# Balkan OI '11 P1 - Two Circles

**Time limit:** 2.0s **Memory limit:** 64M

### Balkan Olympiad in Informatics: 2011 Day 1, Problem 1

We will consider a convex polygon with $N$ vertices. We wish to find the maximum radius $R$ such that two circles of radius $R$ can be placed entirely inside the polygon without overlapping.

## Input Specification

The first line of input contains the number $N$. Each of the next $N$ lines contains a pair of integers $x_i$, $y_i$ – representing the coordinates of the $i$th point, separated by a space.

## Output Specification

You should output a single number $R$ – the desired radius. Output $R$ with a precision of 3 decimals. You will pass a test if the output differs from the true answer by at most $0.001$.

## Constraints

- $3 \leq N \leq 50\,000$
- $-10^7 \leq x_i \leq 10^7$
- $-10^7 \leq y_i \leq 10^7$
- The points are given in trigonometric (anti-clockwise) order.
- For $10\%$ of tests $N = 3$
- For $40\%$ of tests $N \leq 250$

## Sample Input 1

```
4
0 0
1 0
1 1
0 1
```

## Sample Output 1

```
0.293
```

## Explanation for Sample Output 1

The maximum radius is obtained when the centers of the two circles are placed on one of the square's diagonals. The radius can be calculated exactly and it is

$$\frac{\sqrt{2}}{2(1+\sqrt{2})} \approx 0.293$$

## Sample Input 2

```
4
0 0
3 0
3 1
0 1
```

## Sample Output 2

```
0.500
```

## Sample Input 3

```
6
0 0
8 0
8 6
4 8
2 8
0 4
```

## Sample Output 3

```
2.189
```