Assignment #A: dp & bfs

Updated 2 GMT+8 Nov 25, 2024

2024 fall, Complied by 颜鼎堃 工学院

说明：

1）请把每个题目解题思路（可选），源码Python, 或者C++（已经在Codeforces/Openjudge上AC），截图（包含Accepted），填写到下面作业模版中（推荐使用 typora https://typoraio.cn ，或者用word）。AC 或者没有AC，都请标上每个题目大致花费时间。

2）提交时候先提交pdf文件，再把md或者doc文件上传到右侧“作业评论”。Canvas需要有同学清晰头像、提交文件有pdf、"作业评论"区有上传的md或者doc附件。

3）如果不能在截止前提交作业，请写明原因。

1. 题目

LuoguP1255 数楼梯

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

思路：

- 就是斐波那契数列
- 如果真要按照标的数据范围，下面代码是过不了的，因为递归深度不够

代码：

```python
from functools import lru_cache
from sys import setrecursionlimit
setrecursionlimit(1 << 30)
@lru_cache
def Fibonacci(n):
    return Fibonacci(n - 1) + Fibonacci(n - 2) if n > 2 else 1 if n == 1 else 2
print(Fibonacci(int(input())))
```

代码运行截图 （至少包含有"Accepted"）

27528: 跳台阶

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

思路：

- 根据数学方法得到公式$2^n - 1$

代码：

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

代码运行截图（至少包含有"Accepted"）

474D. Flowers

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

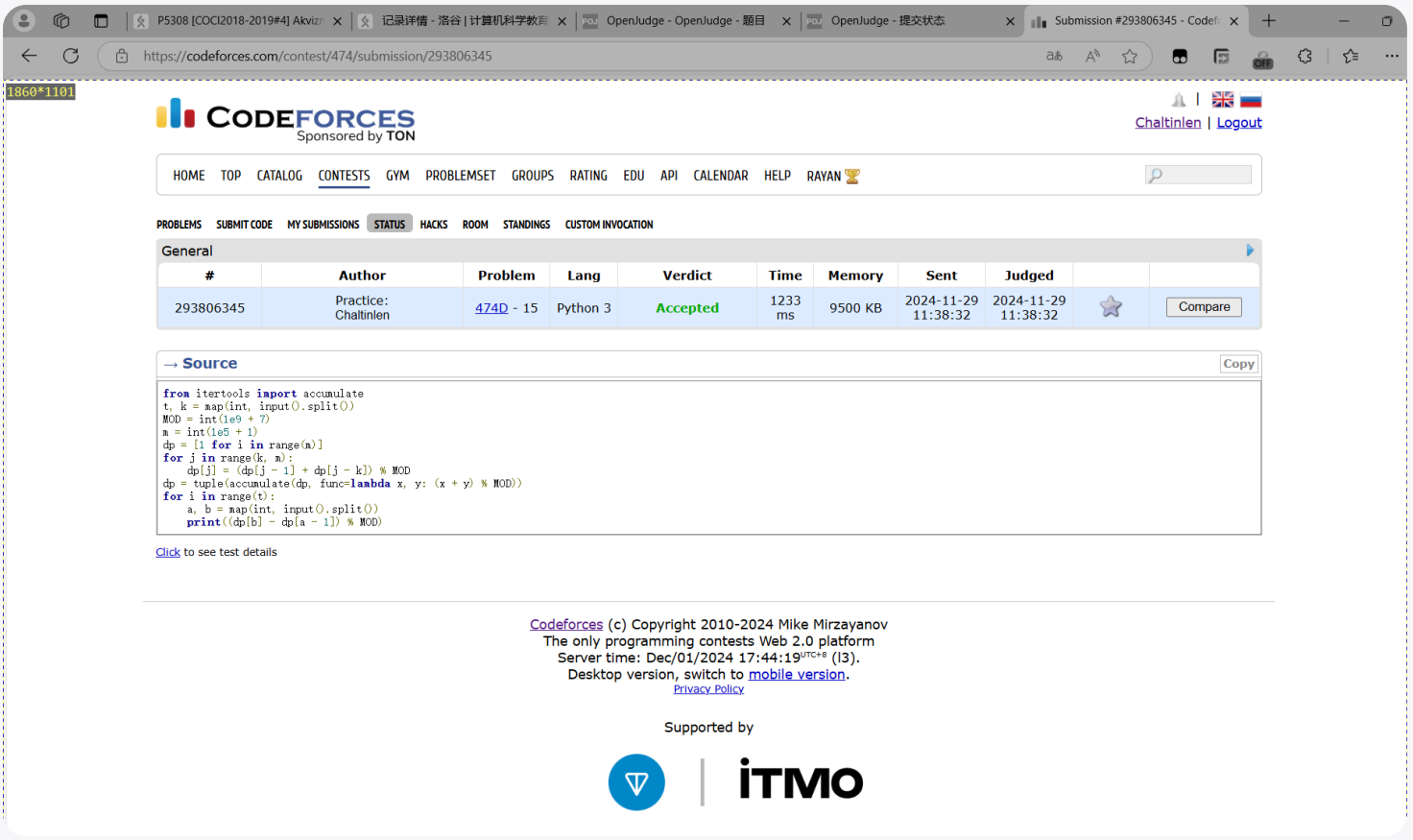
思路：

- 先用$k=2$找思路，根据排列组合公式发现又是斐波那契数列，再合理推广找递推公式$a_n=a_{n-1}+a_{n-k}$就好

代码：

```python
from itertools import accumulate
t, k = map(int, input().split())
MOD = int(1e9 + 7)
m = int(1e5 + 1)
dp = [1 for i in range(m)]
for j in range(k, m):
    dp[j] = (dp[j - 1] + dp[j - k]) % MOD
dp = tuple(accumulate(dp, func=lambda x, y: (x + y) % MOD))
for i in range(t):
    a, b = map(int, input().split())
    print((dp[b] - dp[a - 1]) % MOD)
```

代码运行截图（至少包含有"Accepted"）



LeetCode5.最长回文子串

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

思路：

- 最开始我没看到题目要求子串必须连续！我想了很久，想到了可能要把原字符串逆序但不知道逆序之后干什么，然后一个同学告诉我直接求最长公共子序列就好，感觉瞬间明白了
- 然后发现子串要求连续，在原来程序的基础上，取出所有的公共子序列，再找其中既是回文的又是最长的那个，也算是过了

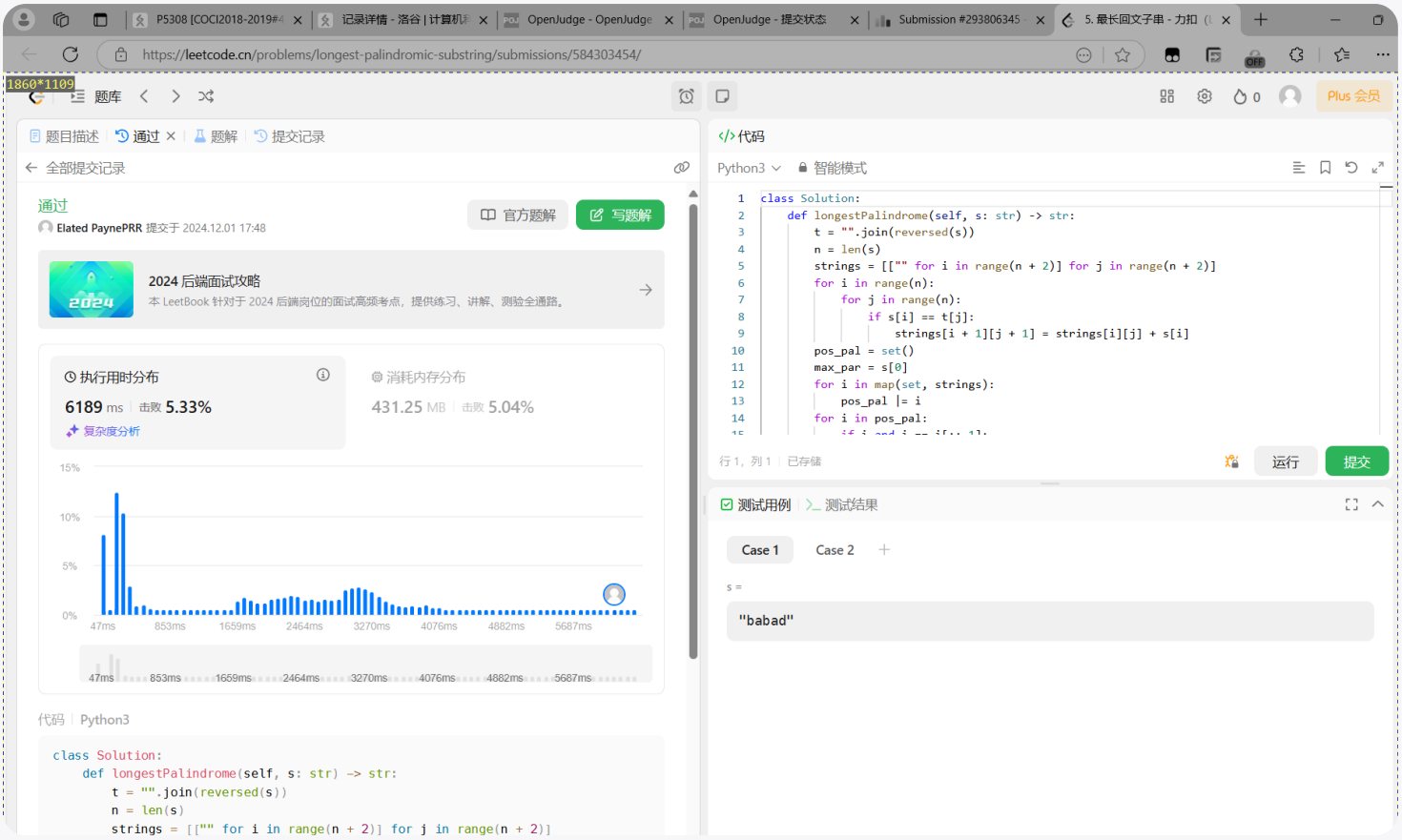
代码：

```python
class Solution:
    def longestPalindrome(self, s: str) -> str:
        t = "".join(reversed(s))
        n = len(s)
        strings = [["" for i in range(n + 2)] for j in range(n + 2)]
        for i in range(n):
            for j in range(n):
                if s[i] == t[j]:
                    strings[i + 1][j + 1] = strings[i][j] + s[i]
        pos_pal = set()
        max_par = s[0]
        for i in map(set, strings):
            pos_pal |= i
        for i in pos_pal:
            if i and i == i[::-1]:
                max_par = max(max_par, i, key=len)
```

```python
        return max_par


if __name__ == '__main__':
    sol = Solution()
    print(sol.longestPalindrome(input()))
```

代码运行截图（至少包含有"Accepted"）



12029: 水淹七军

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

思路：

- 我真的很想看看这个题的测试数据！因为我尝试了一种全新的读取数据思路，即使用`next()`对可迭代对象进行操作，这样完全可以丢掉难以操作的下标计数方法，我感觉这玩意实在是太好使了，但我非常不能理解为什么还给我报**Runtime Error**，差评！

代码：

```python
from sys import stdin
from collections import deque
get = tuple(map(int, stdin.read().split()))
cnt = 1
DIRECTIONS = ((0, 1), (0, -1), (1, 0), (-1, 0))

def bfs(x, y):
    if (x, y) == (I, J):
        return True
    h = mat[x][y]
```

```
    queue = deque()
    queue.append((x, y))
    while queue:
        px, py = queue.popleft()
        for dx, dy in DIRECTIONS:
            nx, ny = px + dx, py + dy
            if mat[nx][ny] < h:
                if (nx, ny) == (I, J):
                    return True
                queue.append((nx, ny))
                mat[nx][ny] = h

for _ in range(get[0]):
    yes = False
    M, N = get[cnt], get[cnt + 1]
    cnt += 2
    mat = [[1e9 for i in range(N + 2)]] + [[1e9] + [0 for i in range(N)] + [1e9] for j in range(M)] + [[1e9 for i in range(N + 2)]]
    for i in range(1, 1 + M):
        for j in range(1, 1 + N):
            mat[i][j] = get[cnt + i * M - M + j - 1]
    cnt += M * N
    I, J = get[cnt], get[cnt + 1]
    cnt += 2
    for i in range(get[cnt]):
        if bfs(get[cnt + 2 * i + 1], get[cnt + 2 * i + 2]):
            yes = True
            break
    print("Yes" if yes else "No")
    cnt += 2 * get[cnt] + 1
```

代码运行截图（至少包含有"Accepted"）

状态: Accepted

源代码

```
from sys import stdin
from collections import deque
get = tuple(map(int, stdin.read().split()))
cnt = 1
DIRECTIONS = ((0, 1), (0, -1), (1, 0), (-1, 0))


def bfs(x, y):
    if (x, y) == (I, J):
        return True
    h = mat[x][y]
    queue = deque()
    queue.append((x, y))
    while queue:
        px, py = queue.popleft()
        for dx, dy in DIRECTIONS:
            nx, ny = px + dx, py + dy
            if mat[nx][ny] < h:
                if (nx, ny) == (I, J):
                    return True
                queue.append((nx, ny))
                mat[nx][ny] = h


for _ in range(get[0]):
    yes = False
    M, N = get[cnt], get[cnt + 1]
    cnt += 2
    mat = [[1e9 for i in range(N + 2)]] + [[1e9] + [0 for i in range(N)
    for i in range(1, 1 + M):
        for j in range(1, 1 + N):
            mat[i][j] = get[cnt + i * M - M + j - 1]
    cnt += M * N
    I, J = get[cnt], get[cnt + 1]
    cnt += 2
    for i in range(get[cnt]):
        if bfs(get[cnt + 2 * i + 1], get[cnt + 2 * i + 2]):
            yes = True
            break
    print("Yes" if yes else "No")
    cnt += 2 * get[cnt] + 1
```

基本信息

#:	47488417
题目:	12029
提交人:	颜鼎堃(24n2400011125)
内存:	6460kB
时间:	47ms
语言:	Python3
提交时间:	2024-11-30 22:24:42

02802: 小游戏

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

思路:

- 最开始写深搜报超时
- 后来改宽搜报超内存
- 给宽搜用上了堆，简单剪了个枝，过了
- 给深搜剪了个枝，没过
- 无语了

代码:

```python
from heapq import heappop, heappush
DIRECTIONS = ((1, 0), (-1, 0), (0, 1), (0, -1))

def bfs(x1, y1, x2, y2):
    min_heap = []
    min_seg = 1e9
    min_heap.append((0, x1, y1, {(x1, y1)}, (0, 0)))
    while min_heap:
        seg, x, y, visited, last_dir = heappop(min_heap)
        for dx, dy in DIRECTIONS:
            nx, ny = x + dx, y + dy
            if (nx, ny) not in visited:
                if (nx, ny) == (x2, y2):
                    min_seg = min(min_seg, seg + (1 if (dx, dy) != last_dir
else 0))
```

```
                    break
                if board[ny][nx] == " ":
                    if seg + (1 if (dx, dy) != last_dir else 0) < min_seg:
                        heappush(min_heap, (seg + (1 if (dx, dy) != last_dir
else 0), nx, ny, visited | {(nx, ny)}, (dx, dy)))
    return min_seg

for _ in range(1, int(1e9)):
    w, h = map(int, input().split())
    if w == 0:
        break
    print(f"Board #{_}:")
    board = [["X" for i in range(w + 4)]]\
     + [["X"] + [" " for i in range(w + 2)] + ["X"]]\
     + [["X", " "] + list(input()) + [" ", "X"] for i in range(h)]\
     + [["X"] + [" " for i in range(w + 2)] + ["X"]]\
     + [["X" for i in range(w + 4)]]
    for cnt in range(1, int(1e9)):
        x1, y1, x2, y2 = map(lambda t: int(t) + 1, input().split())
        if x1 == 1:
            break
        min_seg = bfs(x1, y1, x2, y2)
        if min_seg == 1e9:
            print(f"Pair {cnt}: impossible.")
        else:
            print(f"Pair {cnt}: {min_seg} segments.")
    print()
```

代码运行截图（至少包含有"Accepted"）

状态: Accepted

源代码

```
from heapq import heappop, heappush
DIRECTIONS = ((1, 0), (-1, 0), (0, 1), (0, -1))


def bfs(x1, y1, x2, y2):
    min_heap = []
    min_seg = 1e9
    min_heap.append((0, x1, y1, {(x1, y1)}, (0, 0)))
    while min_heap:
        seg, x, y, visited, last_dir = heappop(min_heap)
        for dx, dy in DIRECTIONS:
            nx, ny = x + dx, y + dy
            if (nx, ny) not in visited:
                if (nx, ny) == (x2, y2):
                    min_seg = min(min_seg, seg + (1 if (dx, dy) != last
                    break
                if board[ny][nx] == " ":
                    if seg + (1 if (dx, dy) != last_dir else 0) < min_s
                        heappush(min_heap, (seg + (1 if (dx, dy) != las
    return min_seg


for _ in range(1, int(1e9)):
    w, h = map(int, input().split())
    if w == 0:
        break
    print(f"Board #{_}:")
    board = [["X" for i in range(w + 4)]]\
     + [["X"] + [" " for i in range(w + 2)] + ["X"]]\
     + [["X", " "] + list(input()) + [" ", "X"] for i in range(h)]\
     + [["X"] + [" " for i in range(w + 2)] + ["X"]]\
     + [["X" for i in range(w + 4)]]
    for cnt in range(1, int(1e9)):
        x1, y1, x2, y2 = map(lambda t: int(t) + 1, input().split())
        if x1 == 1:
            break
        min_seg = bfs(x1, y1, x2, y2)
        if min_seg == 1e9:
            print(f"Pair {cnt}: impossible.")
        else:
            print(f"Pair {cnt}: {min_seg} segments.")
    print()
```

基本信息

#:	47500106
题目:	02802
提交人:	颜鼎堃(24n2400011125)
内存:	5120kB
时间:	151ms
语言:	Python3
提交时间:	2024-12-01 17:16:04

2. 学习总结和收获

如果作业题目简单，有否额外练习题目，比如：OJ“计概2024fall每日选做”、CF、LeetCode、洛谷等网站题目。

第四题感觉是要我命了，当然三五六也相当糟糕

对动态规划的题目掌握不好，对搜索模板的熟练度有待加强。贪心？全方面完蛋！

每次看到有同学说自己计概某个题做了一个下午，我就会想：就这？我都是以天为单位计数的！