Assignment #9: 图论：遍历，及 树算

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2024 spring, Complied by 郑铭毅 数学科学学院

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 typorahttps://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。

编程环境

Windows 11

PyCharm

操作系统： macOS Ventura 13.4.1 (c)

Python编程环境： Spyder IDE 5.2.2, PyCharm 2023.1.4 (Professional Edition)

C/C++编程环境： Mac terminal vi (version 9.0.1424), g++/gcc (Apple clang version 14.0.3, clang-1403.0.22.14.1)

1. 题目

04081: 树的转换

http://cs101.openjudge.cn/dsapre/04081/

思路:

代码

```
def tree_heights(s):
    old_height = 0
    max_old = 0
    new_height = 0
    max_new = 0
    stack = []
    for c in s:
        if c == 'd':
            old_height += 1
            max_old = max(max_old, old_height)
            new_height += 1
            stack.append(new_height)
            max_new = max(max_new, new_height)
        else:
            old_height -= 1
            new_height = stack[-1]
            stack.pop()
    return f"{max_old} => {max_new}"
s = input().strip()
print(tree_heights(s))
```

代码运行截图

08581: 扩展二叉树

http://cs101.openjudge.cn/dsapre/08581/

思路:

```
class Treenode:
    def __init__(self,val):
        self.val=val
        self.left=None
        self.right=None
def build_tree(preorder):
    root_val = preorder.pop(0)
    if root_val == '.':
        return None
    root = Treenode(root_val)
    root.left = build_tree(preorder)
    root.right = build_tree(preorder)
    return root
def inorder_traversal(root):
    if not root:
        return []
    return inorder_traversal(root.left) + [root.val] + inorder_traversal(root.right)
def postorder_traversal(root):
    if not root:
        return []
    return postorder_traversal(root.left) + postorder_traversal(root.right) + [root.val]
preorder_seq = list(input().strip())
root = build_tree(preorder_seq)
inorder_seq = inorder_traversal(root)
postorder_seq = postorder_traversal(root)
print(''.join(inorder_seq))
print(''.join(postorder_seq))
```

代码运行截图 

22067: 快速堆猪

http://cs101.openjudge.cn/practice/22067/

思路:

代码

```
#

```

代码运行截图 （AC代码截图，至少包含有"Accepted"）

04123: 马走日

dfs, http://cs101.openjudge.cn/practice/04123

思路:

代码

```
dx = [-1, -2, -2, -1, 1, 2, 2, 1]
dy = [-2, -1, 1, 2, 2, 1, -1, -2]
def is_valid_move(x, y, n, m, visited):
    return 0 <= x < n and 0 <= y < m and not visited[x][y]
def dfs(x, y, n, m, visited):
    if all(all(row) for row in visited):
        return 1
    count = 0
    for i in range(8):
        nx, ny = x + dx[i], y + dy[i]
        if is_valid_move(nx, ny, n, m, visited):
            visited[nx][ny] = True
            count += dfs(nx, ny, n, m, visited)
            visited[nx][ny] = False
    return count
T = int(input().strip())
for _ in range(T):
    n, m, x, y = map(int, input().strip().split())
    visited = [[False] * m for _ in range(n)]
    visited[x][y] = True
    result = dfs(x, y, n, m, visited)
    print(result)
```

代码运行截图

28046: 词梯

bfs，http://cs101.openjudge.cn/practice/28046/

思路：

代码

```
#

```

代码运行截图 （AC代码截图，至少包含有"Accepted"）

28050: 骑士周游

dfs，http://cs101.openjudge.cn/practice/28050/

思路：

代码

```
dx = [-1, -2, -2, -1, 1, 2, 2, 1]
dy = [-2, -1, 1, 2, 2, 1, -1, -2]
def is_valid_move(x, y, n, visited):
    return 0 <= x < n and 0 <= y < n and not visited[x][y]
def get_valid_moves(x, y, n, visited):
    valid_moves = []
    for i in range(8):
        nx, ny = x + dx[i], y + dy[i]
        if is_valid_move(nx, ny, n, visited):
            count = 0
            for j in range(8):
                tx, ty = nx + dx[j], ny + dy[j]
                if is_valid_move(tx, ty, n, visited):
                    count += 1
            valid_moves.append((count, nx, ny))
    valid_moves.sort()
    return [(nx, ny) for _, nx, ny in valid_moves]
def knights_tour(n, sr, sc):
    visited = [[False] * n for _ in range(n)]
    visited[sr][sc] = True
    count = 1
    x, y = sr, sc
    while count < n * n:
        next_moves = get_valid_moves(x, y, n, visited)
        if not next_moves:
            return False
        nx, ny = next_moves[0]
        visited[nx][ny] = True
        count += 1
        x, y = nx, ny
    return True
n = int(input().strip())
sr, sc = map(int, input().strip().split())
if knights_tour(n, sr, sc):
    print("success")
else:
    print("fail")
```

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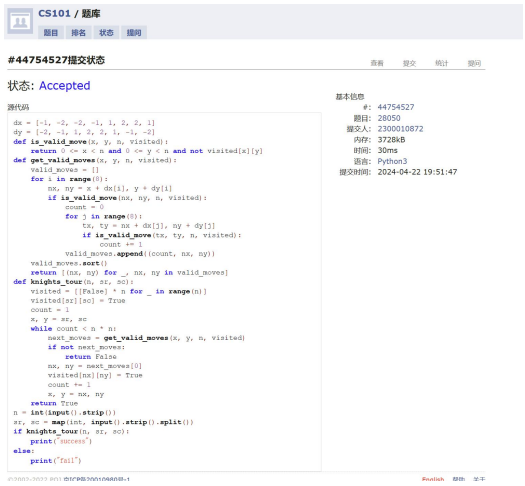
代码运行截图



2. 学习总结和收获

题目对我来说还是相当有难度的，dfs算法还是有点难以理解。期中周过后应该会花更多时间复习一下前面的树之类的，以及再看看这两周的题目，学习一下算法。