# Assignment #F: 十全十美

Updated 1305 GMT+8 Dec 19, 2023

2023 fall, Complied by ==苏王捷 工学院==

**说明：**

本周作业对零基础同学偏难，如果耗时太长，直接找答案看。两个题解，经常更新。所以最好从这个链接下载最新的，https://github.com/GMyhf/2020fall-cs101 。

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, 学号），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、作业评论有md或者doc。

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：Windows 11 22H2

Python编程环境：Spyder IDE 5.4.5

## 1. 题目

如果耗时太长，直接看解题思路，或者源码

### 18155: 组合乘积

dfs, brute force, http://cs101.openjudge.cn/practice/18155

思路：简单置标记递归

**代码**

```
# # -*- coding: utf-8 -*-
"""
Created on Tue Dec 19 16:28:11 2023

@author: Lenovo
"""
```

```python
def dfs(n):
    for num in s:
        if num>n or n%num!=0 or num in vis:
            continue
        elif num==n:
            return True
        else:
            vis.add(num)
            if dfs(n//num):
                return True
            vis.discard(num)
    return False

t=int(input())
s=set(map(int,input().split()))
vis=set()
flag=dfs(t)
print("YES" if flag else "NO")
```

代码运行截图 ==（至少包含有"Accepted"）==

**#43226077提交状态**

查看 提交 统计 提问

状态: Accepted

源代码

```python
# -*- coding: utf-8 -*-
"""
Created on Tue Dec 19 16:28:11 2023

@author: Lenovo
"""


def dfs(n):
    for num in s:
        if num>n or n%num!=0 or num in vis:
            continue
        elif num==n:
            return True
        else:
            vis.add(num)
            if dfs(n//num):
                return True
            vis.discard(num)
    return False

t=int(input())
s=set(map(int,input().split()))
vis=set()
flag=dfs(t)
print("YES" if flag else "NO")
```

基本信息

#: 43226077
题目: 18155
提交人: 23n2300011075(才疏学浅)
内存: 3632kB
时间: 23ms
语言: Python3
提交时间: 2023-12-19 16:46:11

## 20106: 走山路

bfs, http://cs101.openjudge.cn/practice/20106/

思路：heapq——一个very good的数据结构

**代码**

```
# # -*- coding: utf-8 -*-
"""
Created on Mon Dec 18 10:48:27 2023

@author: Lenovo
"""

import heapq
m,n,p=map(int,input().split())
martix=[list(input().split())for i in range(m)]
dir=[(-1,0),(1,0),(0,1),(0,-1)]
for _ in range(p):
    sx,sy,ex,ey=map(int,input().split())
    if martix[sx][sy]=="#" or martix[ex][ey]=="#":
        print("NO")
        continue
    vis,heap,ans=set(),[],[]
    heapq.heappush(heap,(0,sx,sy))
    vis.add((sx,sy,-1))
    while heap:
        tire,x,y=heapq.heappop(heap)
        if x==ex and y==ey:
            ans.append(tire)
        for i in range(4):
            dx,dy=dir[i]
            x1,y1=dx+x,dy+y
            if 0<=x1<m and 0<=y1<n and martix[x1][y1]!="#" and (x1,y1,i) not in
vis:
                t1=tire+abs(int(martix[x][y])-int(martix[x1][y1]))
                heapq.heappush(heap,(t1,x1,y1))
                vis.add((x1,y1,i))
    print(min(ans) if ans else "NO")
```

代码运行截图 ==（至少包含有"Accepted"）==

**#43199527提交状态**

查看 提交 统计 提问

状态: Accepted

基本信息

#: 43199527
题目: 20106
提交人: 23n2300011075(才疏学浅)
内存: 4648kB
时间: 1668ms
语言: Python3
提交时间: 2023-12-18 11:28:37

源代码

```
# -*- coding: utf-8 -*-
"""
Created on Mon Dec 18 10:48:27 2023

@author: Lenovo
"""

import heapq
m,n,p=map(int,input().split())
martix=[list(input().split())for i in range(m)]
dir=[(-1,0),(1,0),(0,1),(0,-1)]
for _ in range(p):
    sx,sy,ex,ey=map(int,input().split())
    if martix[sx][sy]=="#" or martix[ex][ey]=="#":
        print("NO")
        continue
    vis,heap,ans=set(),[],[]
    heapq.heappush(heap,(0,sx,sy))
    vis.add((sx,sy,-1))
    while heap:
        tire,x,y=heapq.heappop(heap)
        if x==ex and y==ey:
            ans.append(tire)
        for i in range(4):
            dx,dy=dir[i]
            x1,y1=dx+x,dy+y
            if 0<=x1<m and 0<=y1<n and martix[x1][y1]!="#" and (x1,y1,i)
                t1=tire+abs(int(martix[x][y])-int(martix[x1][y1]))
                heapq.heappush(heap,(t1,x1,y1))
                vis.add((x1,y1,i))
    print(min(ans) if ans else "NO")
```

# 27314: 一键换词

implementation, string, http://cs101.openjudge.cn/practice/27314/

思路：用“，”和“。”分层分割字符串，然后在各个区间内替换（注意头尾加“ ”保证正确），最后在重组成句子

### 代码

```
# # -*- coding: utf-8 -*-
"""
Created on Sat Dec 16 12:17:17 2023

@author: Lenovo
"""

l=list((" "+input()).split("."))
flag=False
if l[-1]!="":l.append("");flag=True
for i in range(len(l)-1):
    l[i]+=" "
    l[i]=l[i].lower()
    l[i]=list(l[i].split(","))
    for j in range(len(l[i])-1):
        l[i][j]+=" "
```

```
a,b=map(str.lower,input().split())
a,b=" "+a+" "," "+b+" "
for i in range(len(l)-1):
    for j in range(len(l[i])):
        l[i][j]=l[i][j].replace(a,b)
for i in range(len(l)-1):
    for j in range(len(l[i])):
        l[i][j]=l[i][j][1:-1]
for i in range(len(l)-1):
    l[i]=(", ".join(l[i])+".").capitalize()
ans=" ".join(l[:-1]) if not flag else (" ".join(l[:-1])[:-1])
print(ans)
```

代码运行截图 ==（AC代码截图，至少包含有"Accepted"）==

**#43224522提交状态**

查看 提交 统计 提问

状态: Accepted

源代码

```
# -*- coding: utf-8 -*-
"""
Created on Sat Dec 16 12:17:17 2023

@author: Lenovo
"""

l=list((" "+input()).split("."))
flag=False
if l[-1]!="":l.append("");flag=True
for i in range(len(l)-1):
    l[i]+=" "
    l[i]=l[i].lower()
    l[i]=list(l[i].split(","))
    for j in range(len(l[i])-1):
        l[i][j]+=" "
a,b=map(str.lower,input().split())
a,b=" "+a+" "," "+b+" "
for i in range(len(l)-1):
    for j in range(len(l[i])):
        l[i][j]=l[i][j].replace(a,b)
for i in range(len(l)-1):
    for j in range(len(l[i])):
        l[i][j]=l[i][j][1:-1]
for i in range(len(l)-1):
    l[i]=(", ".join(l[i])+".").capitalize()
ans=" ".join(l[:-1]) if not flag else (" ".join(l[:-1])[:-1])
print(ans)
```

基本信息

| | |
|---|---|
| #: | 43224522 |
| 题目: | 27314 |
| 提交人: | 23n2300011075(才疏学浅) |
| 内存: | 3720kB |
| 时间: | 24ms |
| 语言: | Python3 |
| 提交时间: | 2023-12-19 15:59:08 |

## 19961: 最大点数(外太空2048)

matrices, http://cs101.openjudge.cn/practice/19961/

思路：就是对不同方向的操作归一化，通过处理矩阵来实现

**代码**

```
# # -*- coding: utf-8 -*-
"""
Created on Tue Dec 19 15:10:35 2023

@author: Lenovo
"""

import copy,sys
sys.setrecursionlimit(1<<30)

def dfs(martix,step):
    if step==p:
        result.append(max(max(martix[i]) for i in range(m)))
        return
    for i in range(4):
        dfs(move(martix,i),step+1)

def move(martix,dir):
    new_martix=copy.deepcopy(martix)
    if dir==0:
        for i in range(m):
            new_martix[i]=change(martix[i])
    elif dir==1:
        for i in range(m):
            new_martix[i]=change(martix[i][::-1])[::-1]
    elif dir==2:
        for i in range(n):
            changeline=change([martix[j][i] for j in range(m)])
            for j in range(m):
                new_martix[j][i]=changeline[j]
    else:
        for i in range(n):
            changeline=change([martix[j][i] for j in range(m-1,-1,-1)])[::-1]
            for j in range(m):
                new_martix[j][i]=changeline[j]
    return new_martix

def change(row):
    line=row.copy()
    l=len(line)
    for i in range(l):
        if line[i]==0:
            continue
        for j in range(i+1,l):
            if line[i]==line[j]:
                line[i],line[j]=0,2*line[j]
            elif line[j]==0:
                continue
            else:
                break
    newline=[0]*l
    cnt=l-1
    for i in range(l-1,-1,-1):
```

```
        if line[i]!=0:
            newline[cnt]=line[i]
            cnt-=1
    return newline

m,n,p=map(int,input().split())
martix=[list(map(int,input().split()))for i in range(m)]
result=[]
dfs(martix,0)
print(max(result))
```

代码运行截图 ==（AC代码截图，至少包含有"Accepted"）==

**#43224455提交状态**

查看 提交 统计 提问

状态: Accepted

基本信息

#: 43224455
题目: 19961
提交人: 23n2300011075(才疏学浅)
内存: 3756kB
时间: 581ms
语言: Python3
提交时间: 2023-12-19 15:57:32

源代码

```
# -*- coding: utf-8 -*-
"""
Created on Tue Dec 19 15:10:35 2023

@author: Lenovo
"""

import copy,sys
sys.setrecursionlimit(1<<30)

def dfs(martix,step):
    if step==p:
        result.append(max(max(martix[i]) for i in range(m)))
        return
    for i in range(4):
        dfs(move(martix,i),step+1)

def move(martix,dir):
    new_martix=copy.deepcopy(martix)
    if dir==0:
        for i in range(m):
            new_martix[i]=change(martix[i])
    elif dir==1:
        for i in range(m):
            new_martix[i]=change(martix[i][::-1])[::-1]
    elif dir==2:
        for i in range(n):
            changeline=change([martix[j][i] for j in range(m)])
            for j in range(m):
                new_martix[j][i]=changeline[j]
    else:
        for i in range(n):
            changeline=change([martix[j][i] for j in range(m-1,-1,-1)])
            for j in range(m):
                new_martix[j][i]=changeline[j]
    return new_martix

def change(row):
    line=row.copy()
```

## 27401: 最佳凑单

dp, sparse bucket, http://cs101.openjudge.cn/practice/27401/

思路：dp寻找在n个物体下能减少的最大价格

**代码**

```
# # -*- coding: utf-8 -*-
"""
Created on Tue Dec 19 10:35:07 2023

@author: Lenovo
"""

def best_combine(n,a):
    dp=[0]*(a+1)
    for price in prices:
        for i in range(a,price-1,-1):
            dp[i]=max(dp[i],dp[i-price]+price)
    return dp[a]

n,t=map(int,input().split())
prices=list(map(int,input().split()))
if sum(prices)<t:
    print(0)
else:
    result=best_combine(n,sum(prices)-t)
    print(sum(prices)-result)
```

代码运行截图 ==（AC代码截图，至少包含有"Accepted"）==

**#43217118提交状态**

查看　提交　统计　提问

状态: Accepted

源代码

```
# -*- coding: utf-8 -*-
"""
Created on Tue Dec 19 10:35:07 2023

@author: Lenovo
"""

def best_combine(n,a):
    dp=[0]*(a+1)
    for price in prices:
        for i in range(a,price-1,-1):
            dp[i]=max(dp[i],dp[i-price]+price)
    return dp[a]

n,t=map(int,input().split())
prices=list(map(int,input().split()))
if sum(prices)<t:
    print(0)
else:
    result=best_combine(n,sum(prices)-t)
    print(sum(prices)-result)
```

基本信息

#: 43217118
题目: 27401
提交人: 23n2300011075(才疏学浅)
内存: 3656kB
时间: 146ms
语言: Python3
提交时间: 2023-12-19 10:46:31

## 27384: 候选人追踪

heap, http://cs101.openjudge.cn/practice/27384/

熊江凯，这题应该不超纲的，感觉还是挺好的

思路：一开始想到了heap但是堆写法还不够熟练用了一个个pop再push，n^2不出意外超时，之后模仿意识到可以通过堆顶搜索来实现不用pop，果然成功

**代码**

```
# # -*- coding: utf-8 -*-
"""
Created on Sun Dec 17 11:22:46 2023

@author: Lenovo
"""

import heapq
n,k=map(int,input().split())
l=list(map(int,input().split()))
l=[[l[i],l[i+1]]for i in range(0,2*n,2)]
l.sort()
s=set(map(int,input().split()))
heap=[]
for member in s:
    heapq.heappush(heap,[0,member])
count=[0]*314160
if k==314159:
    print(l[-1][0])
    quit()
ans=max2=0
for i in range(n):
    member=l[i][1]
    count[member]+=1
    if member in s:
        while count[heap[0][1]]:
            f=heapq.heappop(heap)
            f=[f[0]+count[f[1]],f[1]]
            heapq.heappush(heap,f)
            count[f[1]]=0
    else:
        max2=max(max2,count[member])
    if heap[0][0]>max2 and i!=n-1 and l[i+1][0]!=l[i][0]:
        ans+=l[i+1][0]-l[i][0]
print(ans)
```

代码运行截图 ==（AC代码截图，至少包含有"Accepted"）==

**#43217467提交状态**

查看 提交 统计 提问

状态: Accepted

基本信息

#: 43217467
题目: 27384
提交人: 23n2300011075(才疏学浅)
内存: 108136kB
时间: 1221ms
语言: Python3
提交时间: 2023-12-19 11:00:09

源代码

```
# -*- coding: utf-8 -*-
"""
Created on Sun Dec 17 11:22:46 2023

@author: Lenovo
"""

import heapq
n,k=map(int,input().split())
l=list(map(int,input().split()))
l=[[l[i],l[i+1]]for i in range(0,2*n,2)]
l.sort()
s=set(map(int,input().split()))
heap=[]
for member in s:
    heapq.heappush(heap,[0,member])
count=[0]*314160
if k==314159:
    print(l[-1][0])
    quit()
ans=max2=0
for i in range(n):
    member=l[i][1]
    count[member]+=1
    if member in s:
        while count[heap[0][1]]:
            f=heapq.heappop(heap)
            f=[f[0]+count[f[1]],f[1]]
            heapq.heappush(heap,f)
            count[f[1]]=0
    else:
        max2=max(max2,count[member])
    if heap[0][0]>max2 and i!=n-1 and l[i+1][0]!=l[i][0]:
        ans+=l[i+1][0]-l[i][0]
print(ans)
```

# CF1883D. In Love

data structure, greedy, 1500, https://codeforces.com/problemset/problem/1883/D

黄源森、查达闻推荐

思路：贪心，找左端点的最大和右端点的最小，如果左比右大那一定有不重合的段

### 代码

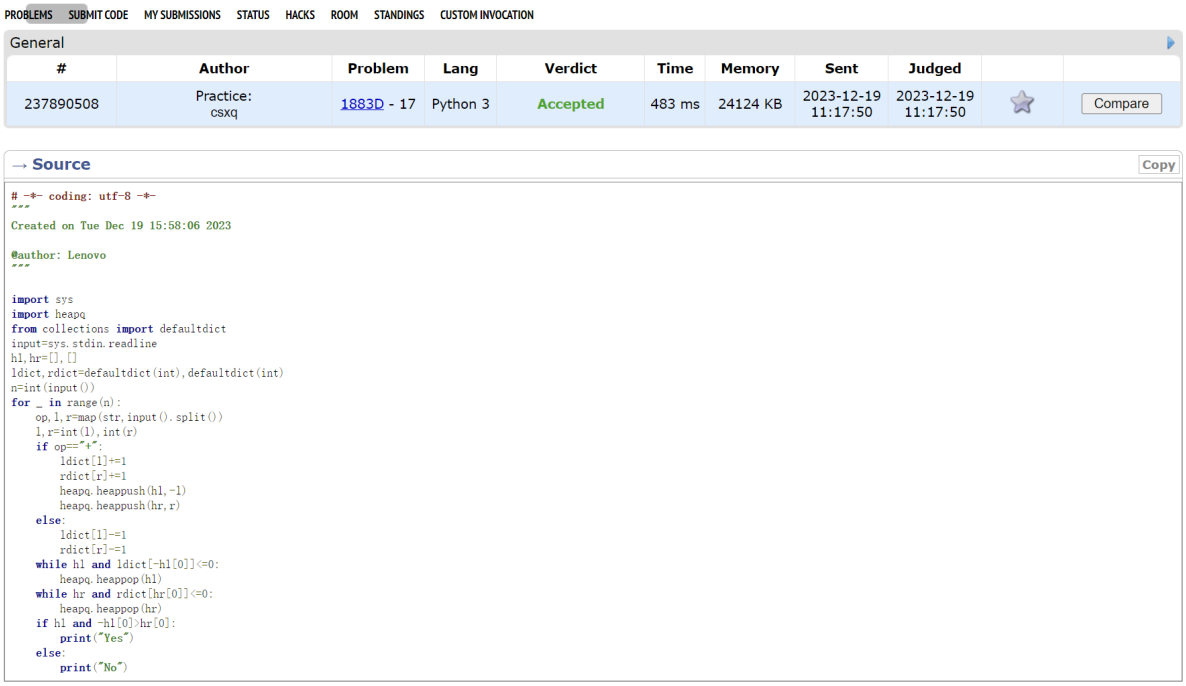
```
# # -*- coding: utf-8 -*-
"""
Created on Tue Dec 19 15:58:06 2023

@author: Lenovo
"""

import sys
import heapq
from collections import defaultdict
input=sys.stdin.readline
hl,hr=[],[]
ldict,rdict=defaultdict(int),defaultdict(int)
n=int(input())
```

```
for _ in range(n):
    op,l,r=map(str,input().split())
    l,r=int(l),int(r)
    if op=="+":
        ldict[l]+=1
        rdict[r]+=1
        heapq.heappush(hl,-l)
        heapq.heappush(hr,r)
    else:
        ldict[l]-=1
        rdict[r]-=1
    while hl and ldict[-hl[0]]<=0:
        heapq.heappop(hl)
    while hr and rdict[hr[0]]<=0:
        heapq.heappop(hr)
    if hl and -hl[0]>hr[0]:
        print("Yes")
    else:
        print("No")
```

代码运行截图 ==（至少包含有"Accepted"）==



PROBLEMS SUBMIT CODE MY SUBMISSIONS STATUS HACKS ROOM STANDINGS CUSTOM INVOCATION

General

| # | Author | Problem | Lang | Verdict | Time | Memory | Sent | Judged | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 237890508 | Practice: csxq | 1883D - 17 | Python 3 | Accepted | 483 ms | 24124 KB | 2023-12-19 11:17:50 | 2023-12-19 11:17:50 | ☆ | Compare |

→ Source Copy

```
# -*- coding: utf-8 -*-
"""
Created on Tue Dec 19 15:58:06 2023

@author: Lenovo
"""

import sys
import heapq
from collections import defaultdict
input=sys.stdin.readline
hl,hr=[],[]
ldict,rdict=defaultdict(int),defaultdict(int)
n=int(input())
for _ in range(n):
    op,l,r=map(str,input().split())
    l,r=int(l),int(r)
    if op=="+":
        ldict[l]+=1
        rdict[r]+=1
        heapq.heappush(hl,-l)
        heapq.heappush(hr,r)
    else:
        ldict[l]-=1
        rdict[r]-=1
    while hl and ldict[-hl[0]]<=0:
        heapq.heappop(hl)
    while hr and rdict[hr[0]]<=0:
        heapq.heappop(hr)
    if hl and -hl[0]>hr[0]:
        print("Yes")
    else:
        print("No")
```

# 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“每日选做”中每天推出的2题目、CF、LeetCode、洛谷等网站题目。==

简单？？？？ ：）乐　　但是heapq真的很好用！！！！