

COMP 7712: Assignment 6

Due date: 11/15/2016

NOTE: email your program(s) directly to the TA (qmtran@memphis.edu) with subject “COMP 7712 Assignment 6”.

Given two strings $x = x_1x_2 \cdots x_n$ and $y = y_1y_2 \cdots y_m$, we wish to find the length of their longest common substring, that is, the largest k for which there are indices i and j with $x_ix_{i+1} \cdots x_{i+k-1} = y_jy_{j+1} \cdots y_{j+k-1}$.

For example, if $x = \text{thecatruns}$ and $y = \text{acatran}$, then the longest common substring is *catr* and the answer, its length, is 4.

1. (80 points) Write a Python program that solves this problem with running time in $O(n^3)$.
Hint: brute force.

2. (20 points) Write a Python program called *LCS* such that $LCS(x, y, i, j)$ computes and returns the length of the longest common substring of $x[0 : i + 1]$ and $y[0 : j + 1]$, with the condition that this common substring must include $x[i]$ and $y[j]$.

Hints: (1) There are two cases to consider (i) $x[i]$ is the same as $y[j]$ and (ii) $x[i]$ is different from $y[j]$. (2) The “smallest cases” are when $i < 0$ or $j < 0$.

3. (10 points) *LCS* does not directly solves our problem yet. Use this function $LCS(x, y, i, j)$ to find the length of longest common substring of x and y .
4. (10 points) Compare the raw running times of these two Python programs with at least 10 different values of x and y .

5. (20) Write a Python program that finds the length of the longest common subsequence of x and y . For example, if $x = \text{thecatruns}$ and $y = \text{acatran}$, then the longest common subsequence is *c, a, t, r, n* and the answer is 5. For this problem, you can define a function $lcs(x, y, i, j)$ to be the length of the longest common subsequence of $x[0 : i + 1]$ and $y[0 : j + 1]$.

Hint: there are also two cases to consider (i) $x[i] == y[j]$ and (ii) $x[i] != y[j]$.