

Problem Statement

IIT Delhi has recently deployed a drone for aerial surveillance on account of independence day. The drone begins at position $(0,0,0)$ and can move infinitely in any direction depending on how it is programmed. A drone program is a string consisting of a sequence instructions, where each instruction is one of the following.

- $+X$: Move one unit in the direction of the positive X -axis.
- $-X$: Move one unit in the direction of the negative X -axis.
- $+Y$: Move one unit in the direction of the positive Y -axis.
- $-Y$: Move one unit in the direction of the negative Y -axis.
- $+Z$: Move one unit in the direction of the positive Z -axis.
- $-Z$: Move one unit in the direction of the negative X -axis.
- $m(P)$, where $m > 0$ is an integer and P is a drone program: Execute program P m times.

For example,

- $2(+X+Y-Z)$ is equivalent to $+X+Y-Z+X+Y-Z$, moving the drone to $(2, 2, -2)$ after traveling distance 6.
- $5(+X)10(-X)$ is equivalent to $+X+X+X+X+X-X-X-X-X-X-X-X-X-X-X-X$, moving the drone to $(-5, 0, 0)$ after traveling distance 15.
- $3(-Y2(+Z))$ is equivalent $-Y+Z+Z-Y+Z+Z-Y+Z+Z$, moving the drone to $(0, -3, 6)$ after traveling distance 9.
- $+X+X+X+X4(+Y)2(+Z-Z)$ is equivalent to $+X+X+X+X+Y+Y+Y+Y+Z-Z+Z-Z$, moving the drone to $(4, 4, 0)$ after traveling distance 12.

Your task is to write a **python** program that takes a drone program P as input and outputs the following.

1. The final position of the drone after it has executed its program P .
2. The total distance travelled by the drone in this process.

To solve this problem, it will be helpful to use stacks, so **implement the Stack data structure and its member functions from scratch**. For full credit, **your program must run in time $O(n)$** on drone programs of length n . We will assume that your program runs in linear time provided it terminates within a specific amount of time set into our auto-grader. To minimise the possibility of a false auto-grader timeout, you are advised to remove all unnecessary print statements that you might have written to debug your program.

Submission Specifications

Submit a single file named `a1.py`. Your submitted file must contain a function `findPositionandDistance(P)` that takes a string P as input, and return a list `[x,y,z,d]` containing four numbers, where (x,y,z) is the final position of the drone after it executes program P , and d is the distance traveled by the drone in the process.

Example Test Cases

```
>>> findPositionandDistance('X+Y+X-Y-Z+X+X-Z-Z-Z-Z-Y+Y-X')
[3, 0, -5, 14]
>>> findPositionandDistance('X2(+Y-X-Z)8(+Y)9(-Z-Z)')
[-1, 10, -20, 33]
>>> findPositionandDistance('')
[0, 0, 0, 0]
>>> findPositionandDistance('5(2(3(+X+X)))')
[60, 0, 0, 60]
>>> findPositionandDistance('Z6(+X+Y+X-Y)9(-X+Z-X-Z8(+X+Y-Z)9(+Y-Z-X-Y4(-X+Y-X-Z+X)))')
[-339, 396, -476, 2221]
>>> findPositionandDistance('1(+X)5(+Y)41(+Z)1805(-X)3263441(-Y)10650056950805(-Z)')
[-1804, -3263436, -10650056950764, 10650060216098]
```