$, and 3 .

```
//Compute minimum cost to multiply  $M_L, M_{L+1}, \dots, M_R$ 
For  $s = 1$  to  $R-L+1$  //s is the number of input matrices
  for  $i = L$  to  $R+1-s$ 
     $j = i+s-1$ 
    if ( $i == j$ )  $M[i, j] = 0$ 
    else
       $M[i, j] = \min_{i \leq k \leq j-1} \{ M[i, k] + M[k+1, j] + C_{i-1} C_k C_j \}$ 
```

3. (5 pts) Textbook (the 3rd version) problem 10.29 (a). In order to show that this greedy choice does not work, provide a counter-example.

4. [10 pts] Textbook (the 3rd version) problem 10.35.

5. (25 pts) This is a programming problem. Implement the dynamic programming algorithm to find the longest common subsequence between two input sequences. You need to fill in the table and then do the trace-back in order to output the LCS. Below you can find the specific requirements:

- 1) The program should be named as LCS and take two files as inputs.

LCS inputfile1 inputfile2

- 2) Both files contain a single-line string of numbers only, such as 10 22 33 etc.
- 3) Your file should output the LCS between the two input strings.
- 4) Two example input files can be found at
<http://www.cse.msu.edu/~cse331/examples/inputfile1> (inputfile2)
- 5) We will test your program using two different files.
- 6) If needed, you can use the driver program hw8-driver.cpp at
www.cse.msu.edu/~cse331/examples/hw8-driver.cpp

6. (5 pts) Suppose a polynomial algorithm is found to solve a known NPC problem, what is the relationship between problem sets P , NP , NPC , and NP -hard?

Bonus problem (5 pts)

How many different orders are there for chain multiplication of n matrices?

For example, there are two different orders for the multiplication of three matrices: $(A1A2)A3$ and $A1(A2A3)$.