

WOBURN CHALLENGE

2017-18 Online Round 2

Friday, February 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: Escaping the Mines

12 Points / Time Limit: 2.00s / Memory Limit: 16M

Submit online: <http://wcipeg.com/problem/wc172j3>

Pursued by a swarm of goblins, the N ($1 \leq N \leq 9$) members of the Fellowship of the Ring are trying to escape from the Mines of Moria. To do so, they must cross a chasm which is M ($1 \leq M \leq 10$) metres wide. The i -th member of the Fellowship can jump a distance of up to J_i ($1 \leq J_i \leq 10$) metres. Therefore, they can only cross the chasm by themselves if they can jump a distance of at least M metres.



Fortunately, if someone is able to jump over the chasm themselves, they can also carry at most one other person along with them. This does not affect their jumping distance. Unfortunately, there isn't enough time for them to then jump back and carry yet another person across.

Assuming that the Fellowship works together, what's the maximum number of its members who can end up getting across the chasm and escaping the Mines of Moria?

Input Format

The first line of input consists of two space-separated integers, N and M . The next line consists of N space-separated integers, $J_{1..N}$.

Output Format

Output a single integer, the maximum number of Fellowship members who can escape.

Sample Input

```
5 6
3 6 4 1 10
```

Sample Output

```
4
```

Sample Explanation

One optimal strategy is for the 2nd member to jump across while carrying the 3rd member, and for the 5th member to jump across while carrying the 4th member. Unfortunately, this leaves the 1st member unable to cross by themselves, but there's no way for the entire Fellowship to escape.

Problem I2: Entish Translation

16 Points / Time Limit: 2.00s / Memory Limit: 16M

Submit online: <http://wcipeg.com/problem/wc172j4>

The Ents of Fangorn Forest have all convened in order to vote on an important decision - should they go to war against the treachery of Saruman, or continue to mind their own business? Merry and Pippin have managed to convince Treebeard, the oldest of the Ents, of the need to take action. As such, Treebeard has prepared a speech designed to convince the other Ents of the same. Unfortunately, he has written it in Old Entish, which is a decidedly unhasty language. The Hobbits suspect that it may take him weeks just to get through it! As such, they'd like to translate it into New Entish, a more compact version of the Ents' language.



The two Hobbits will translate one word at a time. They're taking a look at the first word in the Old Entish speech, which is a non-empty string with at most 100 characters. Each character is either a lowercase letter ("a".."z"), or a dash ("-"). Neither the first nor the last character is a dash, and there are never multiple consecutive dashes. The dashes divide the word up into one or more "tokens". In other words, each token is a maximal contiguous sequence of letters.

Translating a word from Old Entish into New Entish is a two-step process:

1. In each token, for each contiguous sequence of consonants (letters aside from "a", "e", "i", "o", and "u"), reduce it down to just the first letter in that sequence.
2. For each contiguous sequence of equal tokens, reduce it down to just a single copy of that token.

Please determine the result of translating the first word of Treebeard's speech into New Entish by applying the above process to it.

Input Format

The first and only line of input consists of a single string, the word in Old Entish.

Output Format

Output a single string, the word translated into New Entish.

Sample Input

```
a-lalla-lalla-rumba-kamanda-lindor-burume-burumne-byurstume-a-keema
```

Sample Output

```
a-lala-ruma-kamana-linor-burume-a-keema
```

Sample Explanation

For example, during the translation process, each of the 7th, 8th, and 9th tokens initially gets reduced to "burume". Then, only the first of these three equal consecutive tokens is retained.

Problem I3: Keeping Score

28 Points / Time Limit: 3.00s / Memory Limit: 64M

Submit online: <http://wcipeg.com/problem/wc172s1>

There's nothing like a bit of friendly competition, even when your life is on the line! Legolas and Gimli have taken to counting how many enemies they're each able to kill in each confrontation, in an effort to one-up one another.

During the battle of Helm's Deep, Legolas killed L ($2 \leq L \leq 200,000$) enemies, the i -th of which had a strength level of SL_i ($1 \leq SL_i \leq 10^9$). Meanwhile, Gimli killed G ($1 \leq G < L$) enemies, the i -th of which had a strength level of SG_i ($1 \leq SG_i \leq 10^9$).



Though Gimli killed fewer enemies than Legolas did, he's not about to admit defeat to the elf so easily. As such, he's gotten the idea to introduce a new rule: "All enemies with strength levels smaller than X don't count" (for some positive integer X no larger than 10^9). Help Gimli find any value of X which would cause him to "win" (in other words, such that Gimli killed strictly more enemies with strength levels greater than or equal to X than Legolas did). If no possible value of X would have this result, output -1 instead.

Subtasks

In test cases worth 14/28 of the points, $L \leq 1000$.

Input Format

The first line of input consists of two space-separated integers, L and G .
 L lines follow, the i -th of which consists of a single integer SL_i (for $i = 1..L$).
 G lines follow, the i -th of which consists of a single integer SG_i (for $i = 1..G$).

Output Format

Output a single integer, any valid value of X which would cause Gimli to win, or -1 if there's no such value.

Sample Input 1

```
5 4
84
6
105
54
30
91
84
28
66
```

Sample Output 1

```
60
```

Sample Input 2

```
2 1
3 3
3
```

Sample Output 2

```
-1
```

Sample Explanation 2

In the first case, if $X = 60$, then Legolas's score will be 2 (with his 1st and 3rd killed enemies counting), while Gimli's score will be 3. Note that there exist other valid values of X which would also be accepted.

In the second case, if $X \leq 3$, then both Legolas's score will be 2 and Gimli's will be 1. If $X > 3$, then both scores will be 0. Either way, Gimli can't win.

Problem I4: Don't Follow the Lights

44 Points / Time Limit: 6.00s / Memory Limit: 256M

Submit online: <http://wcipeg.com/problem/wc172s2>

Led by the creature Gollum, Frodo and Sam have set out to sneak their way into Mordor. Their journey takes them through the Dead Marshes, a mysterious, ancient battleground which has a way of leaving travellers lost until they perish.



The Dead Marshes can be represented as a 2D grid, with R rows and C columns ($2 \leq R, C \leq 1500$). The three travellers seek to find their way from a certain starting cell to a destination one. Some of the cells

may contain torches, while each other cell appears to be empty, but may contain dangerous boggy water – it's hard to tell which ones are in fact safe to walk on. Each cell is described by one of four characters:

- "S": The starting cell, which is otherwise empty (there's exactly one such cell)
- "D": The destination cell, which is otherwise empty (there's exactly one such cell)
- ".": An empty cell
- "*": A cell with a torch

The party would like to reach the destination cell from the starting one as quickly as possible. Every minute, they may move from their current cell to an adjacent one (either up, down, left, or right). They may not move outside the grid, and may not move into a cell containing a torch.

However, empty cells may be dangerous as well, so they've agreed to also pay attention to the warning words uttered by Gollum: "Don't follow the lights". To be precise, this means that they may not move in a given direction if there are at least two cells containing torches further ahead in that direction, in that same row/column. For example, if $C = 6$ and a certain row has torches in its 3rd and 6th cells, then the party may not move right from the 1st cell to the 2nd cell in that row, but they may move left from the 2nd cell to the 1st cell, or left/right between the 4th and 5th cells.

Please help Frodo, Sam, and Gollum determine the minimum amount of time required for them to reach the destination cell while following the above rules. Output -1 instead if they can't make it at all, and are doomed to wander the Dead Marshes forever.

Subtasks

In test cases worth 36/44 of the points, $R \leq 100$ and $C \leq 100$.

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 characters representing the i -th row of the grid, for $i = 1..R$.

Output Format

Output a single integer, the minimum amount of time required to reach the destination cell, or -1 if it's impossible to do so.

Sample Input 1

```
6 5
**...
.*...
.D.*
..*..
.....
*..S.
```

Sample Output 1

7

Sample Input 2

```
2 10
*.....*.D.*
.S.*.....*
```

Sample Output 2

-1

Sample Explanation 2

In the first case, one optimal path is indicated below:

```
**...
.*...
6D.*
5.*..
432..
*.1S.
```

In the second case, they would need to move up into the 1st row to get around the torch in the 4th cell of the 2nd row. However, moving rightwards in the 1st row towards the torch in the 6th cell is then forbidden, due to the presence of the torch in the 10th cell as well.