[CS 11] Prac 4f – Defying Gravity

Problem Statement

Steve's world can be modeled as a two-dimensional grid.

Currently, there are several blocks floating in the air. (Steve was able to get them floating with the help of some tall flowers.) Each block has a type. There are at most 26 types, so we can conveniently represent them as uppercase letters.

However, the blocks suddenly realized that they're currently violating the laws of physics. To avoid getting arrested, the blocks simultaneously decided to let gravity take its course. They simultaneously start falling down in a straight line. They stop once they hit the ground or another block that has already stopped.

What does the grid look like after all the blocks fall?

Task Details

Your task is to implement a function called `fall`. This function has a single parameter:

- `grid` — a `tuple` of `str`s describing the grid. Here, an uppercase letter represents a block, while a dot represents empty space.

The function must return a `tuple` of `str`s representing a grid of the same dimensions denoting the state of the grid after all the blocks fall.

Restrictions

- Recursion is allowed.
- Up to 8 function definitions are allowed.
- Comprehensions are allowed.
- `range` is allowed.
- The symbols `min`, `max`, `sum` and `sorted` are allowed.
- The source code limit is 900.

Example Calls

Example 1 Function Call

```
fall((
    '.X.X..',
    '......',
    'X...X.',
    '.XXX..',
    '......',
))
```

Example 1 Return Value

```
(
    '......',
    '......',
    '......',
    '.X.X..',
    'XXXXX.',
)
```

Example 2 Function Call

```
fall((
    '..XXXXX',
    '....XXX',
    '.....XX',
    '.....XX',
    '......X',
    '......X',
))
```

Example 2 Return Value

```
(
    '......X',
    '......X',
    '.....XX',
    '.....XX',
    '....XXX',
    '..XXXXX',
)
```

Example 3 Function Call

```
fall((
    '..A.',
    'A.BC',
    'D..C',
    '..A.',
))
```

Example 3 Return Value

```
(
    '....',
    '..A.',
    'A.BC',
    'D.AC',
)
```

Constraints

- The function `fall` will be called at most 200 times.
- The grid will have at most 20 rows and at most 20 columns.
- The only characters that will appear are uppercase English letters and dots.

Scoring

- You get 150 ❤️ points if you solve all test cases where:
  - only `X` appears as a block type.
- You get 100 ❤️ points if you solve all test cases.

Submit solution

My submissions

Points: 250 (partial)
Time limit: 4.0s
Memory limit: 1G

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Problem type

Allowed languages
~~NONE~~, py3

Clarifications

Report an issue

No clarifications have been made at this time.