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Homework 1 - Bumpy Subsequence

CS 6515: Introduction to Graduate Algorithms

1.) **Define the entries of your table in words. E.g., T(i) or T(i, j) is ...**

- Let T(i) = be the maximum length of the longest bumpy sequence from terms a_1....a_i.
- Let S(i) = be the calculated difference between two terms from a_1…a_i.

2.) **State a recurrence for the entries of your table in terms of smaller subproblems.**

Base Case(s): T(0) = 0, T(1) = 1, S(0) = 0, S(1) = 0

Recurrence:

- S(i) = { a[i] - a[i-1] : if (a[i] - a[i-1] > 0 and S[i-1] <= 0) or (a[i] - a[i-1] < 0 and S[i-1] >= 0), S[i-1] : otherwise }, where 2 <= i <= n
- T(i) = { 1 + T[i-1] : if (a[i] - a[i-1] > 0 and S[i-1] <= 0) or (a[i] - a[i-1] < 0 and S[i-1] >= 0), T[i-1] : otherwise }, where 2 <= i <= n

3.) **Write pseudocode for your algorithm to solve this problem.**

```
T[0] = 0
T[1] = 1
S[0] = 0
S[1] = 0
for i = 2 to n:
    x = a[i] - a[i-1]
    if (x > 0 and S[i-1] <= 0) or (x < 0 and S[i-1] >= 0):
        T[i] = 1 + T[i-1]
        S[i] = x
    else:
        T[i] = T[i-1]
        S[i] = S[i-1]
  return T[n]
```

4.) **State and analyze the running time of your algorithm.**

- Running one for loop across n-terms takes O(n) time. Overall runtime is O(n).

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