

Assignment #2: 编程练习

Updated 0953 GMT+8 Feb 24, 2024

2024 spring, Compiled by Xinjie Song, Phy

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

Python编程环境: PyCharm 2023.2 (Community Edition)

C/C++编程环境: g++ (x86_64-win32-seh-rev0, Built by MinGW-W64 project) 8.1.0

1. 题目

27653: Fraction类

http://cs101.openjudge.cn/2024sp_routine/27653/

思路: 常规思路

代码

```
class Fraction:
    def __init__(self, a, b):
        self.a = a
        self.b = b

    def __str__(self):
        return f'{self.a}/{self.b}'

    def __add__(self, other):
        na = self.a*other.b + self.b*other.a
        nb = self.b*other.b

    def gcd(x, y):
        x = abs(x)
        y = abs(y)
        x, y = max(x, y), min(x, y)
        if x % y != 0:
            return gcd(y, x % y)
        return y

    t = gcd(na, nb)
    na //= t
    nb //= t

    return Fraction(na, nb)

ls = list(map(int, input().split()))
print(Fraction(ls[0], ls[1]) + Fraction(ls[2], ls[3]))
```

代码运行截图

OpenJudge - 提交状态

cs101.openjudge.cn/2024sp_routine/solution/43948308/

OpenJudge 题目ID, 标题, 描述 23n2300011524 信箱 账号

CS101 / 2024spring每日选做

题目 排名 状态 提问

#43948308提交状态 查看 提交 统计 提问

状态: Accepted

源代码

```
class Fraction:
    def __init__(self, a, b):
        self.a = a
        self.b = b

    def __str__(self):
        return f'{self.a}/{self.b}'

    def __add__(self, other):
        na = self.a*other.b + self.b*other.a
        nb = self.b*other.b

    def gcd(x, y):
        x = abs(x)
        y = abs(y)
        x, y = max(x, y), min(x, y)
        if x % y != 0:
            return gcd(y, x % y)
        return y

    t = gcd(na, nb)
    na //= t
    nb //= t

    return Fraction(na, nb)

ls = list(map(int, input().split()))
print(Fraction(ls[0], ls[1]) + Fraction(ls[2], ls[3]))
```

基本信息

#: 43948308
题目: 27653
提交人: 23n2300011524
内存: 3640KB
时间: 22ms
语言: Python3
提交时间: 2024-02-21 15:06:55

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04110: 圣诞老人的礼物-Santa Clau's Gifts

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

思路：常规思路

代码

```
n, w = map(int, input().split())
datas = {}
for i in range(n):
    data = list(map(int, input().split()))
    if data[0]/data[1] in datas:
        datas[data[0]/data[1]][0] += data[0]
        datas[data[0]/data[1]][1] += data[1]
    else:
        datas[data[0]/data[1]] = data
value = 0
for i in sorted(datas.keys(), reverse=True):
    value += [datas[i][0]*w/datas[i][1], datas[i][0]][w >= datas[i][1]]
    w -= datas[i][1]
    if w < 0:
        break
print('%.1f' % value)
```

代码运行截图

The screenshot shows the OpenJudge submission page for problem 04110. The page is titled "CS101 / 题库" and includes tabs for "题目", "排名", "状态", and "提问". The submission status is "Accepted". The source code is displayed in a text area, and the basic information is shown on the right side.

源代码

```
n, w = map(int, input().split())
datas = {}
for i in range(n):
    data = list(map(int, input().split()))
    if data[0]/data[1] in datas:
        datas[data[0]/data[1]][0] += data[0]
        datas[data[0]/data[1]][1] += data[1]
    else:
        datas[data[0]/data[1]] = data
value = 0
for i in sorted(datas.keys(), reverse=True):
    value += [datas[i][0]*w/datas[i][1], datas[i][0]][w >= datas[i][1]]
    w -= datas[i][1]
    if w < 0:
        break
print('%.1f' % value)
```

基本信息

- #: 41741938
- 题目: 04110
- 提交人: 23n2300011524
- 内存: 3536kB
- 时间: 20ms
- 语言: Python3
- 提交时间: 2023-10-18 10:07:25

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18182: 打怪兽

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

思路：常规思路

代码

```
for _ in range(int(input())):
    n, m, b = map(int, input().split())
    skills = {}
    for i in range(n):
        t, x = map(int, input().split())
        if skills.get(t):
            skills[t].append(x)
        else:
            skills[t] = [x]
    for t in sorted(skills.keys()):
        b -= sum(sorted(skills[t], reverse=True)[:m])
        if b <= 0:
            break
    print([t, 'alive'][b > 0])
```

xxxxxxxxxx for _ in range(int(input())): n, m, b = map(int, input().split()) skills = {} for i in range(n): t, x = map(int, input().split()) if skills.get(t): skills[t].append(x) else: skills[t] = [x] for t in sorted(skills.keys()): b -= sum(sorted(skills[t], reverse=True)[:m]) if b <= 0: break print([t, 'alive'][b > 0])#

代码运行截图

The screenshot shows the OpenJudge submission page for problem 18182. The page is titled "CS101 / 题库" and includes tabs for "题目", "排名", "状态", and "提问". The submission status is "Accepted". The source code is displayed in a code editor, and the basic information is shown on the right side.

源代码

```
for _ in range(int(input())):
    n, m, b = map(int, input().split())
    skills = {}
    for i in range(n):
        t, x = map(int, input().split())
        if skills.get(t):
            skills[t].append(x)
        else:
            skills[t] = [x]
    for t in sorted(skills.keys()):
        b -= sum(sorted(skills[t], reverse=True)[:m])
        if b <= 0:
            break
    print([t, 'alive'][b > 0])
```

基本信息

- #: 42160036
- 题目: 18182
- 提交人: 23n2300011524
- 内存: 3772kB
- 时间: 71ms
- 语言: Python3
- 提交时间: 2023-11-01 17:32:21

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230B. T-primes

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

思路：常规思路

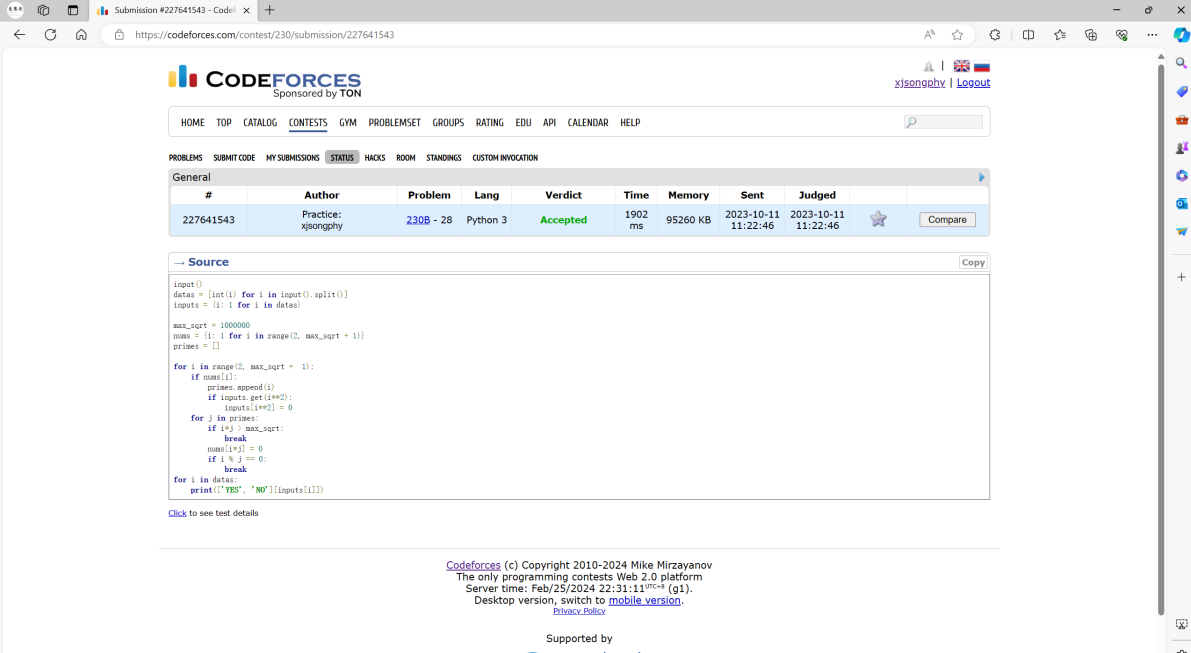
代码

```
input()
datas = [int(i) for i in input().split()]
inputs = {i: 1 for i in datas}

max_sqrt = 1000000
nums = {i: 1 for i in range(2, max_sqrt + 1)}
primes = []

for i in range(2, max_sqrt + 1):
    if nums[i]:
        primes.append(i)
        if inputs.get(i**2):
            inputs[i**2] = 0
    for j in primes:
        if i*j > max_sqrt:
            break
        nums[i*j] = 0
        if i % j == 0:
            break
for i in datas:
    print(['YES', 'NO'][inputs[i]])
```

代码运行截图



The screenshot shows a web browser displaying the Codeforces submission page for problem 230B. The page includes a navigation bar with links like HOME, TOP, CATALOG, CONTESTS, GYM, PROBLEMSET, GROUPS, RATING, EDU, API, CALENDAR, and HELP. Below the navigation bar, there's a table of submissions. The submission for problem 230B - 28, Python 3, is highlighted with a verdict of 'Accepted'. The source code is displayed below the submission table, showing the implementation of the T-primes problem. The code uses a sieve-like approach to find primes up to 1,000,000 and checks if the square of the input number is a prime.

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The only programming contests Web 2.0 platform
Server time: Feb/25/2024 22:31:11 UTC+8 (g1).
Desktop version, switch to [mobile version](#).
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Supported by

1364A. XXXXX

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

思路：常规思路

代码

```
t = int(input())
for i in range(t):
    n, x = map(int, input().split())
    array = [int(j) for j in input().split()]
    if sum(array) % x != 0:
        print(n)
    else:
        found = False
        for j in range(n):
            if array[j] % x != 0 or array[n - 1 - j] % x != 0:
                found = True
                break
        if found:
            print(n - j - 1)
        else:
            print(-1)
```

代码运行截图

The screenshot shows the Codeforces submission interface. At the top, the user 'xjsongqhy' is logged in. The submission for problem 1364A is shown with a status of 'Accepted'. Below the submission table, the source code is displayed in a dark-themed editor. The code is a Python script that reads the number of test cases, then for each case, reads the length of the array and the divisor x. It checks if the sum of the array is divisible by x. If not, it prints the length of the array. If yes, it checks if any element in the array is not divisible by x. If found, it prints the index of the first such element (adjusted for 0-indexing). If not found, it prints -1.

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The only programming contests Web 2.0 platform
Server time: Feb/25/2024 22:30:53^{UTC+8} (g1).
Desktop version, switch to [mobile version](#).
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18176: 2050年成绩计算

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

思路：常规思路

代码

```
m, n = map(int, input().split())
ls = [list(map(int, input().split())) for _ in range(m)]
primes = []
lim = 10**4
nums = {i + 1: 1 for i in range(1, 10**4)}
for i in range(2, 10**4 + 1):
    if nums[i]:
        primes.append(i)
        for j in primes:
            if i*j > lim:
                break
            nums[i*j] = 0
            if i % j == 0:
                break
t_primes = {i**2: 1 for i in primes}
for i in range(m):
    count = sum_score = 0
    for j in ls[i]:
        if j in t_primes:
            count += 1
            sum_score += j
    if count:
        print('%.2f' % (sum_score/len(ls[i])))
    else:
        print(0)
```

代码运行截图

OpenJudge - 提交状态

cs101.openjudge.cn/practice/solution/43004429/

23n2300011524 信箱 账号

OpenJudge 题目ID, 标题, 描述

CS101 / 题库

题目 排名 状态 提问

#43004429提交状态

查看 提交 统计 提问

状态: Accepted

源代码

```
m, n = map(int, input().split())
ls = [list(map(int, input().split())) for _ in range(m)]
primes = []
lim = 10**4
nums = [1] * (lim + 1)
for i in range(2, lim + 1):
    if nums[i]:
        primes.append(i)
        for j in primes:
            if i * j > lim:
                break
            nums[i * j] = 0
            if i % j == 0:
                break
t_primes = (i**2: i for i in primes)
for i in range(n):
    count = sum_score = 0
    for j in ls[i]:
        if j in t_primes:
            count += 1
            sum_score += j
    if count:
        print('%2f' % (sum_score / len(ls[i])))
    else:
        print(0)
```

基本信息

#: 43004429
题目: 18176
提交人: 23n2300011524
内存: 7064kB
时间: 53ms
语言: Python3
提交时间: 2023-12-08 10:25:18

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English 帮助 关于

2. 学习总结和收获

确实简单，教材看了一半，看完以后开始做每日选做