International Olympiad in Informatics 2012

23-30 September 2012

Sirmione - Montichiari, Italy

Practice tasks

queue

English — 1.0

Italian queue

Sometimes (fortunately less often than many people think) in Italy the usual concept of monodimensional waiting line is replaced by a far less rigorous idea, to which we are going to refer as *Italian Queue*.

The Big Mess Theory

While it is a common thought that the Universe undergoes some supreme order, a long time ago we Italians realized, as Galileo's descendents, that the Universe is more complicated than expected. We empirically found that the Universe is better modeled after the *Big Mess Theory* and the Italian Queue is a good illustrative example. What for a foreigner seems to be a chaotic queue, for us it is just experimental validation of a theory…

Italian Queue (IQ)

Suppose that there is a large square room containing many people at the same time, and a special place in the room that is very interesting for some reason: we call this place the Very Interesting Point (VIP). At some time, more people decide to enter the already crowded room, one by one, to get close to the VIP: instead of queuing in the waiting line in arrival order, as normally expected, they form an IQ so that each newcomer reaches the currently free place that is closest to the VIP. (Ties are broken arbitrarily when there are many free places at the same distance from the VIP.) As expected, the resulting IQ is not a simple waiting line and this seems to confirm our theory.

Statement

This is an output-only task. You are given 10 text files named `input0.txt`, `input1.txt`, …, `input9.txt` containing the initial arrangement of the room and you are to submit files named `output0.txt`, `output1.txt`, …, `output9.txt` containing a possible final arrangement of the room (in other words, a simulation of where people might go).

The first line of each input file contains two positive integers N and K, where N is the size of the room (recall that the room is square), and K is the number of people that are going to enter the room (that is, the people whose behaviour you are going to simulate).

A description of the initial arrangement of the room follows. The VIP is represented by capital letter 'O', a person is represented by capital letter 'X', a free place is represented by the dash symbol '-'.

Each output file must contain the final description of one of the possible final states of the room, using the same format above. Since K people will have entered the room (settling in as many free places), we have that K '-' will be replaced by so many 'X'.

Remarks

Each character of the room's description represents what we have so far called a *place*, whose coordinates are non-negative integers where (0, 0) is the coordinate of the topmost and leftmost places. The K new people can reach *every* free place, included the ones surrounded by other people. The distance between any two places is defined as the *Euclidean distance* between their integer coordinates.

Example

Suppose you are given the following input file.

```
5 3
--XX-
-XO-X
-XXX-
X—-
-X-XX
```

The first person entering the room has only one choice (marked in red), at distance 1 from the VIP:

```
--XX-
-XOXX
-XXX-
X—-
-X-XX
```

The second one is going to settle in the only position at distance √2 from the VIP:

```
-XXX-
-XOXX
-XXX-
X—-
-X-XX
```

Finally, the third person has two possible positions (both at distance 2 from the VIP):

```
-XXX-
XXOXX
-XXX-
X-X--
-X-XX
```

Since only one solution is required, you can choose between the two possibilities. For example, a valid output file would be the following:

```
-XXX-
-XOXX
-XXX-
X-X--
-X-XX
```

Subtasks [10 points each]

Each of the 10 test cases is worth 10 points.