

**Optical cables**

<b>Submission deadline:</b>	<b>2011-11-20 23:59:59</b>	298968.928 sec
<b>Evaluation:</b>	<b>0.0000</b>	
<b>Max. assessment:</b>	<b>5.0000</b> (Without bonus points)	
<b>Submissions:</b>	0 / 10 Free retries + 20 Penalized retries (-2 % penalty each retry)	
<b>Advices:</b>	0 / 2 Advices for free + 2 Advices with a penalty (-10 % penalty each advice)	

Your task is to develop a program which helps optimize optical Internet connection network.

We assume a city where all streets are parallel to east-west or north-south directions (like Manhattan). Thus, the position of a house is unique if x and y coordinates are given. We are planning an optical Internet connection network in the city. The technology requires a separate fiber optic between each customer and some central point (a hub). Moreover, the optical cables can only be laid in the north-south or east-west directions (the cables must be laid below streets).

The input of the program is a list of houses. Each house is described by a 2D coordinate. The input ends when EOF is active (the user pressed Ctrl-D (UNIX) or Ctrl-Z (Win)). The program shall read the coordinates and store them in some memory structure.

The output of the program is the overall length of optical cables needed to connect the customers. The trick is the position of the central point (the hub) is not given. The program must decide where to place the hub to minimize the overall cable length.

The program must detect invalid input data. If there is non-numerical input or if the total number of customers is zero, the program shall print an error message (see sample runs) and terminate.

The program is tested in a limited environment. Both run time and memory is limited. The memory limit is set such that there is enough room to store the input data at least three times (in a binary form). Time is limited such that a solution based on the naive algorithm succeeds all required tests. However the naive algorithm is not fast enough to successfully pass the bonus tests.

Sample program runs:

```
Enter customer coordinates:
0 0
5 0
10 0
10 5
10 10
Total length: 30
```

```
Enter customer coordinates:
0 0
5 0
10 0
10 5
10 10
0 10
Total length: 50
```

```
Enter customer coordinates:
0 0
8 8
10 10
Total length: 20
```

```
Enter customer coordinates:
```

```
-20 -20
20 20
Total length: 80
```

```
Enter customer coordinates:
0 3
5 9
2 6
8 11
27 8
6 15
2 6
Total length: 57
```

```
Enter customer coordinates:
1 abcd
Invalid input.
```

**Notes:**

- It is OK to list one coordinate twice (or more times). It only means that there are two (or more) customers on the same address. And it means that there must be two (or more) separate cables to connect them.
- The coordinates may be negative.
- The total cable length may exceed `int` range in the bonus tests. However, the `int` range is enough for regular tests.

**Sample data:**

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**Submit:**

[Submit](#)

☐ **Reference**