Problem 1728: Cat and Mouse II

Problem Information

Difficulty: Hard
Acceptance Rate: 40.06%
Paid Only: No
Tags: Array, Math, Dynamic Programming, Graph, Topological Sort, Memoization, Matrix, Game Theory

Problem Description

A game is played by a cat and a mouse named Cat and Mouse.

The environment is represented by a `grid` of size `rows x cols`, where each element is a wall, floor, player (Cat, Mouse), or food.

* Players are represented by the characters `'C'`(Cat)`,'M'`(Mouse). * Floors are represented by the character `'.'` and can be walked on. * Walls are represented by the character `'#'` and cannot be walked on. * Food is represented by the character `'F'` and can be walked on. * There is only one of each character `'C'`, `'M'`, and `'F'` in `grid`.

Mouse and Cat play according to the following rules:

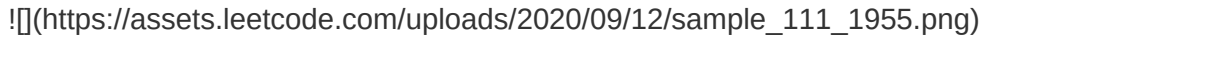
* Mouse **moves first** , then they take turns to move. * During each turn, Cat and Mouse can jump in one of the four directions (left, right, up, down). They cannot jump over the wall nor outside of the `grid`. * `catJump, mouseJump` are the maximum lengths Cat and Mouse can jump at a time, respectively. Cat and Mouse can jump less than the maximum length. * Staying in the same position is allowed. * Mouse can jump over Cat.

The game can end in 4 ways:

* If Cat occupies the same position as Mouse, Cat wins. * If Cat reaches the food first, Cat wins. * If Mouse reaches the food first, Mouse wins. * If Mouse cannot get to the food within 1000 turns, Cat wins.

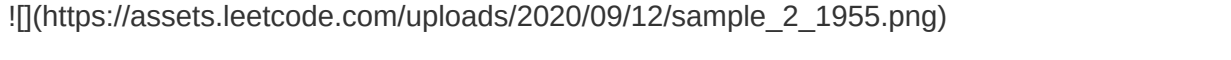
Given a `rows x cols` matrix `grid` and two integers `catJump` and `mouseJump`, return `true` _if Mouse can win the game if both Cat and Mouse play optimally, otherwise return_ `false`.

Example 1:



Input: grid = ["####F","#C...","M...."], catJump = 1, mouseJump = 2 **Output:** true **Explanation:** Cat cannot catch Mouse on its turn nor can it get the food before Mouse.

Example 2:



Input: grid = ["M.C...F"], catJump = 1, mouseJump = 4 **Output:** true

Example 3:

Input: grid = ["M.C...F"], catJump = 1, mouseJump = 3 **Output:** false

Constraints:

* `rows == grid.length` * `cols = grid[i].length` * `1 <= rows, cols <= 8` * `grid[i][j]` consist only of characters `'C'`, `'M'`, `'F'`, `'.'`, and `'#'`. * There is only one of each character `'C'`, `'M'`, and `'F'` in `grid`. * `1 <= catJump, mouseJump <= 8`

Code Snippets

C++:

```
class Solution {
public:
bool canMouseWin(vector<string>& grid, int catJump, int mouseJump) {

}
};
```

Java:

```
class Solution {
public boolean canMouseWin(String[] grid, int catJump, int mouseJump) {

}
}
```

Python3:

```
class Solution:
def canMouseWin(self, grid: List[str], catJump: int, mouseJump: int) -> bool:
```