4532 - Magic Rope

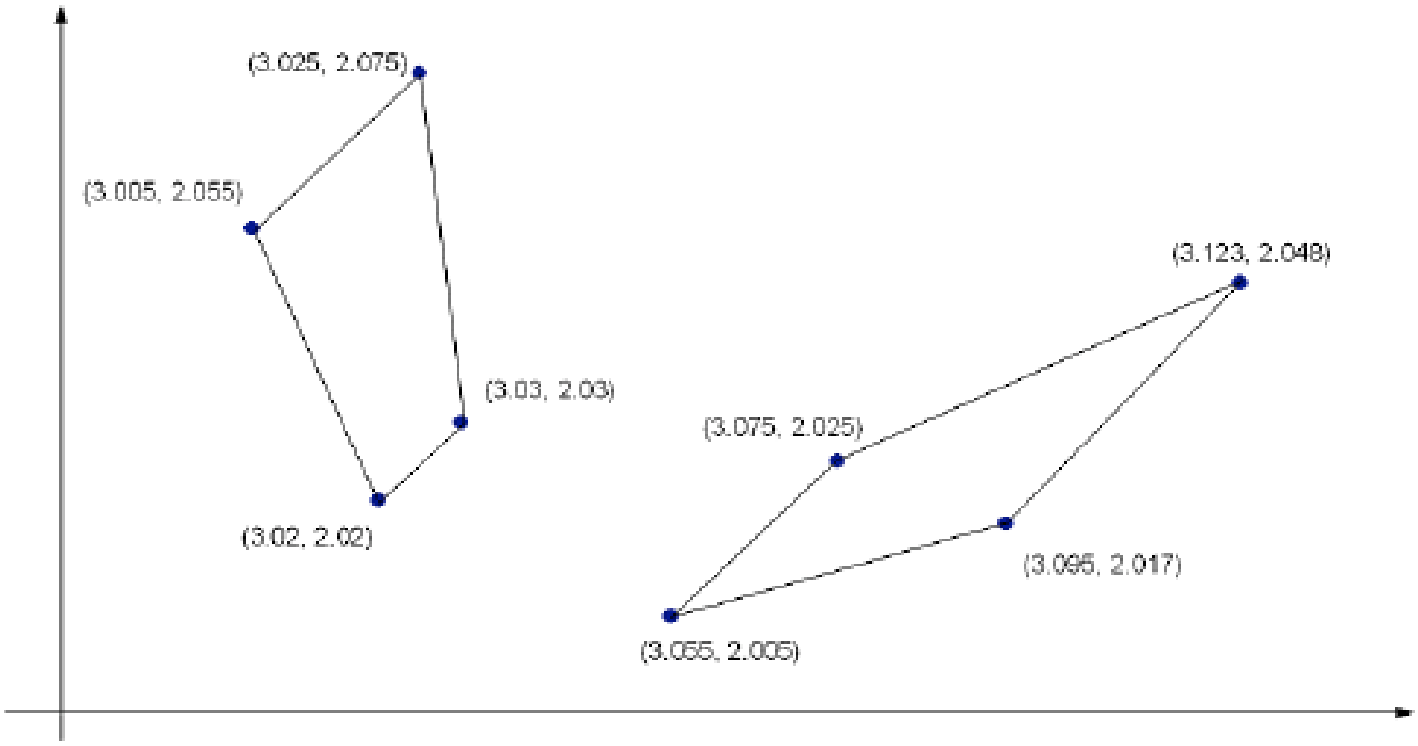
Asia - Hsinchu - 2009/2010

A young magician, David Jr., just learned an Ancient Cord Magic (ACM) that he can teleport a number of objects at a time to anywhere as he wishes. However, since David Jr. is not proficient in ACM yet, he still needs to use the tool, called Magic Rope, to surround the objects, and all the objects enclosed by the magic rope will be teleported together in an attempt.

David Jr. can teleport four objects at most at a time. David Jr. is liked by everyone because of his special skill of ACM. For example, he is very helpful when his friends are moving in/out the student dorm every year. However, David Jr. sets some rules as follows.

1. His friends need to pay him the moving cost, which is measured by the length of the Magic Rope used in teleporting.
2. To save his friends' money, David Jr. will always move four objects at a time. Moreover, he will always use as least length of the magic rope as possible to surround the four objects (i.e., forming a quadrangle, which might be convex or concave, with the minimum circumference) in each teleporting.
3. If there are two groups of objects (four objects in each group) that can be surrounded by the least length of the magic rope, David Jr. will teleport the group that has the smallest X-coordinate value among the distinct objects of the two groups, i.e., the objects that belong to exact one (but not both) of the two groups.
4. Every time after David Jr. finishes one round of teleporting, he will make the decision of the next four objects to be teleported, based on the X and Y coordinate values of the rest objects.

For example, there are eight objects on the plane, and their coordinates are (3.02, 2.02), (3.03, 2.03), (3.075, 2.025), (3.055, 2.005), (3.025, 2.075), (3.005, 2.055), (3.095, 2.017) and (3.123, 2.048) respectively. In the first round, David Jr. has two candidate groups of objects to teleport: the first group is (3.02, 2.02), (3.03, 2.03), (3.075, 2.025), and (3.055, 2.005); and the second group is (3.02, 2.02), (3.03, 2.03), (3.025, 2.075), and (3.005, 2.055). Both groups can be surrounding by a magic rope of the cord length 0.1258. However, since there are only four distinct objects in the two groups, i.e., (3.075, 2.025), (3.055, 2.005), (3.025, 2.075), and (3.005, 2.055), and the second group has the object (3.005, 2.055) which has the smallest X-coordinate value among the four distinct objects, David Jr. will teleport the second group in the first round. Then, he will teleport the remaining objects in the second round (cord length is 0.1650). The total length of the magic rope used is 0.1258 + 0.1650 = 0.2908.



Technical Specification

1. There are $4N$ objects. N is an integer, and $1 \leq N \leq 50$.
2. The X, Y coordinates of the i-th object is (X_i, Y_i). X_i and Y_i are positive real numbers; moreover, $0 < X_i \leq 1,000$ and $0 < Y_i \leq 1,000$.
3. For any two distinct objects A and B, we know that $X_A \neq X_B$ and $Y_A \neq Y_B$.
4. There are no three objects collinear on the plane.

Input

The first line of the input file contains an integer indicating the number of test cases to follow. For each test case, the first line contains a positive integer N, representing the number of rounds required to teleport the input objects. In the following $4N$ lines, the i-th line contains two positive real numbers, X_i and Y_i , which are separated by one single space and represent the X and Y coordinate values of the i-th object respectively (the values of X_i and Y_i are round off to four digits after decimal).

Output

Please output one number in one line for each test case. The number represents the length of the magic rope required to teleport the input objects. The value of the output number should be round off to four digits after decimal, with error within $\pm 10^{-4}$.

Sample Input

```
2
2
2.0000 2.0000
5.0000 4.0000
6.0000 3.0000
7.0000 7.0000
12.0000 5.0000
14.0000 8.0000
16.0000 6.0000
17.0000 10.0000
2
3.0200 2.0200
3.0300 2.0300
3.0750 2.0250
3.0550 2.0050
3.0250 2.0750
3.0050 2.0550
3.0950 2.0170
3.1230 2.0480
```

Sample Output

```
30.9146
0.2908
```

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