# 2438 - Takeshi Castle

Oceania - South Pacific - 2008/2009

Takeshi Castle was a Japanese game show that aired from 1986 to 1989 on the Tokyo Broadcasting System. It featured the esteemed Japanese actor Takeshi Kitano as a count who owns a castle and sets up impossible challenges for a volunteer army to get to him. The show has become a television hit around the world. An old fan of the show asked us for help with the design of a challenge, called Lily Pads (The **Lily Pads** challenge is to cross a body of cold water by jumping between circular discs, with legs tied together, without falling into the water.), to use as a game following the upcoming ICPC Finals. As a challenge cannot be suitable for a Takeshi Castle game unless it is biased against the volunteer army, your task is to write a program to verify that a given placement of the discs will cause the majority of the volunteer army members to fail the challenge. The maximum distance that each member of the army can leap, to jump from one disc to another, has been collected by Takeshi spies and will be made available to us.

=6in
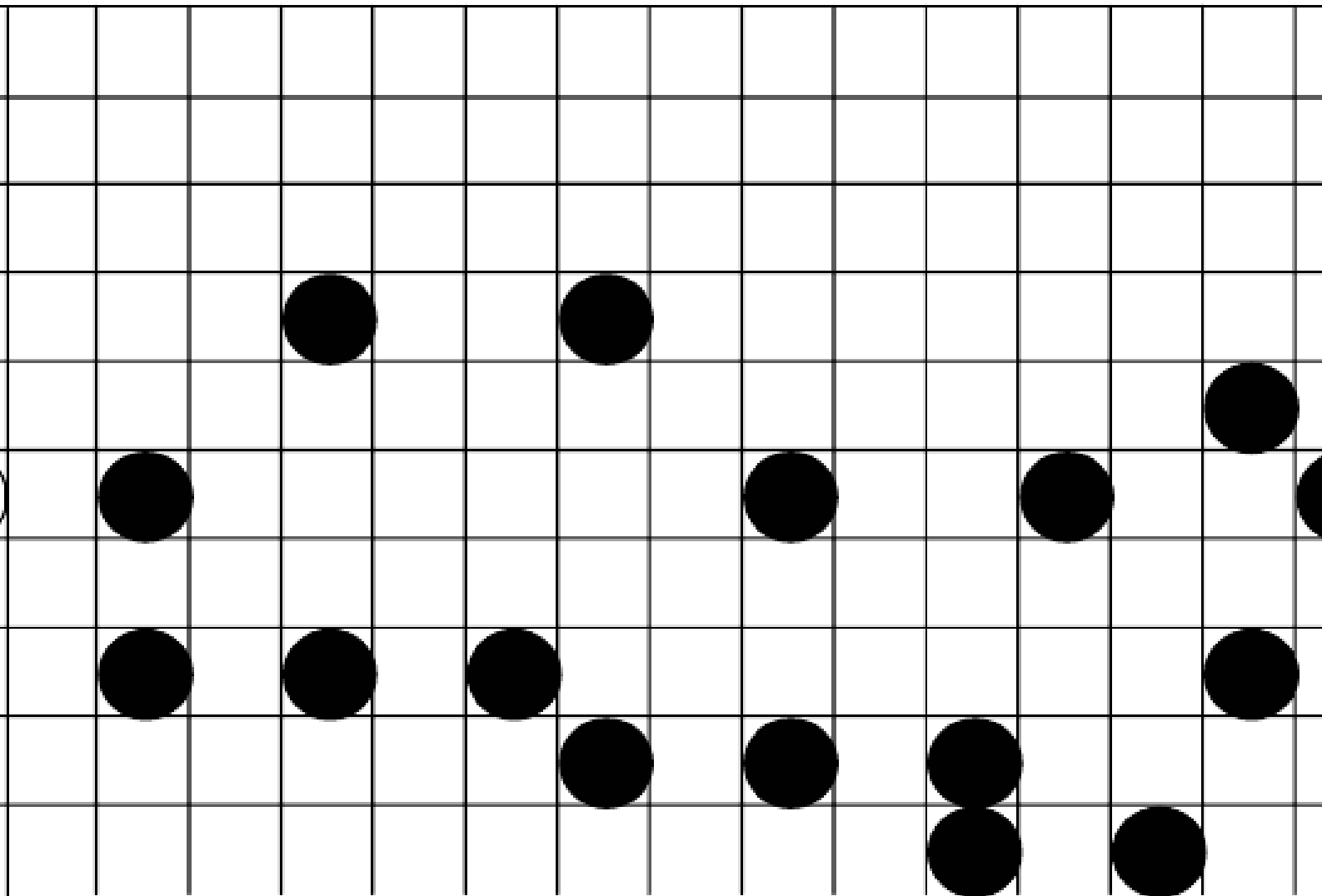
For example: the above setting with each grid cell being of size 1×1 , is a suitable challenge against a volunteer army of five members with three members capable of jumping a maximum distance of two units and two members capable of jumping a maximum of three units as the majority of volunteers will fail the challenge. Note that the distance between two discs is defined to be the length of the line connecting their centers. In the plane, the distance between points (x_1, y_1) and (x_2, y_2) is given by

$$((x_1 - x_2)^2 + (y_1 - y_2)^2)^{1/2}$$

Input

The input consists of a series of challenges. The first line in each challenge consists of the positive integers N and M , separated by one space. N is the number of the volunteers and M is the number of discs in the lily pad pond, where $30000 \geq N > 0$ and $50 \geq M \geq 2$. The second line consists of N positive integers that represent the

maximum distances that the N members of the volunteer army can leap. The third line consists of 4 positive integers that represent the x - and y -coordinates of the start and finish discs (The start and finish discs are shown striped in the example.). Each of the following M-2 lines contains two positive integers that represent the x - and y -coordinates of the remaining discs. The integers are separated by single spaces. The values of all x - and y -coordinates do not exceed 500.

Input is terminated by a challenge where N and M equal -1. This challenge should not be processed.

Output

Output consists of one line for each challenge. It will be in one of the following two formats:

```
NOT valid
valid
```

Sample Input

```
5 18
3 3 3 3 3
1 5 17 5
3 5
3 3
10 5
13 5
16 5
5 3
5 7
7 3
8 2
8 7
10 2
12 1
12 2
14 1
15 3
15 6
6 18
1 2 1 3 1 2
1 5 17 5
3 5
3 3
10 5
13 5
16 5
```

```
5 3
5 7
7 3
8 2
8 7
10 2
12 1
12 2
14 1
15 3
15 6
-1 -1
```

Sample Output

```
NOT valid
valid
```

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