WOBURN CHALLENGE

2017-18 Online Round 3

Friday, March 23rd, 2018

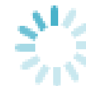
Intermediate Division Problems

Automated grading is available for these problems at:
wcipeg.com

For more problems from past contests, visit:
woburnchallenge.com

Problem I1: Uncrackable

12 Points / Time Limit: 2.00s / Memory Limit: 16M *Submit online: http://wcipeg.com/problem/wc173j3*



You'd like to register an account on an extremely entertaining website. You've already selected a username, but it seems that the requirements for choosing a password are quite strict, in order to completely protect your account from being hacked into. The password must be a string between 8 and 12 characters long (inclusive), such that every character is either a lowercase letter ("`a`".."`z`"), uppercase letter ("`A`".."`Z`"), or digit ("`0`".."`9`"). Furthermore, it must contain at least three lowercase letters, at least two uppercase letters, and at least one digit.

You've got a potential password in mind, a non-empty string made up of at most 100 characters, each of which is a lowercase letter, uppercase letter, or digit. Rather than entering the password into the site and risking rejection, you'd like to determine for yourself whether or not your password would validly satisfy all of the rules.

Input Format

The first and only line of input consists of a single string, the password.

Output Format

Output a single string, either "`Valid`" if the password is valid, or "`Invalid`" otherwise.

Sample Input 1

```
PassW0rd
```

Sample Output 1

```
Valid
```

Sample Input 2

```
CorrectHorseBatteryStaple
```

Sample Output 2

```
Invalid
```

Sample Explanations

In the first case, the password has 8 characters, with 5 lowercase letters, 2 uppercase letters, and 1 digit, meaning that all of the rules are satisfied.

In the second case, the password has two issues – it's more than 12 characters long, and it doesn't contain at least one digit.

Problem I2: Meme Generator

16 Points / Time Limit: 2.00s / Memory Limit: 16M *Submit online: http://wcipeg.com/problem/wc173j4*

As part of your internship at a popular [meme generation site](), you've been tasked with implementing a new ASCII art feature!

You're given a grid of non-whitespace characters with R rows and C columns ($5 \le R, C \le 100$), representing a meme image. The user will then be able to specify two pieces of custom text to overlay onto the image, near its top and bottom edges, in order to enhance its comedic effect.

The user will first specify a non-empty string T with length no greater than $C - 2$. Each of its characters will be either an uppercase letter or an underscore, and it will neither start nor end with an underscore. This string should be laid on top of the image in the second row from the top, and horizontally centered. If it can't be perfectly centered (for example, if its length is odd while C is even), then it should instead be placed slightly to the left, as close to centered as possible. Underscores should be omitted, allowing the original image's characters to show through at those locations instead.

Finally, the user will specify a non-empty string B with the same constraints as T. It should similarly be laid on top of the image in the second row from the bottom, and horizontally centered.

Your task is to generate the resulting $R \times C$ image after both strings T and B have been laid on top of it, and give it back to the user, so that they can go post it on various social media platforms and obtain millions of well-deserved upvotes for their original, creative comedic content.

Input Format

The first line of input consists of two space-separated integers, R and C.
R lines follow, the i-th of which consists of C characters representing the i-th row of the image grid, for $i = 1..R$.
The next line consists of a single string, T.
The next line consists of a single string, B.

Output Format

Output R lines with C characters per line, the i-th of which should be the i-th row of the updated image grid.

Sample Explanation

Much ASCII.

Sample Input

```
17 28
........._.............__...
........|+\...........|/++|..
```

Sample Output

Problem I3: Mutual Friends

26 Points / Time Limit: 2.00s / Memory Limit: 16M *Submit online: http://wcipeg.com/problem/wc173s1*

The social network Google+ has N ($2 \le N \le 6$) users, with user IDs from 1 to N. Each pair of distinct users are either friends with one another, or not.

You're given an $N \times N$ grid of values M, with $M_{i,j}$ ($0 \le M_{i,j} \le N$) being the number of mutual friends which users i and j have in common. This corresponds to the number of other users which are friends with both i and j. Note that it does not depend on whether or not i and j are friends with one another. $M_{i,j} = M_{j,i}$ for each pair of users i and j, $M_{i,i}$ is considered to be 0 for each user i.

Given the above information, you'd like to guess which users are friends with one another. If there exists a valid set of friendships which result in the given grid of mutual friend counts, then please output the number of friendships F, followed by F lines each describing one of the friendships (with 2 integers, the IDs of the two users involved in the friendship). No two friendships should involve the same unordered pair of users. If there are multiple valid sets of friendships, you may output any of them. If there are no valid sets of friendships, output "`Impossible`" instead.

Subtasks

In test cases worth 8/26 of the points, $N \le 3$.

Input Format

The first line of input consists of a single integer, N.
N lines follow, the i-th of which consists of integers, $M_{i,\,1..N}$, for $i = 1..N$.

Output Format

Either the string "`Impossible`", or 1 integer F followed by F lines, the i-th of which contains 2 integers describing the i-th friendship

Sample Input 1

```
5
0 0 0 1 2
0 0 2 0 0
0 2 0 0 0
1 0 0 0 1
2 0 0 1 0
```

Sample Output 1

```
5
1 2
2 5
5 3
3 1
2 4
```

Sample Input 2

```
3
0 1 1
1 0 0
1 0 0
```

Sample Output 2

```
Impossible
```

Sample Explanations

In the first case, one valid set of 5 friendships is indicated in the sample output. For this set, users 1 and 5 have exactly 2 mutual friends (users 2 and 3) as required, users 1 and 4 have exactly 1 mutual friend (user 2) as required, and so on. Note that there exist other outputs which would also be accepted. For example, the friendship between users 2 and 4 could be replaced with a friendship between users 3 and 4, the friendships could be outputted in any order, and the users in each friendship could be swapped.

In the second case, no set of friendships amongst 3 users would result in the required grid of mutual friend counts.

Problem I4: GleamingProudChickenFunRun

46 Points / Time Limit: 6.00s / Memory Limit: 128M *Submit online: http://wcipeg.com/problem/wc173s2*

You've assembled a set of N ($1 \le N \le 300{,}000$) Twitch clips from a live stream by your favourite twitch.tv streamer. A clip is a video fragment of the stream, and the i-th clip encapsulates the exclusive time interval from A_i to B_i seconds into the stream ($0 \le A_i < B_i \le 10^9$). The clips are not all guaranteed to be distinct.

In an effort to convince your friends to start watching this stream and join you in spamming its chat, you plan to show them some of the clips. You'd like to choose the smallest possible subset S of the clips which still offer a good representation of the whole stream. In particular, each of the N total clips must have some time in common with at least one clip in S. A pair of clips have some time in common with each other if there's a positive amount of time from the stream which is present in both clips – in other words, if the intersection of their exclusive time intervals is non-empty. For example, clips with time intervals (0, 5) and (4, 10) have some time in common, while clips with time intervals (0, 5) and (5, 10) do not.

Can you determine the minimum possible number of clips which S can be made up of?

Subtasks

In test cases worth 10/46 of the points, $N \le 15$.
In test cases worth another 22/46 of the points, $N \le 1000$.

Input Format

The first line of input consists of a single integer, N.
N lines follow, the i-th of which consists of two space-separated integers, A_i and B_i, for $i = 1..N$.

Output Format

Output a single integer, the minimum possible number of clips which S can be made up of.

Sample Input

```
6
11 14
14 23
5 22
12 28
2 6
22 31
```

Sample Output

```
2
```

Sample Explanation

No single clip can be chosen such that all 5 other clips have some time in common with it. However, there are various valid sets S made up of 2 clips, such as clips 4 (12..28) and 5 (2..6).