Fraudband Online

Fraudband Online is a new broadband Internet service provider in Dhaka city. They have done huge campaign and are committed to their motto "One Internet line for every home". They are so confident about their service that they think eventually each and every house on a street will ultimately subscribe for their service. So their strategy is to consider a street of Dhaka city and provide every house of that street with their internet service. To accomplish this, they place network switches at several points of a street. Every house is then connected to its nearest switch using network cables. However, they have only a limited budget for purchasing network switches. So, they need your help to decide where they should place the switches. They would like to have as good signal quality as possible in every house. So they want to place the available switches so that the maximum distance between any house and the switch closest to it is as small as possible.

Streets of Dhaka city are perfectly straight road.

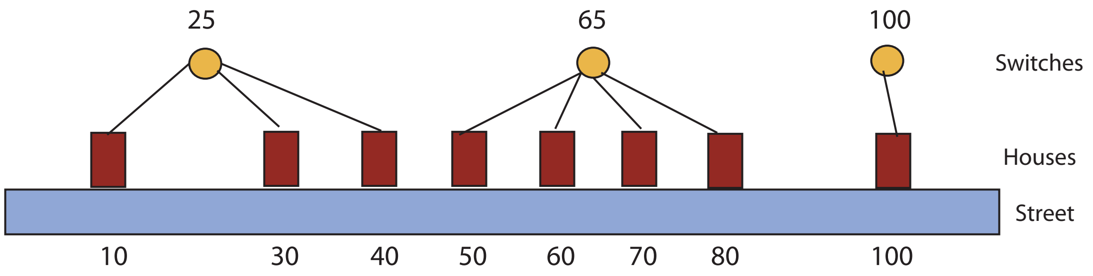

Figure 1: An example scenario

Input Specification

The input contains multiple test cases. Each test case contains description about a street. The first line of each test case contains two positive integers n, the number of switches that the ISP can buy, and m, the number of houses on the Street. The following m integers contain the distance (in meter) of the houses from the end of the street. There will be no more than 100000 houses on a street, and the distance of a house from the end of the street will be no greater than one million. Test cases are separated by a blank line. Last line of input is 0 for both n and m.

Output Specification

For each test case, output a line containing one number, the maximum distance between any house and the network switch nearest to it. Round the number to the nearest tenth of a meter, and output it with exactly one digit after the decimal point. Check the sample output section for clarification.

Sample Input

```
3 8
10 30 40 50 60 70 80 100

3 16
1 2 10 11 15 27 30 35 36 37 40 41 42 44 50 52

4 12
102 104 110 111 150 160 170 180 182 184 190 192

4 25
22 24 27 28 30 35 40 50 60 62 66 67 68 110 120 150 151 160 200 2000 5000
10000 5000 50000 55000

6 25
22 24 27 28 30 35 40 50 60 62 66 67 68 110 120 150 151 160 200 2000 5000
10000 5000 50000 55000

0 0
```

Sample Output

```
15.0
7.0
5.0
2489.0
89.0
```

Remarks

Algorithm You should use `Binary Search` over the solution space to complete this assignment. Suppose, the ISP can place n switches. Now, place switches so that no house is $> D$ distance apart from its nearest switch in $O(m)$ time. Keep track of how many switch is required if we do not let the distance between a switch and a house to be $> D$. If number of switches required is $\leq n$, then it is a valid placement, otherwise not. Your objective is to apply binary search on D.

Input Output Explanation In the sample input given, there are five scenes. The first scene starts with the line `3 10` and ends with `... 90 100` in the second line. Output for that scenario is `15.0` as shown in the sample output. Here the first switch can be placed at a position which is `25` meter distant from the end of the street, so first, second and third all three houses have distance from the switch at most `15`. Second switch can be placed at position `65` for same reason for fourth, fifth, sixth and seventh house. The third switch can be placed anywhere in less than `15` meters apart from the eigth house.

Take input in a loop like the following code:

```
while(scanf("%d%d",&n,&m)==2)
{
    if(n==0 && m==0) break;

    // some initialization here...

    // take input of house distances.

    // .... process and print output
}
```

Extra Credit You can print an optimal placement of the switches to get some bonus credits. If you can code the bonus portion, you should make it a separate program, and please keep the original file intact which prints the output exactly as specified in this problem specification.

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