Dynamic Programming Project (Fall 2020/2021)

Minimum Chakra

Naruto is a Genin (beginner Ninja) in the Hidden Leaf village. He dreams of one day becoming the Hokage of the village (highest ranked Ninja). For that to happen, he has to train day and night. Most importantly, he has to practice various Ninja techniques. Ninja techniques can be divided into four elemental types:

- Fire-based (Katon) techniques
- Water-based (Suiton) techniques
- Wind-based (Futon) techniques
- Light-based (Raiton) techniques

However, Naruto can only perform the first three types only (he cannot do Light-based techniques). Whenever Naruto performs a technique, his Chakra (inner energy) is consumed a little.

Naruto's Mentor (Jiraya-Sama 😢) is taking Naruto for a training camp. The camp will last for N days. On each training day *i* (where *i* ranges from 1 to N), Naruto is allowed to perform one Ninja technique only. Each technique consumes a different amount of chakra on different days. For example, a Fire-based technique might consume 10 chakra points on day 1 but could consume 15 chakra points on day 3 or 8 chakra points on day 4 and so on.

Naruto is allowed to perform any technique he likes in any training day, however, Jiraya-Sama doesn't allow him to perform two techniques of the same type in two successive days.

For example, If on day 1 Naruto performs a Wind-based technique, then on day 2 he is allowed to perform Water-based technique or Fire-based technique but not a Wind-based technique, because that would mean he performed two Wind-based techniques in a row which will make Jiraya-Sama angry.

You are given three arrays of size N, each specifying for each technique type the amount of chakra points it consumes on each day of the N training days.

Find the minimum amount of Chakra needed by Naruto to finish the training camp.

Input Format

The first line is N (training days)

The second line is the chakra consumed by Fire-based techniques from day 1 to day N

The third line is the chakra consumed by Water-based techniques from day 1 to day N

The fourth line is the chakra consumed by Wind-based techniques from day 1 to day N

Output Format

Minimum chakra consumed for the N training days.

Example

Input:

3

2 5 8

5 2 4

7 1 5

Output:

7

Explanation: On day 1 Naruto performs a fire-based technique (costs 2 points), on second day he performs a wind-based technique (costs 1 point) and on day three he performs a water-based technique (costs 4 points) so total = 2 + 1+ 4 = 7

Here is a reminder of the outline of your solution:

Part1: Divide & Conquer

1- Define the value returned by the function *f* which we want to optimize.

2- Define the parameters which *f* depends on.

3- Draw the recursion tree for *f* using the values from the example above.

4- Write the recursive (divide and conquer) code to solve the question.

Part2: Dynamic Programming

5- Draw the table and determine the dependencies between the table cells.

6- Determine the direction of movement within the table.

7- Write the Dynamic programming code which fills the table(s).

8- Write the code that will print the sequence of moves that go you the solution.

You are requested to submit a report that explains each of the steps above which also includes graphs and figures to explain your solution and the rationale behind it. Also, you need to submit your working code on the hackerrank website as usual. The link will be provided on Moodle/FB Group.

Important:

To solve this task you are not allowed to copy/be inspired by any piece of code from the internet or from a colleague or from anyone or any place.

If any percentage of resemblance is found between your code and a code listed on the internet (even if the code is a solution for a different problem), it will be considered cheating.

You are only allowed to check the code of the three problems we studied at class and the last years problems I posted on Moodle.

If it has been proven that you cheated on this task (no matter how small the percentage is), you will get zero in the final exam mark.

Good Luck

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