Territory Wars Tutorial

Pre-requisites:

This problem will concepts of dynamic programming to solve. Make sure your basics of recursion and dynamic programming are clear before attempting this problem. The following links can help you learn the prerequisites:

- http://www.geeksforgeeks.org/recursion/
- https://www.topcoder.com/community/data-science/data-science-tutorials/an-introduction-to-recursion-part-1/
- https://www.topcoder.com/community/data-science/data-science-tutorials/an-introduction-to-recursion-part-2/
- https://www.topcoder.com/community/data-science/data-science-tutorials/dynamic-programming-from-novice-to-advanced/

Problem Description:

In this problem, n numbers are to be distributed amongst two parties, using a complicated strategy. First the order in which the numbers is to be decided. The parties have decided a special token and whoever has the token gets to decide who will get the next number, and the party which did not get the next number gets the token for the next iteration. Assuming both parties make their decisions optimally, we have to find out how much will be the total of each party. The input is given in the order in which the numbers are to be allotted.
The two parties are two gangs- Homies and Ballas and the numbers to be allotted are areas of sub-territories that they have to divide amongst themselves.
Initially, homies have the special token.

Difficulty Level:

Medium

Editorial:

Let us begin by understanding how we got the given sample output from the given sample input. In the example, Homies take the sub-territory with area 141 for

themselves and give the special token to Ballas. Then Ballas gives the sub-territory with area 592 to Homies and keep the special token for themselves, so that they can then allot the sub-territory with area 653 to themselves.

To solve the problem, Denote *Score*(*L*) as the sum total area of all sub-territories that will belong to the gang which has the token, for a list of sub-territories *L*, and denote *Total*(*L*) as the total area of all sub-territories, and *Rest*(*L*) as the list of sub-territories formed by removing the first sub-territory.

Note that the total area of sub-territories allotted to the gang which doesn't hold the token is given by *Total*(*L*) - *Score*(*L*).

Let's consider the options available to the gang with the token. If they choose to take the sub-territory for themselves, they end up with *L*[0] + *Total*(*Rest*(*L*)) - *Score*(*Rest*(*L*)) total area. If they let the other gang have the sub-territory, they end up with *Score*(*Rest*(*L*))total area. They will choose whichever option is larger. To compute the answer, we simply start from the end and work backwards to the beginning.

Complexity of solution:

The complexity of the solution has been reduced to O(n) because the solution involves linear traversal.