[CS 11] Prac 6i – Parallel Universes

Problem Statement

Mario has become QPU misaligned and needs to perform special maneuvers to return to the original universe!

We can think of the multiverse as an infinite rectangular grid of parallel universes. Thus, we can label each parallel universe with a **lattice point**, that is, a point on the Cartesian plane with integer coordinates.

Mario is currently at universe (x_0, y_0). He then performs n movements. Each movement specifies:

- a direction, which is one of north, south, east, or west, and
- the number of steps toward that direction. One "step" means going to the universe one unit across.

Given the sequence of instructions, which universe does Mario end up in?

Notes:

- "North" is the positive y direction.
- "East" is the positive x direction.

Task Details

Your task is to implement a function called `move2d`. This function has two parameters:

- the first parameter is a pair of `int`s `(x0, y0)` denoting Mario's initial location universe.
- the second parameter is a `tuple` of length n consisting of movement data. Each element is a pair `(d, s)` where:
  - `d` is a `str` representing the direction: `north`, `south`, `east` or `west`
  - `s` is an `int` representing the number of steps.

The function must return a pair of `int`s `(x, y)` denoting Mario's final location universe, after performing all the movements.

Restrictions

(See 6a for more restrictions)

For this problem:

- Loops and lists are allowed.
- Up to 8 function definitions are allowed.
- Recursion is **disallowed**. (The recursion limit has been greatly reduced.)
- Sets and dictionaries are allowed.
- Generators and comprehensions are allowed.
- The following names are allowed: `set`, `dict`, `iter`, `next`, `any`, `all`, `popitem`, `setdefault`, `update`, `add`, `discard`.
- The source code limit is 600.

Example Calls

Example 1 Function Call

```
move2d((3, 5), (
    ('south', 2),
    ('east', 5),
    ('west', 3),
    ('south', 2),
    ('south', 5),
))
```

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Example 1 Return Value

```
(5, -4)
```

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Constraints

- The function `move2d` will be called at most $50{,}000$ times.
- The total length of all movement data will be at most $150{,}000$.
- Each individual movement data will be at most $150{,}000$ in length.
- Each coordinate will have an absolute value at most 10^{10}.
- $1 \le s \le 10^{10}$

Scoring

- You get 50 ❤️ points if you solve all test cases where:
  - the length of movement data is at most 50 individually.
  - the length of movement data is at most 500 overall.
- You get 50 ❤️ points if you solve all test cases where:
  - the length of movement data is at most $4{,}000$ individually.
  - the length of movement data is at most $8{,}000$ overall.
- You get 25 ❤️ points if you solve all test cases.

Clarifications

Report an issue

No clarifications have been made at this time.

Submit solution [CS 11] Practice 6 ❤️

My submissions ❤️

Points: 175 (partial)
Time limit: 6.0s
Memory limit: 1G

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Problem type

Allowed languages ~~NONE~~, py3