# Problem I. Shortest Bridge

| | |
|---|---|
| Input file: | *standard input* |
| Output file: | *standard output* |
| Time limit: | 2 seconds |
| Memory limit: | 512 mebibytes |

There is a city whose shape is a $1,000 \times 1,000$ square. The city has a big river, which flows from the north to the south and separates the city into just two parts: the west and the east.

Recently, the city mayor has decided to build a highway from a point $s$ on the west part to a point $t$ on the east part. A highway consists of a bridge on the river, and two roads: one of the roads connects $s$ and the west end of the bridge, and the other one connects $t$ and the east end of the bridge. Note that each road doesn't have to be a straight line, but the intersection length with the river must be zero.

In order to cut building costs, the mayor intends to build a highway satisfying the following conditions:

- Since bridge will cost more than roads, at first the length of a bridge connecting the east part and the west part must be as short as possible.
- Under the above condition, the sum of the length of two roads is minimum.

Your task is to write a program computing the total length of a highway satisfying the above conditions.

## Input

At first, we refer to a point on the city by a coordinate $(x, y)$: the distance from the west side is $x$ and the distance from the north side is $y$.

The first line of the input contains four integers $s_x$, $s_y$, $t_x$, and $t_y$ ($0 \leq s_x, s_y, t_x, t_y \leq 1,000$): points $s$ and $t$ are located at $(s_x, s_y)$ and $(t_x, t_y)$ respectively.

The next line contains an integer $N$ ($2 \leq N \leq 20$), where $N$ is the number of points composing the west riverside. Each of the following $N$ lines contains two integers $wx_i$ and $wy_i$ ($0 \leq wx_i, wy_i \leq 1,000$): the coordinate of the $i$-th point of the west riverside is $(wx_i, wy_i)$. The west riverside is a polygonal line obtained by connecting the segments between $(wx_i, wy_i)$ and $(wx_i + 1, wy_i + 1)$ for all $1 \leq i \leq N - 1$.

The next line contains an integer $M$ ($2 \leq M \leq 20$), where $M$ is the number of points composing the east riverside. Each of the following $M$ lines contains two integers $ex_i$ and $ey_i$ ($0 \leq ex_i, ey_i \leq 1,000$): the coordinate of the $i$-th point of the east riverside is $(ex_i, ey_i)$. The east riverside is a polygonal line obtained by connecting the segments between $(ex_i, ey_i)$ and $(ex_i + 1, ey_i + 1)$ for all $1 \leq i \leq M - 1$.

You can assume that test cases are under the following conditions.

- $wy_1$ and $ey_1$ must be 0, and $wy_N$ and $ey_M$ must be 1,000.
- Each polygonal line has no self-intersection.
- Two polygonal lines representing the west and the east riverside have no cross point.

- A point $s$ must be on the west part of the city. More precisely, $s$ must be on the region surrounded by the square side of the city and the polygonal line of the west riverside and not containing the east riverside points.
- A point $t$ must be on the east part of the city. More precisely, $t$ must be on the region surrounded by the square side of the city and the polygonal line of the east riverside and not containing the west riverside points.
- Each polygonal line intersects with the square only at the two end points. In other words, $0 < wx_i, wy_i < 1,000$ holds for $2 \leq i \leq N-1$ and $0 < ex_i, ey_i < 1,000$ holds for $2 \leq i \leq M-1$.

# Output

Output single-space separated two numbers in a line: the length of a bridge and the total length of a highway (i.e. a bridge and two roads) satisfying the above mayor's demand. The output can contain an absolute or a relative error no more than $10^{-8}$.

# Examples

| standard input | standard output |
|---|---|
| 200 500 800 500<br>3<br>400 0<br>450 500<br>400 1000<br>3<br>600 0<br>550 500<br>600 1000 | 100 600 |
| 300 300 700 100<br>5<br>300 0<br>400 100<br>300 200<br>400 300<br>400 1000<br>4<br>700 0<br>600 100<br>700 200<br>700 1000 | |