

# Distribution of goods

Adam's company is growing fast. Consequently, the company's storehouse and goods collection point is no longer able to serve customers smoothly. Moreover, the customers complain about the long distance and high transport costs.

Adam concerns two solutions:

1. To develop his own transport service and deliver all goods to the customers' places.
2. To set up new collection points.

To decide between those two opportunities Adam needs to know how much he is able to reduce the dissatisfaction of his customers by setting up  $k$  new collection points.

To evaluate the above he created the following model:

- instead of a real terrain map he will use the Cartesian coordinates with the Adam's company headquarters ( $d_0$ ) located in the point  $D_0 = (0,0)$ ,
- all customers  $c_i$  ( $1 \leq i \leq n \leq 2000$ ) receive a weight values  $w_i$  ( $1 \leq w_i \leq 10$ ) in such a way that more important customers receive larger  $w_i$  and the locations given by points  $C_i = (c_{ix}, c_{iy})$ , where  $c_{ix}$  and  $c_{iy}$  are integers
- describe each of the planned collection points:  $d_j$  ( $1 \leq j \leq k$ ) will be assigned the point  $D_j$ .
- As a criterion function Adam took:

$$\sum_{i=1}^n w_i \cdot \min_{0 \leq j \leq k} |C_i D_j|,$$

the sum of distances from each of the customers to the nearest collection point, with customers' weights taken as coefficients.

Write a program which, for a given input, computes the best allocation of  $d$  new collection points, according to the criterion function.

## Input data specification

First  $t$  - the number of test cases. Next, for each of the test cases :  $n$ , the number of customers and  $k$ , the number of new collection points. Next,  $n$  rows follow, one for each customer, describing its location:  $c_{xi}$ ,  $c_{yi}$  and weight  $w_i$ .

## Output data specification

For each of the testcases, output: CASE Y [N if you do not want to solve the test]

$d_{x1}, d_{y1}$  [ $-1000 \leq d_{xi}, d_{yi} \leq 1000$ ]

$d_{x2}, d_{y2}$

...

$d_{xk}, d_{yk}$

## Scoring

Let  $s$  be equal to

$$\sum_{i=1}^n w_i \cdot \|C_i\|,$$

and  $s'$  - the criterion function computed for the program output. For each test the program scores:  $s_j = s/(ks')$  points. For the entire set of  $t$  tests, the program scores:

$(10/t) \cdot (s_1 + s_2 + \dots + s_t)$  points

The total score is the sum of points scored for correctly solved test sets.

The number of points given in the ranking is scaled so that it is equal to 10 for the contestant whose solution has the highest score, and is proportionally less for all solutions with lower scores.

## Example 1

**Input:**

```
3
4 1
12 -7 2
15 -1 9
12 -2 3
10 -9 8
6 2
12 -1 3
10 -9 3
13 -2 6
9 -9 7
13 -3 3
10 -9 3
8 4
4 -6 2
8 -7 4
7 -11 10
3 -6 3
6 -8 1
6 -10 3
3 -6 2
10 -7 4
```

**Exemplary Output:**

```
CASE 1 Y
11 -8
CASE 2 Y
12 -1
10 -10
CASE 3 N
```

**Score:**

136.978804

## Note

The essential part of the [test generator](#) has been revealed.

Test cases has been generated with following parameters:

- 1  $t=10$ ,  $10 \leq n \leq 20$ ,  $k=2$ ,  $\text{clusters}=2$ ,  $20 \leq \text{cluster\_range} \leq 35$ ;
- 2  $t=10$ ,  $100 \leq n \leq 110$ ,  $k=6$ ,  $\text{clusters}=7$ ,  $5 \leq \text{cluster\_range} \leq 10$ ;
- 3  $t=1$ ,  $n=500$ ,  $k=18$ ,  $\text{clusters}=2$ ,  $\text{cluster\_range}=400$ ;
- 4  $t=1$ ,  $n=500$ ,  $k=50$ ,  $\text{clusters}=6$ ,  $\text{cluster\_range}=250$ ;
- 5  $t=1$ ,  $n=1000$ ,  $k=3$ ,  $\text{clusters}=7$ ,  $\text{cluster\_range}=300$ ;
- 6  $t=10$ ,  $30 \leq n \leq 40$ ,  $k=4$ ,  $\text{clusters}=4$ ,  $20 \leq \text{cluster\_range} \leq 30$ ;
- 7  $t=10$ ,  $200 \leq n \leq 210$ ,  $k=14$ ,  $\text{clusters}=15$ ,  $20 \leq \text{cluster\_range} \leq 30$ ;
- 8  $t=1$ ,  $n=700$ ,  $k=4$ ,  $\text{clusters}=3$ ,  $\text{cluster\_range}=500$ ;
- 9  $t=1$ ,  $n=800$ ,  $k=37$ ,  $\text{clusters}=9$ ,  $\text{cluster\_range}=250$ ;
- 10  $t=1$ ,  $n=2000$ ,  $k=17$ ,  $\text{clusters}=250$ ,  $\text{cluster\_range}=50$ ;

For the first weeks of the series all submissions to this problem will be visible to all users and tested on 5 data sets only.

For the last week of the series, submissions will be visible to the submitting contestant, only, and tested on all 10 data sets. (Earlier solutions will also be extended to all 10 data sets.)