

Assignment #2: 编程练习

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2024 spring, Compiled by 刘思瑞 元培学院

说明:

1) The complete process to learn DSA from scratch can be broken into 4 parts:

- Learn about Time and Space complexities
- Learn the basics of individual Data Structures
- Learn the basics of Algorithms
- Practice Problems on DSA

2) 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。

3) 课程网站是Canvas平台, <https://pku.instructure.com>, 学校通知3月1日导入选课名单后启用。**作业写好后，保留在自己手中，待3月1日提交。**

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。

4) 如果不能在截止前提交作业，请写明原因。

编程环境

操作系统: Windows 11 22H2 22621.2283

Python编程环境: Visual Studio (1.82.2); python 3.11.3

C/C++编程环境: 无

1. 题目

27653: Fraction类

<http://cs101.openjudge.cn/practice/27653/>

思路:

正常写类

代码

```
1  '''
2  2100017810 刘思瑞
3  '''
4  import math
5
6  class fraction:
7      def __init__(self,a,b):
8          self.a = a
9          self.b = b
10     def add(self,m):
11         c = self.b * m.b
12         d = self.a * m.b + self.b * m.a
13         e = math.gcd(c,d)
14         f = c//e
15         g = d//e
16         return fraction(g,f)
17     def output(self):
18         print('%d/%d' %(self.a ,self.b))
19
20 a,b,c,d = map(int,input().split())
21 p = fraction(a,b)
22 q= fraction(c,d)
23 (p.add(q)).output()
```

代码运行截图

状态: Accepted

源代码

```
'''
2100017810 刘思瑞
'''

import math

class fraction:
    def __init__(self, a, b):
        self.a = a
        self.b = b
    def add(self, m):
        c = self.b * m.b
        d = self.a * m.b + self.b * m.a
        e = math.gcd(c, d)
        f = c // e
        g = d // e
        return fraction(g, f)
    def output(self):
        print('%d/%d' % (self.a, self.b))

a, b, c, d = map(int, input().split())
p = fraction(a, b)
q = fraction(c, d)
(p.add(q)).output()
```

04110: 圣诞老人的礼物-Santa Clau's Gifts

greedy/dp, <http://cs101.openjudge.cn/practice/04110>

思路:

贪心, 排序一下

代码

```
1 '''
2 刘思瑞 2100017810
3 '''
4 n, w0 = map(int, input().split())
5 record = []
6 for i in range(n):
7     v, w = map(int, input().split())
8     record.append([v/w, v, w])
9 for i in range(n-1):
```

```

10     for j in range(n-1-i):
11         if record[j][0] < record[j+1][0]:
12             record[j] , record[j+1] = record[j+1] , record[j]
13     sum = 0
14     for i in record:
15         if i[2] < w0:
16             sum+= i[1]
17             w0 -= i[2]
18         else:
19             sum+= i[0] * w0
20             break
21     print('%.1f' % sum)

```

代码运行截图

状态: Accepted

源代码

```

'''
刘思瑞 2100017810
'''
n , w0 = map(int,input().split())
record = []
for i in range(n):
    v , w = map(int,input().split())
    record.append([v/w,v,w])
for i in range(n-1):
    for j in range(n-1-i):
        if record[j][0] < record[j+1][0]:
            record[j] , record[j+1] = record[j+1] , record[j]
sum = 0
for i in record:
    if i[2] < w0:
        sum+= i[1]
        w0 -= i[2]
    else:
        sum+= i[0] * w0
        break
print('%.1f' % sum)

```

18182: 打怪兽

implementation/sortings/data structures, <http://cs101.openjudge.cn/practice/18182/>

思路:

排序

代码

```
1  '''
2  刘思瑞 2100017810
3  '''
4  testnum = int(input())
5  for i in range(testnum):
6      n ,m ,b = map(int,input().split())
7      release = []
8      time = []
9      flag = 1
10     for j in range(n):
11         t , hurt = map(int,input().split())
12         if t in time:
13             release[time.index(t)].append(hurt)
14         else:
15             time.append(t)
16             release.append([hurt])
17     l = len(time)
18     for j in range(l-1):
19         for k in range(l-1-j):
20             if time[k] > time[k+1]:
21                 time[k] , time[k+1] , release[k] , release[k+1] = time[k+1]
22                 , time[k] , release[k+1] , release[k]
23         for j in range(l):
24             release[j].sort(reverse = True)
25             hurting = sum(release[j][:m])
26             if hurting >= b:
27                 print(time[j])
28                 flag = 0
29                 break
30         else:
31             b -= hurting
32     if flag:
33         print('alive')
```

代码运行截图

状态: Accepted

源代码

```
'''
刘思瑞 2100017810
'''
testnum = int(input())
for i in range(testnum):
    n , m , b = map(int, input().split())
    release = []
    time = []
    flag = 1
    for j in range(n):
        t , hurt = map(int, input().split())
        if t in time:
            release[time.index(t)].append(hurt)
        else:
            time.append(t)
            release.append([hurt])
    l = len(time)
    for j in range(l-1):
        for k in range(l-1-j):
            if time[k] > time[k+1]:
                time[k] , time[k+1] , release[k] , release[k+1] = time[k+1] , time[k] , release[k+1] , release[k]
    for j in range(l):
        release[j].sort(reverse = True)
        hurting = sum(release[j][:m])
        if hurting >= b:
            print(time[j])
            flag = 0
            break
```

230B. T-primes

binary search/implementation/math/number theory, 1300, <http://codeforces.com/problemset/problem/230/B>

思路:

欧拉筛

代码

```
1 '''
2 刘思瑞 2100017810
3 '''
4 def euler(n):
5     filter, primers = [False for i in range(n + 1)], []
6     for i in range(2, n + 1):
7         if not filter[i]:
8             primers.append(i)
9             for prime in primers:
10                 if i * prime > n:
```

```

11         break
12         filter[i * prime] = True
13         if i % prime == 0:
14             break
15     return filter
16
17 def search(num):
18     global prime_
19     sq = int(num**(0.5))
20     if int(sq**2) != num or num == 1:
21         return 'NO'
22     if not prime_[sq]:
23         return 'YES'
24     return 'NO'
25
26 n = int(input())
27 num = list(map(int, input().split()))
28 n = int(max(num)**(0.5))
29 prime_ = euler(n)
30 for i in num:
31     print(search(i))

```

代码运行截图

PROBLEMS SUBMIT CODE MY SUBMISSIONS STATUS HACKS ROOM STANDINGS CUSTOM INVOCATION

General

#	Author	Problem	Lang	Verdict	Time	Memory	Sent	Judged		
228568167	Practice: meinvader	230B - 28	Python 3	Accepted	1558 ms	23540 KB	2023-10-17 18:09:06	2023-10-17 18:09:06	★	Compare

→ Source [Copy](#)

```

...
刘思瑞 2100017810
...
def euler(n):
    filter, primes = [False for i in range(n + 1)], []
    for i in range(2, n + 1):
        if not filter[i]:
            primes.append(i)
            for prime in primes:
                if i * prime > n:
                    break
                filter[i * prime] = True
                if i % prime == 0:
                    break
    return filter

def search(num):
    global prime_
    sq = int(num**(0.5))
    if int(sq**2) != num or num == 1:
        return 'NO'
    if not prime_[sq]:
        return 'YES'
    return 'NO'

n = int(input())
num = list(map(int, input().split()))
n = int(max(num)**(0.5))
prime_ = euler(n)
for i in num:
    print(search(i))

```

1364A. XXXXX

brute force/data structures/number theory/two pointers, 1200, <https://codeforces.com/problemset/problem/1364/A>

思路：

可以说明一定是从两侧开始计算最长

代码

```
1      '''
2      刘思瑞 2100017810
3      '''
4      def calcu(le,x,array):
5          nonzero = []
6          for i in range(le):
7              array[i] %= x
8              if array[i] != 0:
9                  nonzero.append(i)
10         sum = -1
11         if len(nonzero) ==0:
12             return sum
13         if len(nonzero) ==1:
14             return le
15         sum = nonzero[0] +1
16         nsum = 0
17         for j in range(0,len(nonzero)):
18             nsum += array[nonzero[j]]
19             if nsum % x != 0:
20                 if j+1 < len(nonzero):
21                     if nonzero[j+1] >sum:
22                         sum = nonzero[j+1]
23             else:
24                 return le
25         return sum
26
27
28     n = int(input())
29     for i in range(n):
30         le , x = map(int,input().split())
31         array = list(map(int,input().split()))
32         print(max(calcu(le,x,array),calcu(le,x,array[::-1])))
```

代码运行截图

General

#	Author	Problem	Lang	Verdict	Time	Memory	Sent	Judged		
227551858	Practice: meinvader	1364A - 15	Python 3	Accepted	436 ms	17188 KB	2023-10-10 17:24:25	2023-10-10 17:24:25	★	Compare

→ Source

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```
...
刘思瑞 2100017810
'''
def calcu(le,x,array):
    nonzero = []
    for i in range(le):
        array[i] %= x
        if array[i] != 0:
            nonzero.append(i)
    sum = -1
    if len(nonzero) ==0:
        return sum
    if len(nonzero) ==1:
        return le
    sum = nonzero[0] +1
    nsum = 0
    for j in range(0,len(nonzero)):
        nsum += array[nonzero[j]]
        if nsum % x != 0:
            if j+1 < len(nonzero):
                if nonzero[j+1] >sum:
                    sum = nonzero[j+1]
            else:
                return le
    return sum

n = int(input())
for i in range(n):
    le , x = map(int,input().split())
    array = list(map(int,input().split()))
    print(max(calcu(le,x,array),calcu(le,x,array[::-1])))
```


18176: 2050年成绩计算

<http://cs101.openjudge.cn/practice/18176/>

思路:

欧拉筛

代码

```
1  '''
2  2100017810 刘思瑞
3  '''
4  N=10001
5  isprime = [True for i in range(N)]
6  prime= []
7  def euler():
8      global N
9      isprime[1]=False
10     for i in range(2,N) :
11         if isprime[i]:
12             prime.append(i)
13             for j in prime:
14                 if i*j>=N:
15                     break
16                 isprime[i*j] = False
17                 if i%j == 0:
18                     break
19
20 def calcu(grade):
21     global isprime
22     temp = []
23     for i in grade:
24         if i == int(i**0.5)**2:
25             if isprime[int(i**0.5)]:
26                 temp.append(i)
27     if temp == []:
28         print('0')
29     return
30     print('%.2f' % (sum(temp)/len(grade)))
31     return
32
33 euler()
34 m , n = map(int , input().split())
35 for i in range(m):
36     calcu(list(map(int , input().split())))
```

代码运行截图

状态: Accepted

源代码

```
'''
2100017810 刘思瑞
'''
N=10001
isprime = [True for i in range(N)]
prime= []
def euler():
    global N
    isprime[1]=False
    for i in range(2,N) :
        if isprime[i]:
            prime.append(i)
            for j in prime:
                if i*j>=N:
                    break
                isprime[i*j] = False
                if i%j == 0:
                    break

def calcu(grade):
    global isprime
    temp = []
    for i in grade:
        if i == int(i**0.5)**2:
            if isprime[int(i**0.5)]:
                temp.append(i)
    if temp == []:
        print('0')
        return
    print('%.2f' % (sum(temp)/len(grade)))
    return
```

2. 学习总结和收获

还是上学期的练习题，每日选座做了一些