# Homework 1

Start Assignment

**Due** Monday by 8am **Points** 20 **Submitting** a file upload **File Types** pdf
**Available** Jan 15 at 8am - Jan 22 at 8am

**Suggested reading**

Chapter 6 [DPV]

**Practice Problems**
**(*Do not turn these in; Model solutions will be made available on Thursday*)**

**[DPV] Problem 6.4** – Dictionary lookup

You are given a string of n characters s[1...n],which you believe to be a corrupted text document in which all punctuation has vanished...

**[DPV] Problem 6.8** – Longest common substring

Given two strings x = [1...n] and y = [1...m] we wish to find the length of their longest common substrings...

**[DPV] Problem 6.18** – Making change II

Consider the following variation on the change-making problem (Exercise 6.17): you are given denominations $x_1, x_2, \ldots, x_n$, ...

**[DPV] Problem 6.19** – Making change k

Given an unlimited supply of coins of denominations $x_1, x_2, \ldots, x_n$, we wish to make change for a value v using at most k coins...

**[DPV] Problem 6.20** – Optimal Binary Search Tree

Suppose we know the frequency with which keywords occur in programs of a certain language, for instance ...

**[DPV] Problem 6.26** – Alignment

Sequence alignment. When a new gene is discovered, a standard approach to understanding its function is to look through a database of known genes and find close matches

**Graded Problem**
**(*You will submit your solution to this Problem in Canvas*)**

A sequence of integers $A = \{a_1, a_2, \ldots, a_n\}$ is said to be *bumpy* when the signs of the differences between two consecutive terms in the sequence strictly alternate between + and - values. A difference of zero can never be part of a *bumpy* sequence. So the sequence either follows $a_1 < a_2 > a_3 < a_4 > \ldots$ or it follows $a_1 > a_2 < a_3 > a_4 < \ldots$.

An example of a *bumpy* sequence is 2, 4, -1, 9, 0, 5, -2. On the other hand, the sequence 2, 4, 7, 3, 10, 5, 5 is not *bumpy* because the differences between the three consecutive elements 2, 4, 7 do not alternate. Two 5's also show up at the end of the sequence causing the consecutive difference to be zero.

You are given a sequence of integers $A = \{a_1, a_2, \ldots, a_n\}$. Your task is to find the length of the longest *bumpy* subsequence in A. Design a dynamic programming algorithm to solve this problem.

Please answer the following parts:

1. Define the entries of your table in words. E.g. T(i) or T(i, j) is ...
2. State a recurrence for the entries of your table in terms of smaller subproblems. Don't forget your base case(s).
3. Write pseudocode for your algorithm to solve this problem.
4. State and analyze the running time of your algorithm.

Faster (in asymptotic Big O notation) and correct solutions are worth more credit.

You will upload a pdf of your typed solution. **Handwritten solutions will be penalized.** Please see the related threads in Ed Discussions for detailed expectations regarding your submission.