

Assignment One

SOFE 3770U: Design and Analysis of Algorithms, Fall 2017

Dr. Shahryar Rahnamayan, PEng, SMIEEE

Submission Deadline: Friday, Sep. 22, 2017, 11:59 PM

Problem: Airport Construction in an Island, [Computational time limit: 2 seconds](#)

Problem Statement: Given a polygon-shape island map, you need to compute the length of the longest landing strip (i.e., straight line segment) that can be built on the island for an airport. The landing strip must not intersect the sea, but it may touch or run along the boundary of the island. Figure 1 shows an example corresponding to the first sample input.

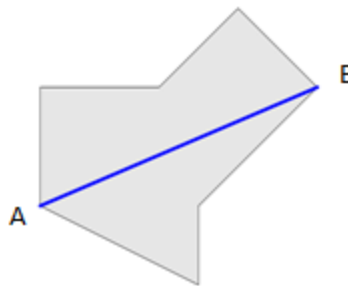


Figure 1: The island modeled as a polygon. The longest possible landing strip is shown as a thick line.

Inputs: The input starts with a line containing an integer n ($3 \leq n \leq 200$) specifying the number of vertices of the polygon. This is followed by n lines, each containing two integers x and y ($|x|, |y| \leq 10^6$) that give the coordinates $(x; y)$ of the vertices of the polygon in counter-clockwise order. The polygon is simple, i.e., its vertices are distinct and no two edges of the polygon intersect or touch, except that consecutive edges touch at their common vertex. In addition, no two consecutive edges are collinear.

Outputs: Display the length of the longest straight line segment that fits inside the polygon, with an absolute or relative error of at most 10^{-6} .

Sample Input 1	Sample Output 1
7 0 20 40 0 40 20 70 50 50 70 30 50 0 50	76.157731059

Sample Input 2	Sample Output 2
3 0 2017 -2017 -2017 2017 0	4510.149110617

Note: As extra outputs, you should report the coordinates of A and B (i.e., the line's end points). And also, you need to visualize the polygon and the line as shown in Figure 1. The actual running time should be reported too.

Test Cases: The above two test cases (for $n=7$ and 3) plus you need to have three more test cases created by yourself for $n=5$, 9, and 13.

As one PDF file, in your report, you need to submit a) your algorithm description in pseudo-code, b) Big-O analysis, c) code, d) output results for asked test cases (i.e., $n=3,5,7,9,13$) [including line length, its A and B coordinates, visualization of the polygon and the line, and actual running time of the program]. In your report, would you please mention your system's specifications (i.e., hardware, operating system, compiler,...).

One submission per group and no more than three students per group, please.