Assignment #10: dp & bfs

2024 fall, Complied by 吕金浩，物理学院

1. 题目

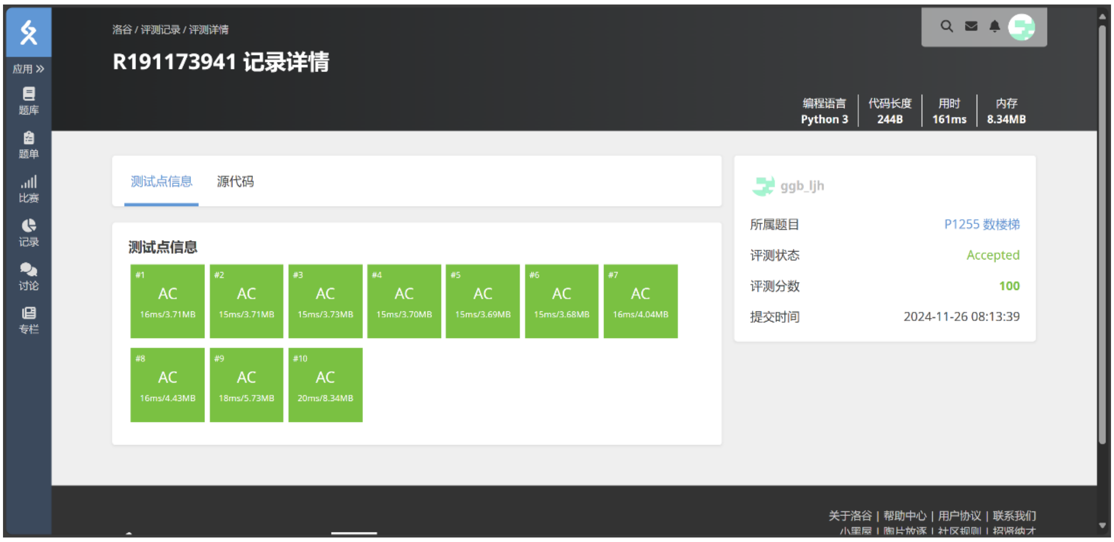
LuoguP1255 数楼梯

dp, bfs, https://www.luogu.com.cn/problem/P1255

思路：递归秒了……

代码：

```
import sys
sys.setrecursionlimit(1<<30)
from functools import lru_cache
@lru_cache(maxsize=None)
def stairs(n):
    if n==1:
        return 1
    if n==2:
        return 2
    return stairs(n-1)+stairs(n-2)
print(stairs(int(input())))
```



洛谷 / 评测记录 / 评测详情

R191173941 记录详情

编程语言	代码长度	用时	内存
Python 3	244B	161ms	8.34MB

测试点信息

#1 AC 16ms/3.71MB
#2 AC 15ms/3.71MB
#3 AC 15ms/3.73MB
#4 AC 15ms/3.70MB
#5 AC 15ms/3.69MB
#6 AC 15ms/3.68MB
#7 AC 16ms/4.04MB
#8 AC 16ms/4.43MB
#9 AC 18ms/5.73MB
#10 AC 20ms/8.34MB

ggb_ljh

所属题目	P1255 数楼梯
评测状态	Accepted
评测分数	100
提交时间	2024-11-26 08:13:39

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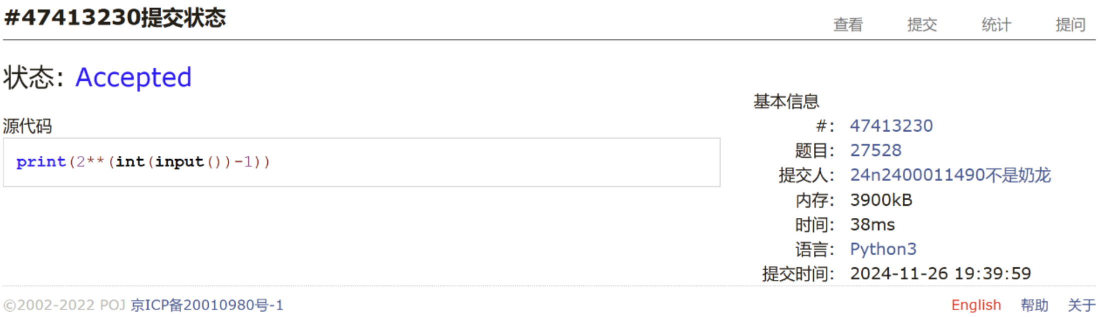
27528: 跳台阶

dp, http://cs101.openjudge.cn/practice/27528/

思路：What can I say?

代码：

```
print(2**(int(input())-1))
```



#47413230提交状态

状态: Accepted

源代码

```
print(2**(int(input())-1))
```

基本信息

#:	47413230
题目:	27528
提交人:	24n2400011490不是奶龙
内存:	3900kB
时间:	38ms
语言:	Python3
提交时间:	2024-11-26 19:39:59

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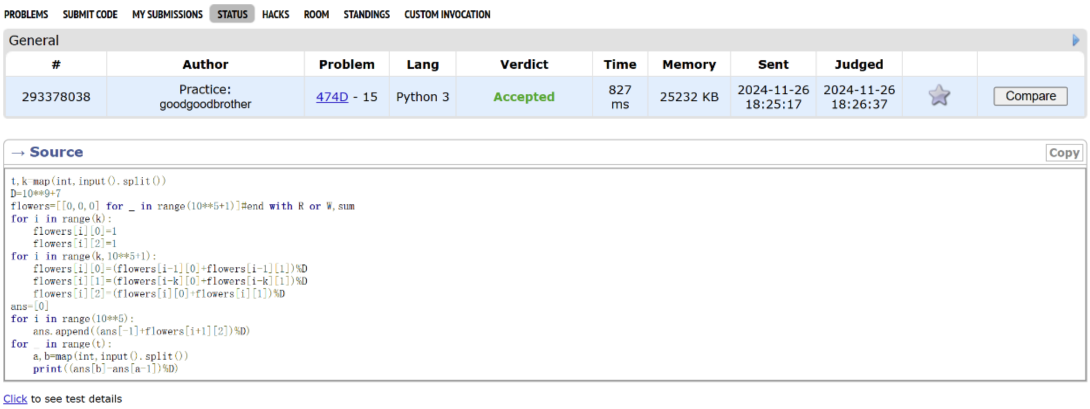
474D. Flowers

dp, https://codeforces.com/problemset/problem/474/D

思路：一开始想的递推是首尾两端都可以加东西，想了差不多一个小时，然后突然意识到可以直接在尾端加 1 个 R 或 k 个 W，就很快写出来了

代码:

```
t,k=map(int,input().split())
D=10**9+7
flowers=[[0,0,0] for _ in range(10**5+1)]#end with R or W,sum
for i in range(k):
    flowers[i][0]=1
    flowers[i][2]=1
for i in range(k,10**5+1):
    flowers[i][0]=(flowers[i-1][0]+flowers[i-1][1])%D
    flowers[i][1]=(flowers[i-k][0]+flowers[i-k][1])%D
    flowers[i][2]=(flowers[i][0]+flowers[i][1])%D
ans=[0]
for i in range(10**5):
    ans.append((ans[-1]+flowers[i+1][2])%D)
for _ in range(t):
    a,b=map(int,input().split())
    print((ans[b]-ans[a-1])%D)
```



General

#	Author	Problem	Lang	Verdict	Time	Memory	Sent	Judged		
293378038	Practice: goodgoodbrother	474D - 15	Python 3	Accepted	827 ms	25232 KB	2024-11-26 18:25:17	2024-11-26 18:26:37	☆	Compare

→ Source

```
t,k=map(int,input().split())
D=10**9+7
flowers=[[0,0,0] for _ in range(10**5+1)]#end with R or W,sum
for i in range(k):
    flowers[i][0]=1
    flowers[i][2]=1
for i in range(k,10**5+1):
    flowers[i][0]=(flowers[i-1][0]+flowers[i-1][1])%D
    flowers[i][1]=(flowers[i-k][0]+flowers[i-k][1])%D
    flowers[i][2]=(flowers[i][0]+flowers[i][1])%D
ans=[0]
for i in range(10**5):
    ans.append((ans[-1]+flowers[i+1][2])%D)
for _ in range(t):
    a,b=map(int,input().split())
    print((ans[b]-ans[a-1])%D)
```

Click to see test details

LeetCode5.最长回文子串

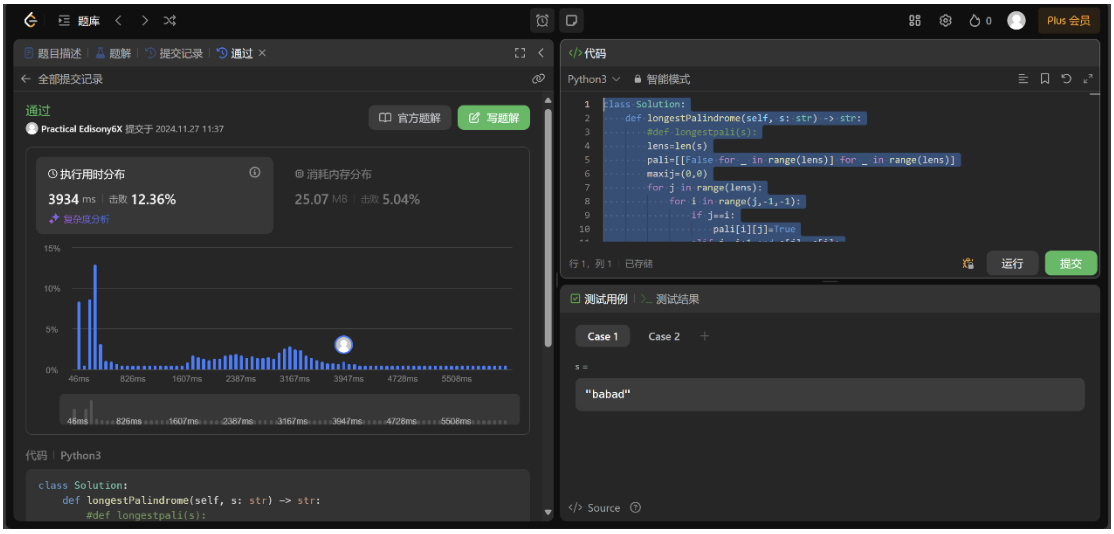
dp, two pointers, string, https://leetcode.cn/problems/longest-palindromic-substring/

解法 1

思路：找递推关系，判断每条字串是不是回文的

代码:

```
class Solution:
    def longestPalindrome(self, s: str) -> str:
        #def longestpali(s):
        lens=len(s)
        pali=[[False for _ in range(lens)] for _ in range(lens)]
        maxij=(0,0)
        for j in range(lens):
            for i in range(j,-1,-1):
                if j==i:
                    pali[i][j]=True
                elif j==i+1 and s[j]==s[i]:
                    pali[i][j]=True
                else:
                    pali[i][j]=s[j]==s[i] and pali[i+1][j-1]
                if pali[i][j] and j-i>maxij[1]-maxij[0]:
                    maxij=(i,j)
        return s[maxij[0]:maxij[1]+1]
```



通过

Practical Edisony6X 提交于 2024.11.27 11:37

执行用时分布

3934 ms | 击败 12.36%

消耗内存分布

25.07 MB | 击败 5.04%

代码 | Python3

```
class Solution:
    def longestPalindrome(self, s: str) -> str:
        #def longestpali(s):
```

```
class Solution:
    def longestPalindrome(self, s: str) -> str:
        #def longestpali(s):
        lens=len(s)
        pali=[[False for _ in range(lens)] for _ in range(lens)]
        maxij=(0,0)
        for j in range(lens):
            for i in range(j,-1,-1):
                if j==i:
                    pali[i][j]=True
```

行 1，列 1 | 已存储

s =

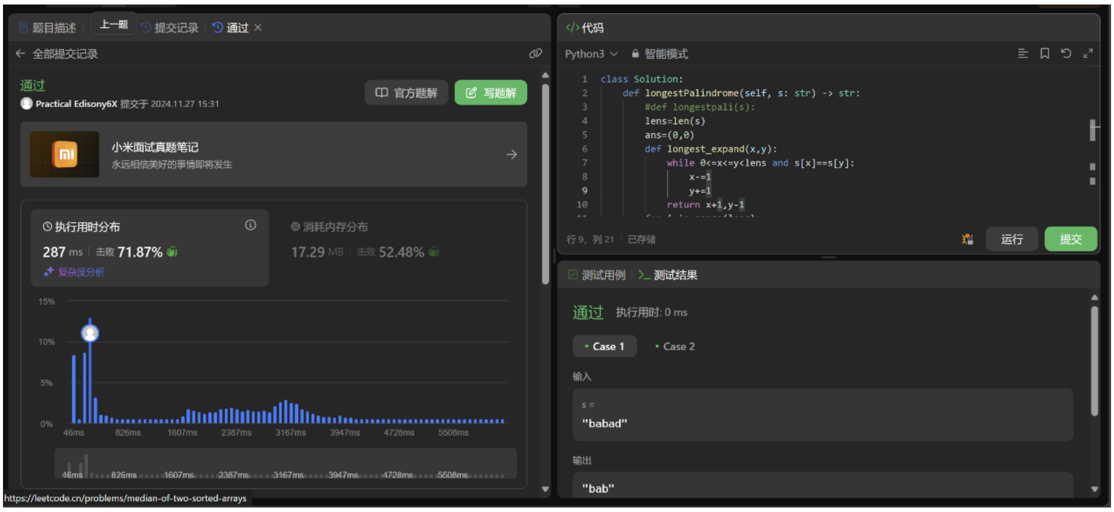
"babad"

解法 2

思路：看了答案之后，写出的我自己看得懂、写得出的双指针

代码:

```
class Solution:
    def longestPalindrome(self, s: str) -> str:
        #def longestpali(s):
        lens=len(s)
        ans=(0,0)
        def longest_expand(x,y):
            while 0<=x<=y<lens and s[x]==s[y]:
                x-=1
                y+=1
            return x+1,y-1
        for i in range(lens):
            for j in range(2):
                a = longest_expand(i, i+j)
                if a[1] - a[0] > ans[1] - ans[0]:
                    ans = a
        return s[ans[0]:ans[1]+1]
```



通过

Practical Edisony6X 提交于 2024.11.27 15:31

287 ms | 击败 71.87%

17.29 MB | 击败 52.48%

https://leetcode.cn/problems/median-of-two-sorted-arrays

```
class Solution:
    def longestPalindrome(self, s: str) -> str:
        #def longestpali(s):
        lens=len(s)
        ans=(0,0)
        def longest_expand(x,y):
            while 0<=x<=y<lens and s[x]==s[y]:
                x-=1
                y+=1
            return x+1,y-1
```

行 9，列 21 | 已存储

通过 执行用时: 0 ms

输入

s =

"babad"

输出

"bab"

12029: 水淹七军

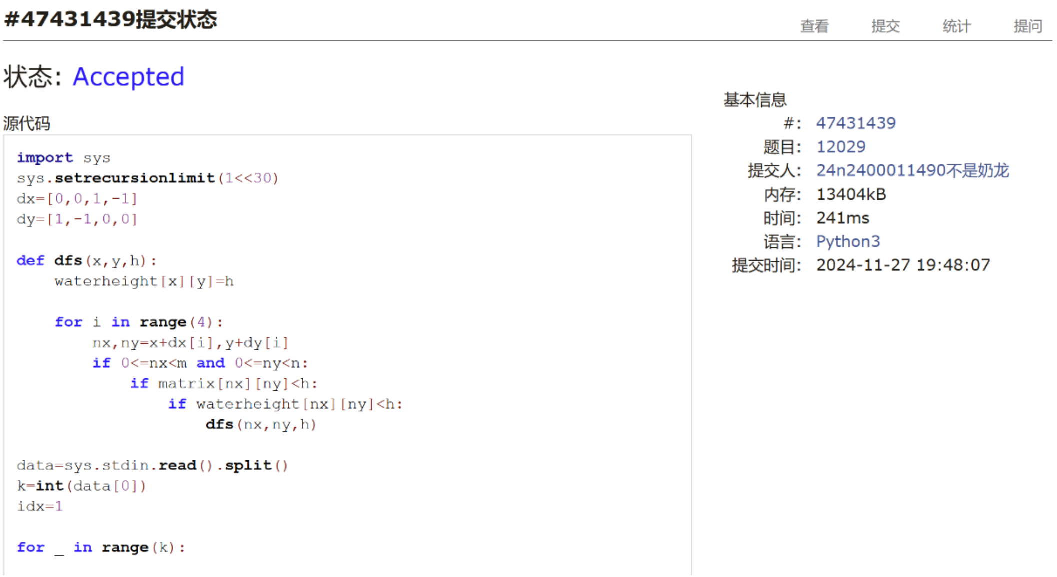
bfs, dfs, http://cs101.openjudge.cn/practice/12029/

思路：RE 了二十次，最后照着答案和老师的回答做出来的，另外用 visited 会 TLE。

代码：

```
import sys
sys.setrecursionlimit(1<<30)
dx=[0,0,1,-1]
dy=[1,-1,0,0]

def dfs(x,y,h):
    waterheight[x][y]=h

    for i in range(4):
        nx,ny=x+dx[i],y+dy[i]
        if 0<=nx<m and 0<=ny<n:
            if matrix[nx][ny]<h:
                if waterheight[nx][ny]<h:
                    dfs(nx,ny,h)

data=sys.stdin.read().split()
k=int(data[0])
idx=1
```

```
for _ in range(k):

    m,n=map(int,data[idx:idx+2])
    idx+=2
    matrix=[]
    for _ in range(m):
        matrix.append([int(x) for x in data[idx:idx+n]])
        idx+=n
    a,b=map(int,data[idx:idx+2])
    idx+=2

    tarx,tary=a-1,b-1
    tarh=matrix[tarx][tary]
    p=int(data[idx])
    idx+=1
    waters=[]
    for _ in range(p):
        a,b=map(int,data[idx:idx+2])
        idx+=2
        waters.append((a-1,b-1,matrix[a-1][b-1]))

    waterheight=[[0 for _ in range(n)] for _ in range(m) ]

    for water in waters:
        wx,wy,wh=water

        if wh>tarh:
            dfs(wx,wy,wh)
    print('Yes' if waterheight[tarx][tary]>0 else 'No')
```



#47431439提交状态

状态: Accepted

源代码

```
import sys
sys.setrecursionlimit(1<<30)
dx=[0,0,1,-1]
dy=[1,-1,0,0]

def dfs(x,y,h):
    waterheight[x][y]=h

    for i in range(4):
        nx,ny=x+dx[i],y+dy[i]
        if 0<=nx<m and 0<=ny<n:
            if matrix[nx][ny]<h:
                if waterheight[nx][ny]<h:
                    dfs(nx,ny,h)

data=sys.stdin.read().split()
k=int(data[0])
idx=1

for _ in range(k):
```

基本信息

#:	47431439
题目:	12029
提交人:	24n2400011490不是奶龙
内存:	13404kB
时间:	241ms
语言:	Python3
提交时间:	2024-11-27 19:48:07

02802: 小游戏

bfs, http://cs101.openjudge.cn/practice/02802/

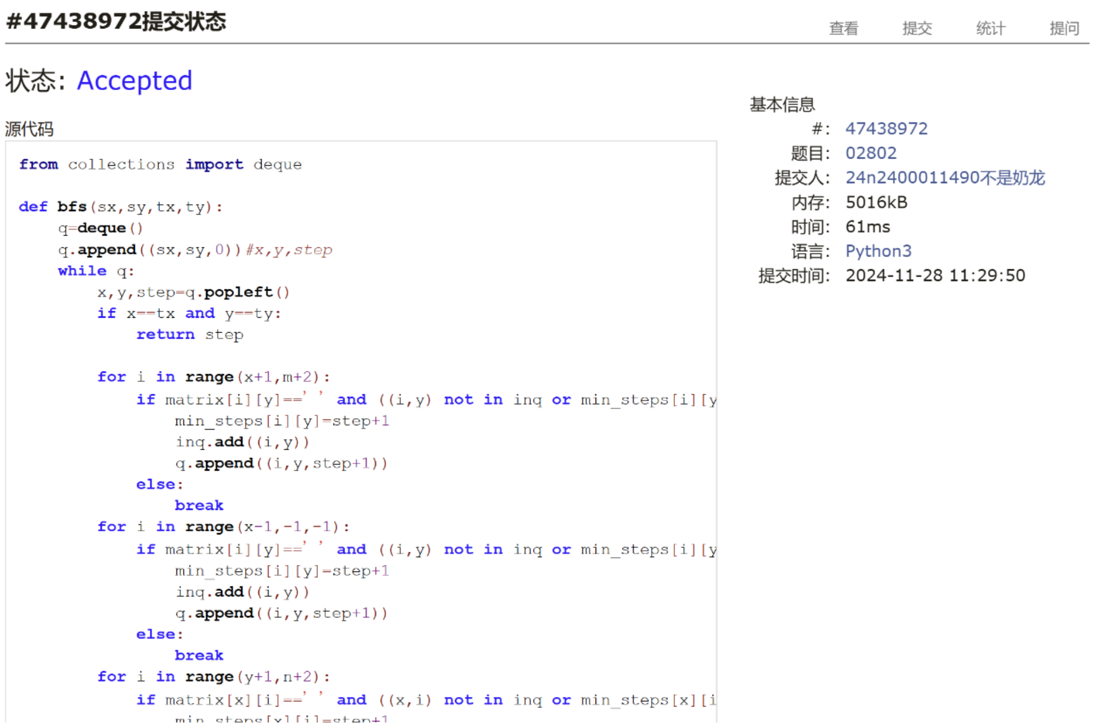
思路：

比上一题舒服多了……这一题就只 presentation error 了一次，发现是输出空行搞错了之后，改了一下就 AC 了。

先将目标卡片设为空位，对线段数作 bfs。对每一个 k 段线段能找到的空位，令其向四方向延展，找到 k+1 段线段能找到的空位。注意要适当允许重复现象，否则可能会导致路被堵死。

代码：

```
from collections import deque

def bfs(sx,sy,tx,ty):
    q=deque()
    q.append((sx,sy,0))#x,y,step
    while q:
        x,y,step=q.popleft()
        if x==tx and y==ty:
            return step

        for i in range(x+1,m+2):
            if matrix[i][y]==' ' and ((i,y) not in inq or min_steps[i][y]==step+1):#适当允许重复
                min_steps[i][y]=step+1
                inq.add((i,y))
                q.append((i,y,step+1))
            else:
                break
        for i in range(x-1,-1,-1):
            if matrix[i][y]==' ' and ((i,y) not in inq or min_steps[i][y]==step+1):
                min_steps[i][y]=step+1
                inq.add((i,y))
                q.append((i,y,step+1))
            else:
                break
        for i in range(y+1,n+2):
            if matrix[x][i]==' ' and ((x,i) not in inq or min_steps[x][i]==step+1):
                min_steps[x][i]=step+1
                inq.add((x,i))
                q.append((x,i,step+1))
            else:
                break
        for i in range(y-1,-1,-1):
            if matrix[x][i]==' ' and ((x,i) not in inq or min_steps[x][i]==step+1):
                min_steps[x][i]=step+1
                inq.add((x,i))
                q.append((x,i,step+1))
            else:
                break

    return -1

board=0
while True:
    n,m=map(int,input().split())
    if m==0 and n==0:
        break
    board+=1
    if board>1:
        print('')
    print('Board #{}:'.format(board))
    matrix=[[' ']*(n+2)]+[list(' '+input()+' ') for _ in range(m) ]+[[' ']*(n+2)]

    pair=0
    while True:
        y1,x1,y2,x2=map(int,input().split())
        if y1==0 and x1==0 and y2==0 and x2==0:
            break
        pair+=1
        inq={(x1,y1)}
        min_steps=[[float('inf') for _ in range(n+2)] for _ in range(m+2)]
        min_steps[x1][y1]=0
        matrix[x1][y1]=' '
        matrix[x2][y2]=' '
        segment=bfs(x1,y1,x2,y2)
        print('Pair {}: {} segments.'.format(pair,segment) if segment>0 else 'Pair {}: impossible.'.format(pair))
        matrix[x1][y1] = 'X'
        matrix[x2][y2] = 'X'
```



#47438972提交状态

状态: Accepted

源代码

```
from collections import deque

def bfs(sx,sy,tx,ty):
    q=deque()
    q.append((sx,sy,0))#x,y,step
    while q:
        x,y,step=q.popleft()
        if x==tx and y==ty:
            return step

        for i in range(x+1,m+2):
            if matrix[i][y]==' ' and ((i,y) not in inq or min_steps[i][y
                min_steps[i][y]=step+1
                inq.add((i,y))
                q.append((i,y,step+1))
            else:
                break
        for i in range(x-1,-1,-1):
            if matrix[i][y]==' ' and ((i,y) not in inq or min_steps[i][y
                min_steps[i][y]=step+1
                inq.add((i,y))
                q.append((i,y,step+1))
            else:
                break
        for i in range(y+1,n+2):
            if matrix[x][i]==' ' and ((x,i) not in inq or min_steps[x][i
                min_steps[x][i]=step+1
```

基本信息

#:	47438972
题目:	02802
提交人:	24n2400011490不是奶龙
内存:	5016kB
时间:	61ms
语言:	Python3
提交时间:	2024-11-28 11:29:50

2. 学习总结和收获

我现在做 dp 主打一个递归，对于大部分遇到的 dp 题还是比较有用的，简化了对于边界条件的考虑。另外，感受到 bfs 和 dfs 的繁杂了，希望老师期末手下留情（