

Czech ACM Student Chapter

Charles University in Prague
Masaryk University
Pavol Jozef Šafárik University in Košice
Slovak University of Technology

Czech Technical University in Prague

Technical University of Ostrava
University of Žilina
Matej Bel University in Banská Bystrica



CTU Open Contest 2022

Needle

`needle.c`, `needle.cpp`, `Needle.java`, `needle.py`

Another unexpected invention of Cimrman, a marvel of microminiaturization, is the self-balancing reactive needle.

It is capable of keeping itself upright and move itself freely on a flat surface in this orientation without being supported by any external device. While moving, it can draw extremely thin lines and curves. The trace the needle leaves is in fact only few molecules wide. However, the drawing surface should be extremely clean.

Another needle experiment is in process. The drawing surface contains experimental points which are divided into so-called clouds. The clouds arrangement is specific: Each cloud contains at least three points. The area of the convex hull of each cloud is positive. The intersection of convex hulls of any two clouds is empty.

The needle has to travel between two additional points S and T. None of these two points lies inside the boundary of any cloud. The boundary of the cloud is considered to be the boundary of the convex hull of the cloud.

The needle has to travel from S to T along a shortest possible route. It should not travel inside the boundary of any cloud, the surface there may be unsuitable for the needle movement. On the other hand, the needle can travel along any part of the boundary of any cloud.

Input Specification

The first input line contains five numbers N, S_x, S_y, T_x, T_y, the number of clouds, and the coordinates (S_x, S_y) of the start point S and the coordinates (T_x, T_y) of the target point T, respectively. Next N lines contain description of cloud points in the following format. The i-th line contains an integer number c_i, the number of points in the i-th cloud. Next on the line, there are $2 \cdot c_i$ numbers $x_{i,j}, y_{i,j}$ for $3 \leq j \leq c_i$, the coordinates of the points in the i-th cloud. All coordinates are integers in the range -2000 to 2000. All input points are pairwise distinct. It is guaranteed that $1 \leq N \leq 200$, and also

$$\sum_{i=1}^{N} c_i \leq 500.$$

Output Specification

Output a single number, the length of the needle's shortest path from S to T, avoiding interiors of boundaries of all clouds. Your answer must be precise to 4 decimal digits.

Sample Input 1

```
1 0 0 10 0
3 4 2 7 3 5 -4
```

Output for Sample Input 1

```
11.8770543023
```

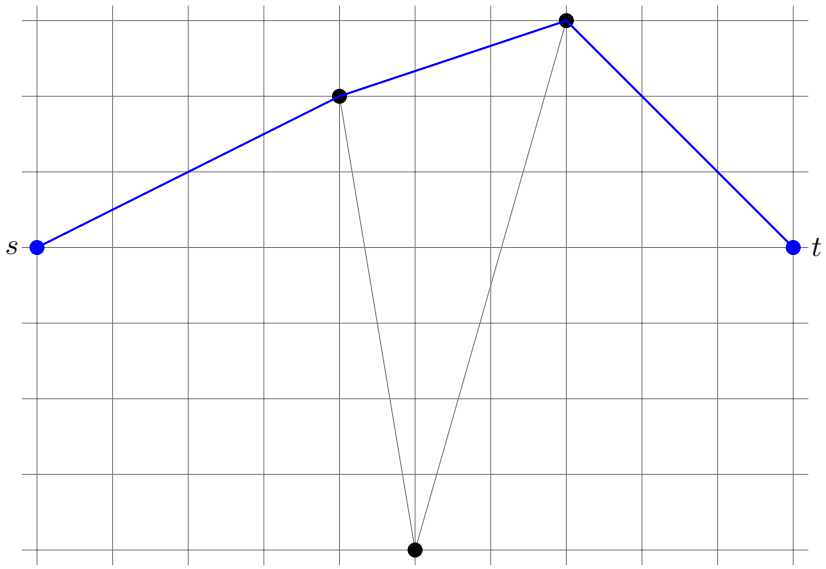


Figure 1: Depiction of Sample Input 1 and its optimal solution (in blue/bold).