Assignment #D: May月考

Updated 1654 GMT+8 May 8, 2024

2024 spring, Complied by ==同学的姓名、院系==

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。

编程环境

==（请改为同学的操作系统、编程环境等）==

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

02808: 校门外的树

http://cs101.openjudge.cn/practice/02808/

思路：

代码

```
#
```

代码运行截图 ==（至少包含有"Accepted"）==

20449: 是否被5整除

http://cs101.openjudge.cn/practice/20449/

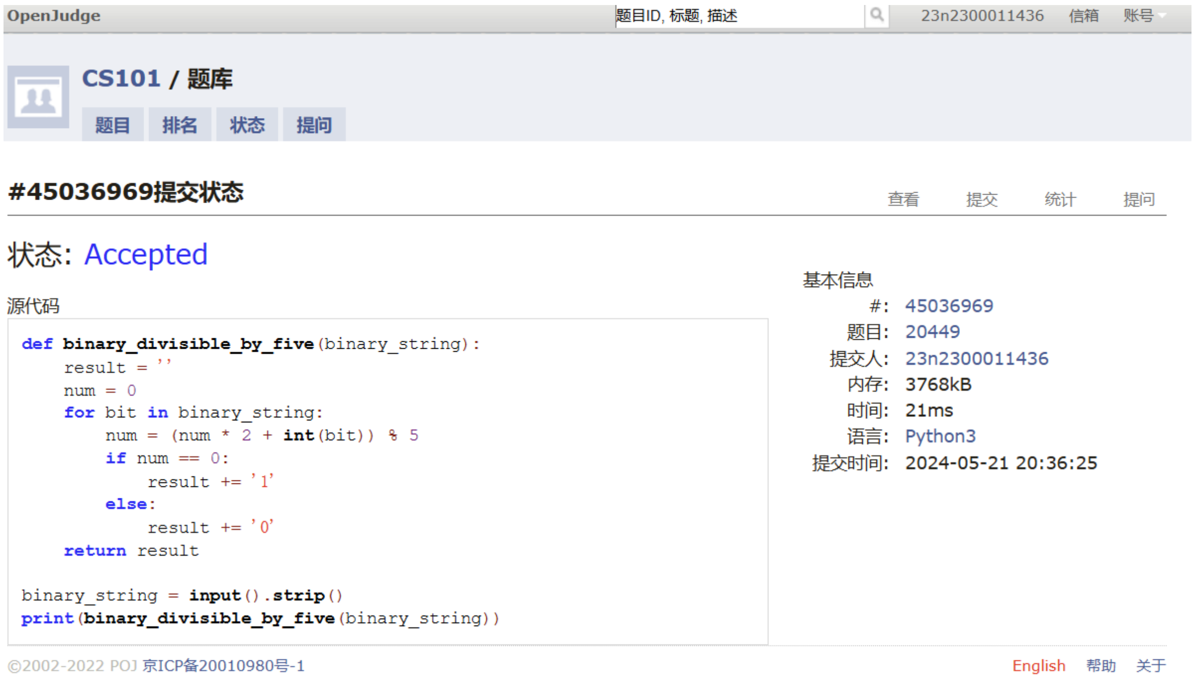
思路：

代码

```
def binary_divisible_by_five(binary_string):
    result = ''
    num = 0
    for bit in binary_string:
        num = (num * 2 + int(bit)) % 5
        if num == 0:
            result += '1'
        else:
            result += '0'
    return result

binary_string = input().strip()
print(binary_divisible_by_five(binary_string))xxxxxxxxxx def
binary_divisible_by_five(binary_string):    result = ''    num = 0    for bit in
binary_string:        num = (num * 2 + int(bit)) % 5        if num == 0:
   result += '1'        else:            result += '0'    return
resultbinary_string =
input().strip()print(binary_divisible_by_five(binary_string))#
```

代码运行截图 == （至少包含有"Accepted"） ==



#45036969提交状态

状态: Accepted

源代码

```
def binary_divisible_by_five(binary_string):
    result = ''
    num = 0
    for bit in binary_string:
        num = (num * 2 + int(bit)) % 5
        if num == 0:
            result += '1'
        else:
            result += '0'
    return result

binary_string = input().strip()
print(binary_divisible_by_five(binary_string))
```

基本信息

#:	45036969
题目:	20449
提交人:	23n2300011436
内存:	3768kB
时间:	21ms
语言:	Python3
提交时间:	2024-05-21 20:36:25

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01258: Agri-Net

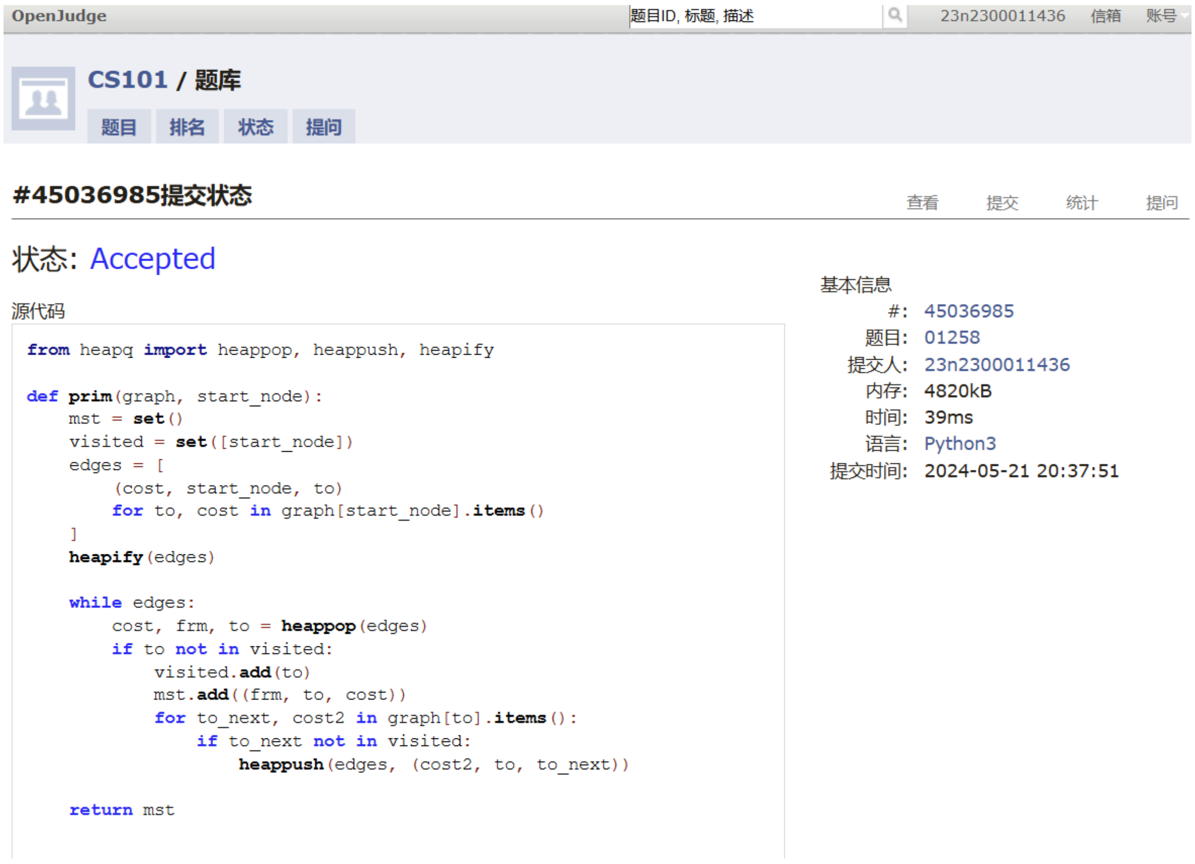
http://cs101.openjudge.cn/practice/01258/

思路：

代码

```python
from heapq import heappop, heappush, heapify

def prim(graph, start_node):
    mst = set()
    visited = set([start_node])
    edges = [
        (cost, start_node, to)
        for to, cost in graph[start_node].items()
    ]
    heapify(edges)

    while edges:
        cost, frm, to = heappop(edges)
        if to not in visited:
            visited.add(to)
            mst.add((frm, to, cost))
            for to_next, cost2 in graph[to].items():
                if to_next not in visited:
                    heappush(edges, (cost2, to, to_next))

    return mst


while True:
    try:
        N = int(input())
    except EOFError:
        break

    graph = {i: {} for i in range(N)}
    for i in range(N):
        for j, cost in enumerate(map(int, input().split())):
            graph[i][j] = cost

    mst = prim(graph, 0)
    total_cost = sum(cost for frm, to, cost in mst)
    print(total_cost)
```

代码运行截图 ==（AC代码截图，至少包含有"Accepted"）==



#45036985提交状态

状态: Accepted

源代码

```python
from heapq import heappop, heappush, heapify

def prim(graph, start_node):
    mst = set()
    visited = set([start_node])
    edges = [
        (cost, start_node, to)
        for to, cost in graph[start_node].items()
    ]
    heapify(edges)

    while edges:
        cost, frm, to = heappop(edges)
        if to not in visited:
            visited.add(to)
            mst.add((frm, to, cost))
            for to_next, cost2 in graph[to].items():
                if to_next not in visited:
                    heappush(edges, (cost2, to, to_next))

    return mst
```

基本信息

#:	45036985
题目:	01258
提交人:	23n2300011436
内存:	4820kB
时间:	39ms
语言:	Python3
提交时间:	2024-05-21 20:37:51

27635: 判断无向图是否连通有无回路(同23163)

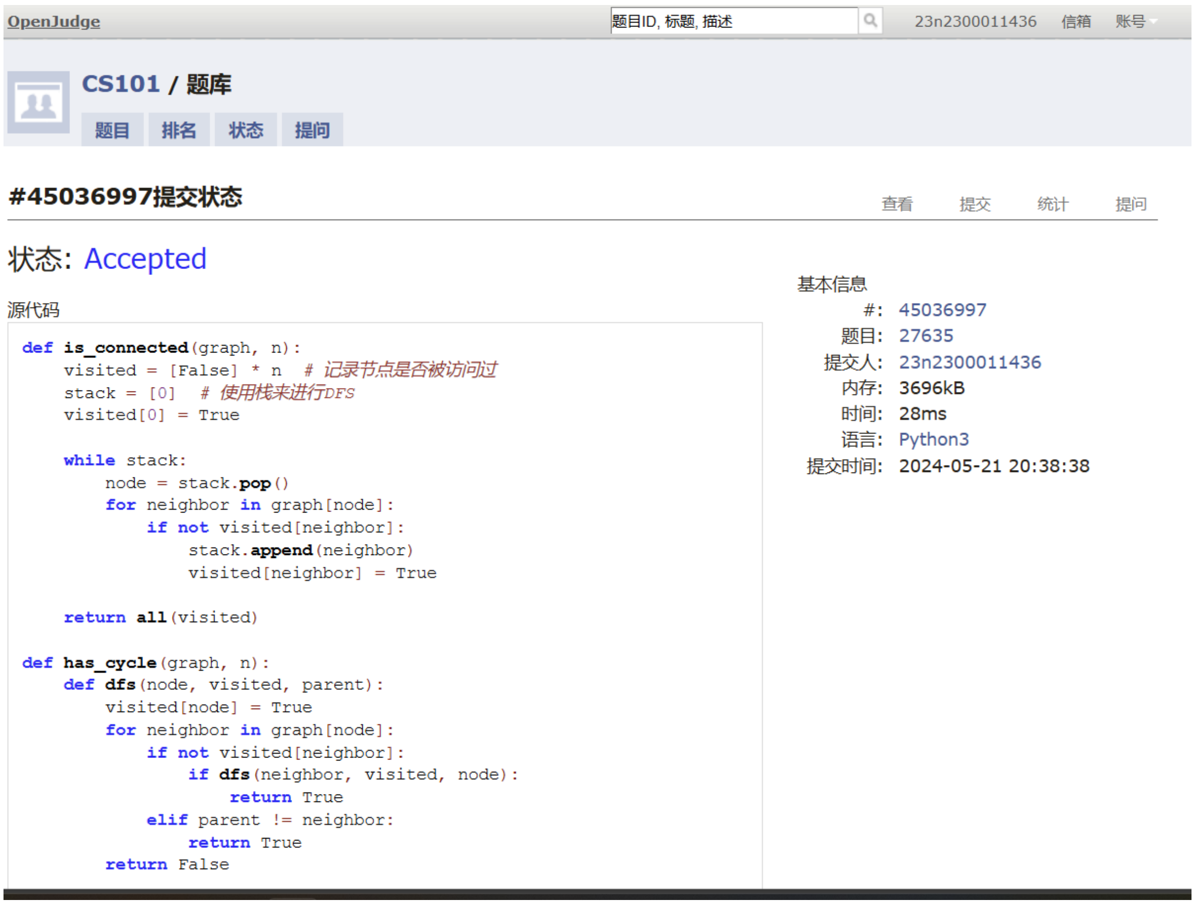
http://cs101.openjudge.cn/practice/27635/

思路：

代码

```python
def is_connected(graph, n):
    visited = [False] * n  # 记录节点是否被访问过
    stack = [0]  # 使用栈来进行DFS
    visited[0] = True

    while stack:
        node = stack.pop()
        for neighbor in graph[node]:
            if not visited[neighbor]:
                stack.append(neighbor)
                visited[neighbor] = True

    return all(visited)

def has_cycle(graph, n):
    def dfs(node, visited, parent):
            visited[node] = True
            for neighbor in graph[node]:
                if not visited[neighbor]:
                    if dfs(neighbor, visited, node):
                        return True
                elif parent != neighbor:
                    return True
            return False

        visited = [False] * n
        for node in range(n):
            if not visited[node]:
                if dfs(node, visited, -1):
                    return True
        return False

# 读取输入
n, m = map(int, input().split())
graph = [[] for _ in range(n)]
for _ in range(m):
    u, v = map(int, input().split())
    graph[u].append(v)
    graph[v].append(u)

# 判断连通性和回路
connected = is_connected(graph, n)
has_loop = has_cycle(graph, n)
print("connected:yes" if connected else "connected:no")
print("loop:yes" if has_loop else "loop:no")
```

代码运行截图 ==（AC代码截图，至少包含有"Accepted"）==



#45036997提交状态

状态: Accepted

源代码

```python
def is_connected(graph, n):
    visited = [False] * n  # 记录节点是否被访问过
    stack = [0]  # 使用栈来进行DFS
    visited[0] = True

    while stack:
        node = stack.pop()
        for neighbor in graph[node]:
            if not visited[neighbor]:
                stack.append(neighbor)
                visited[neighbor] = True

    return all(visited)

def has_cycle(graph, n):
    def dfs(node, visited, parent):
        visited[node] = True
        for neighbor in graph[node]:
            if not visited[neighbor]:
                if dfs(neighbor, visited, node):
                    return True
            elif parent != neighbor:
                return True
        return False
```

基本信息
#: 45036997
题目: 27635
提交人: 23n2300011436
内存: 3696kB
时间: 28ms
语言: Python3
提交时间: 2024-05-21 20:38:38

27947: 动态中位数

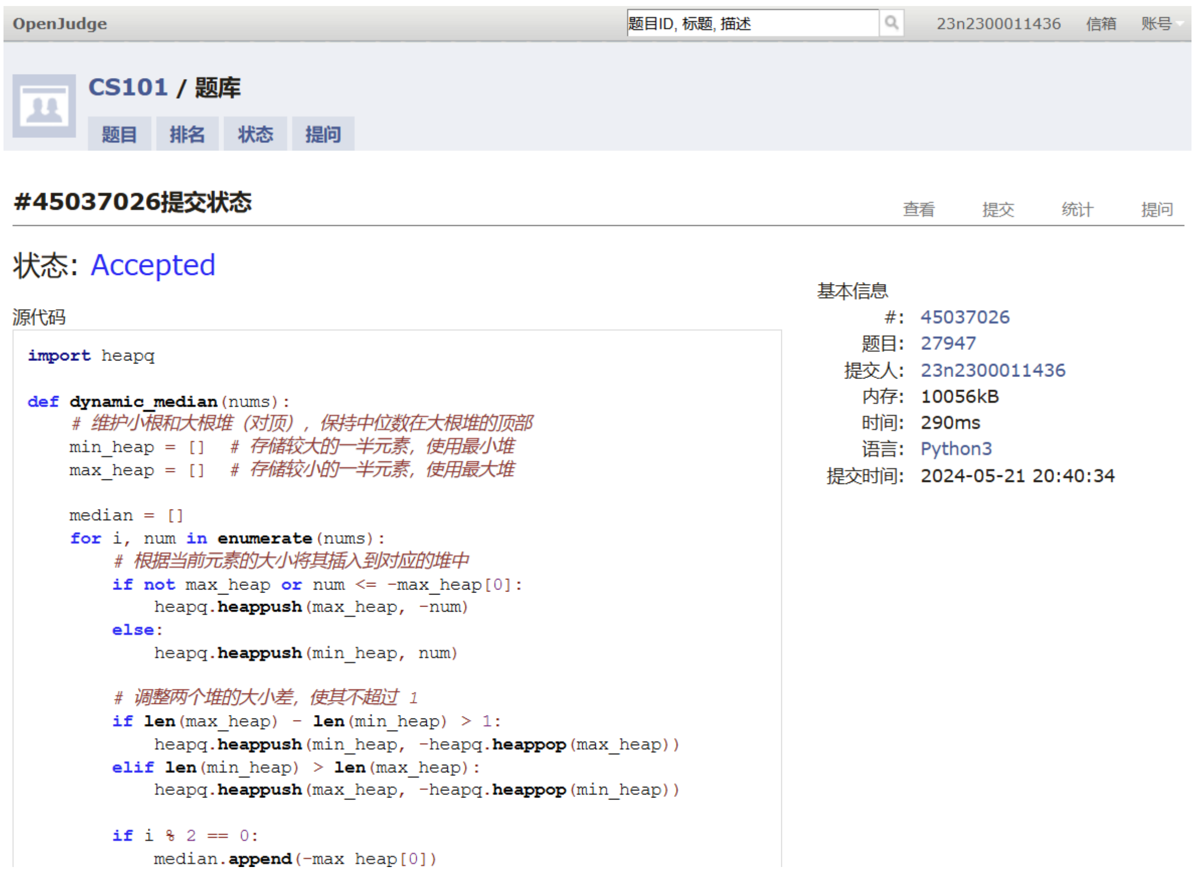
http://cs101.openjudge.cn/practice/27947/

思路:

代码

```python
import heapq

def dynamic_median(nums):
    # 维护小根和大根堆（对顶），保持中位数在大根堆的顶部
    min_heap = []  # 存储较大的一半元素，使用最小堆
    max_heap = []  # 存储较小的一半元素，使用最大堆

    median = []
    for i, num in enumerate(nums):
        # 根据当前元素的大小将其插入到对应的堆中
        if not max_heap or num <= -max_heap[0]:
            heapq.heappush(max_heap, -num)
        else:
            heapq.heappush(min_heap, num)

        # 调整两个堆的大小差，使其不超过 1
        if len(max_heap) - len(min_heap) > 1:
            heapq.heappush(min_heap, -heapq.heappop(max_heap))
        elif len(min_heap) > len(max_heap):
            heapq.heappush(max_heap, -heapq.heappop(min_heap))

        if i % 2 == 0:
            median.append(-max_heap[0])

    return median

T = int(input())
for _ in range(T):
    #M = int(input())
    nums = list(map(int, input().split()))
    median = dynamic_median(nums)
    print(len(median))
    print(*median)
```

代码运行截图 == （AC代码截图，至少包含有"Accepted"） ==



OpenJudge　题目ID, 标题, 描述　23n2300011436　信箱　账号

CS101 / 题库

题目　排名　状态　提问

#45037026提交状态　查看　提交　统计　提问

状态: Accepted

源代码

```
import heapq

def dynamic_median(nums):
    # 维护小根和大根堆（对顶），保持中位数在大根堆的顶部
    min_heap = []  # 存储较大的一半元素，使用最小堆
    max_heap = []  # 存储较小的一半元素，使用最大堆

    median = []
    for i, num in enumerate(nums):
        # 根据当前元素的大小将其插入到对应的堆中
        if not max_heap or num <= -max_heap[0]:
            heapq.heappush(max_heap, -num)
        else:
            heapq.heappush(min_heap, num)

        # 调整两个堆的大小差，使其不超过 1
        if len(max_heap) - len(min_heap) > 1:
            heapq.heappush(min_heap, -heapq.heappop(max_heap))
        elif len(min_heap) > len(max_heap):
            heapq.heappush(max_heap, -heapq.heappop(min_heap))

        if i % 2 == 0:
            median.append(-max_heap[0])
```

基本信息

#:	45037026
题目:	27947
提交人:	23n2300011436
内存:	10056kB
时间:	290ms
语言:	Python3
提交时间:	2024-05-21 20:40:34

28190: 奶牛排队

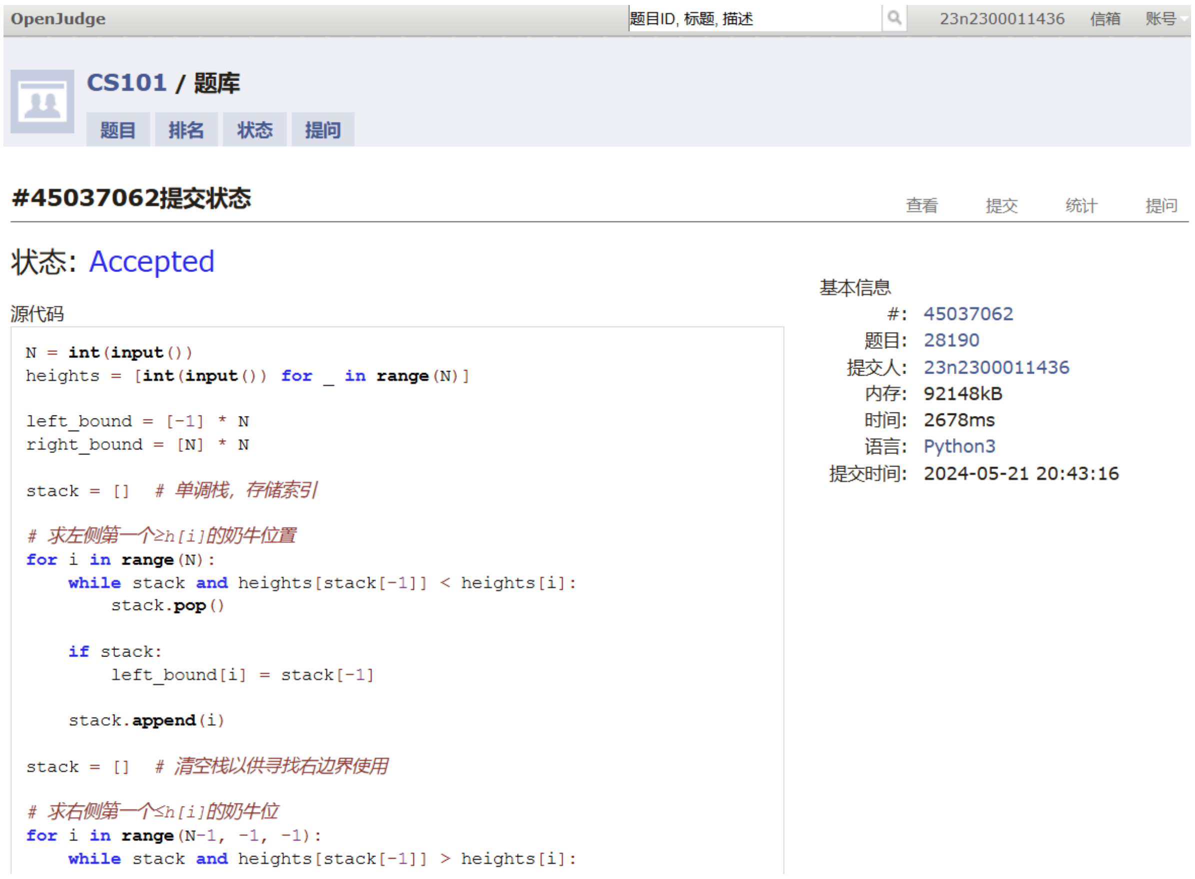
http://cs101.openjudge.cn/practice/28190/

思路：

代码

```
N = int(input())
heights = [int(input()) for _ in range(N)]

left_bound = [-1] * N
right_bound = [N] * N

stack = []  # 单调栈，存储索引

# 求左侧第一个≥h[i]的奶牛位置
for i in range(N):
    while stack and heights[stack[-1]] < heights[i]:
        stack.pop()

    if stack:
        left_bound[i] = stack[-1]

    stack.append(i)

stack = []  # 清空栈以供寻找右边界使用

# 求右侧第一个≤h[i]的奶牛位
for i in range(N-1, -1, -1):
    while stack and heights[stack[-1]] > heights[i]:
        stack.pop()

    if stack:
        right_bound[i] = stack[-1]

    stack.append(i)

ans = 0

for i in range(N):  # 枚举右端点 B寻找 A，更新 ans
    for j in range(left_bound[i] + 1, i):
        if right_bound[j] > i:
            ans = max(ans, i - j + 1)
            break
print(ans)
```

代码运行截图 ==（AC代码截图，至少包含有"Accepted"）==



#45037062提交状态

状态: Accepted

源代码

```python
N = int(input())
heights = [int(input()) for _ in range(N)]

left_bound = [-1] * N
right_bound = [N] * N

stack = []  # 单调栈，存储索引

# 求左侧第一个≥h[i]的奶牛位置
for i in range(N):
    while stack and heights[stack[-1]] < heights[i]:
        stack.pop()

    if stack:
        left_bound[i] = stack[-1]

    stack.append(i)

stack = []  # 清空栈以供寻找右边界使用

# 求右侧第一个≤h[i]的奶牛位
for i in range(N-1, -1, -1):
    while stack and heights[stack[-1]] > heights[i]:
```

基本信息

#:	45037062
题目:	28190
提交人:	23n2300011436
内存:	92148kB
时间:	2678ms
语言:	Python3
提交时间:	2024-05-21 20:43:16

2. 学习总结和收获

学习了一些堆和栈的用法，练习了dfs和bfs的题目