Assignment #10: dp & bfs

Updated 2 GMT+8 Nov 25, 2024

2024 fall, Complied by <mark>付耀贤，信息管理系</mark>

1. 题目

LuoguP1255 数楼梯

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

思路：
DP 经典题目，没有问题。

代码：

```
n=int(input())
dp = [0] * (n + 3)
dp[1] = 1
dp[2] = 2
for i in range(3, n + 1):
    dp[i]=dp[i-1]+dp[i-2]
print(dp[n])
```

代码运行截图 <mark>（至少包含有"Accepted"）</mark>

27528: 跳台阶

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

思路：
dp 关系变为:dp[i] = dp[i-1] + dp[i-2] + ... + dp[0]，本质是一样的

代码：

```
n=int(input())
dp = [0] * (n+1)
dp[0] = 1
for i in range(1, n+1):
    for j in range(i):
        dp[i]+=dp[j]
print(dp[n])
```

代码运行截图 ==（至少包含有"Accepted"）==

状态: Accepted

源代码

```
n=int(input())
dp = [0] * (n+1)
dp[0] = 1
for i in range(1, n+1):
    for j in range(i):
        dp[i]+=dp[j]
```

基本信息

#: 47408891
题目: 27528
提交人: beginner
内存: 3612kB
时间: 29ms
语言: Python3
提交时间: 2024-11-26 16:24:21

474D. Flowers

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

思路：

K=2 时，可以推出来 n**2//4+1；但是超时。dp 关系找不出来，，看题解有点糊涂。

代码：

```
MOD = 1000000007
def solve(t, k, queries):
    max_n = 100000
    dp = [0] * (max_n + 1)
    dp[0] = 1
    for n in range(1, max_n + 1):
        dp[n] = dp[n - 1]  # 如果直接吃红花的选择
        if n >= k:
            dp[n] = (dp[n] + dp[n - k]) % MOD  # 加上成组的白花的选择
    # 计算前缀和
    prefix_sum = [0] * (max_n + 1)
    for i in range(1, max_n + 1):
        prefix_sum[i] = (prefix_sum[i - 1] + dp[i]) % MOD
    # 返回查询结果
    result = []
    for a, b in queries:
        if a > 0:
            result.append((prefix_sum[b] - prefix_sum[a - 1]) % MOD)
        else:
            result.append(prefix_sum[b] % MOD)
    return result

import sys
input = sys.stdin.read
data = input().splitlines()
t, k = map(int, data[0].split())
queries = [tuple(map(int, line.split())) for line in data[1:t + 1]]
```

```
results = solve(t, k, queries)
sys.stdout.write('\n'.join(map(str, results)) + '\n')
```

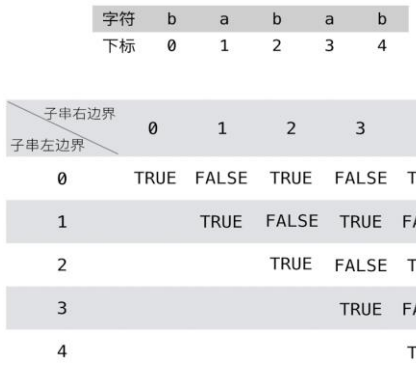
代码运行截图 <mark>（至少包含有"Accepted"）</mark>

293341322	Nov/26/2024 18:30^{UTC+8}	aglint	D - Flowers	Python 3	Accepted	328 ms	35000 KB

LeetCode5.最长回文子串

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

思路：
看的题解，这张图很清楚！



字符	b	a	b	a	b
下标	0	1	2	3	4

子串右边界 / 子串左边界	0	1	2	3	4
0	TRUE	FALSE	TRUE	FALSE	TRUE
1		TRUE	FALSE	TRUE	FALSE
2			TRUE	FALSE	TRUE
3				TRUE	FALSE
4					TRUE

状态转移方程：dp[i][j] = (s[i] == s[j]) and (j - i < 3 or dp[i + 1][j - 1])

由于 dp[i][j] 参考它左下方的值：

(1) 先升序填列；

(2) 再升序填行。

代码：

```
class Solution:
    def longestPalindrome(self, s: str) -> str:
        n = len(s)
        if n < 2:
            return s
        max_len = 1
        begin = 0
        # dp[i][j] 表示 s[i..j] 是否是回文串
        dp = [[False] * n for _ in range(n)]
        for i in range(n):
            dp[i][i] = True

        # 递推开始
        # 先枚举子串长度
        for L in range(2, n + 1):
            # 枚举左边界，左边界的上限设置可以宽松一些
```

```
            for i in range(n):
                # 由 L 和 i 可以确定右边界，即 j - i + 1 = L 得
                j = L + i - 1
                if j >= n:
                    break
                if s[i] != s[j]:
                    dp[i][j] = False
                else:
                    if j - i < 3:
                        dp[i][j] = True
                    else:
                        dp[i][j] = dp[i + 1][j - 1]

                # 只要 dp[i][L] == true 成立，就表示子串 s[i..L] 是回文，此时记录回文长度和起始位置
                if dp[i][j] and j - i + 1 > max_len:
                    max_len = j - i + 1
                    begin = i
        return s[begin:begin + max_len]
```

代码运行截图 <mark>（至少包含有"Accepted"）</mark>

12029: 水淹七军

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

思路：
看题解的 bfs 实现法。

代码：

```
from collections import deque
import sys
input = sys.stdin.read

def is_valid(x, y, m, n):
    return 0 <= x < m and 0 <= y < n

def bfs(start_x, start_y, start_height, m, n, h, water_height):
    dx = [-1, 1, 0, 0]
```

```
    dy = [0, 0, -1, 1]
    q = deque([(start_x, start_y, start_height)])
    water_height[start_x][start_y] = start_height

    while q:
        x, y, height = q.popleft()
        for i in range(4):
            nx, ny = x + dx[i], y + dy[i]
            if is_valid(nx, ny, m, n) and h[nx][ny] < height:
                if water_height[nx][ny] < height:
                    water_height[nx][ny] = height
                    q.append((nx, ny, height))

def main():
    data = input().split()
    idx = 0
    k = int(data[idx])
    idx += 1
    results = []

    for _ in range(k):
        m, n = map(int, data[idx:idx + 2])
        idx += 2
        h = []
        for i in range(m):
            h.append(list(map(int, data[idx:idx + n])))
            idx += n
        water_height = [[0] * n for _ in range(m)]

        i, j = map(int, data[idx:idx + 2])
        idx += 2
        i, j = i - 1, j - 1

        p = int(data[idx])
        idx += 1

        for _ in range(p):
            x, y = map(int, data[idx:idx + 2])
            idx += 2
            x, y = x - 1, y - 1
            if h[x][y] <= h[i][j]:
                continue
            bfs(x, y, h[x][y], m, n, h, water_height)
```

```
            results.append("Yes" if water_height[i][j] > 0 else "No")

    sys.stdout.write("\n".join(results) + "\n")

if __name__ == "__main__":
    main()
```

代码运行截图 <mark>（至少包含有"Accepted"）</mark>

状态: Accepted

源代码

```
from collections import deque
import sys
input = sys.stdin.read

def is_valid(x, y, m, n):
    return 0 <= x < m and 0 <= y < n
```

基本信息

#: 47417233
题目: 12029
提交人: beginner
内存: 6344kB
时间: 252ms
语言: Python3
提交时间: 2024-11-26 23:22:49

02802: 小游戏

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

思路：
一眼做不出来，直接学习题解代码。

代码：

```
import heapq
num1=1
while True:
    w,h=map(int,input().split())
    if w==0 and h==0:
        break
    print(f"Board #{num1}:")
    martix=[[" "]*(w+2)]+[[" "]+list(input())+[" "] for _ in
range(h)]+[[" "]*(w+2)]
    dir=[(0,1),(0,-1),(1,0),(-1,0)]
    num2=1
    while True:
        x1,y1,x2,y2=map(int,input().split())
        if x1==0 and x2==0 and y1==0 and y2==0:
            break
        queue,flag=[],False
        vis=set()
        heapq.heappush(queue,(0,x1,y1,-1))
```

```
        martix[y2][x2]=" "
        vis.add((-1,x1,y1))
        while queue:
            step,x,y,dirs=heapq.heappop(queue)
            if x==x2 and y==y2:
                flag=True
                break
            for i,(dx,dy) in enumerate(dir):
                px,py=x+dx,y+dy
                if 0<=px<=w+1 and 0<=py<=h+1 and (i,px,py) not in vis
and martix[py][px]!="X":
                    vis.add((i,px,py))
                    heapq.heappush(queue,(step+(dirs!=i),px,py,i))
        if flag:
            print(f"Pair {num2}: {step} segments.")
        else:
            print(f"Pair {num2}: impossible.")
        martix[y2][x2]="X"
        num2+=1
    print()
    num1+=1
```

代码运行截图 <mark>（至少包含有"Accepted"）</mark>

状态: Accepted

源代码

```
import heapq
num1=1
while True:
    w,h=map(int,input().split())
    if w==0 and h==0:
        break
```

基本信息

#: 47417132
题目: 02802
提交人: beginner
内存: 4688kB
时间: 75ms
语言: Python3
提交时间: 2024-11-26 23:14:13

2. 学习总结和收获

我觉得要把学习策略转向了，很清楚一些难题自己很难理解，即使当时明白了考场上也很难做出来。不在难题上花费很多时间，大概能懂题解就行。省下来的时间开始做一些类似往年期末中等难度的题目和比较套路化、模板化的较难题目。