



REGULATIONS

Due date: 23:59, 26 December 2023, Thursday (*Not subject to postpone*)

Submission: Electronically. You should save your program source code as a text file named `the3.py`. Check the announcement on the ODTUCLASS course page for the submission procedure.

Team: There is **no** teaming up. This is an EXAM.

Cheating: Source(s) and Receiver(s) will receive zero and be subject to disciplinary action.

INTRODUCTION

In computer graphics, the area of overlap between two geometric shapes is a fundamental cue for various applications like collision detection in video games, where it's essential to know if and where game entities overlap, or in graphic design and modeling software for creating complex shapes and patterns.

Finding the overlapping area between two geometric shapes involves calculating the region where two shapes, such as circles, rectangles, or polygons, intersect. The algorithmic approach to determining this overlapping area depends on the specific shapes involved. For instance, overlap between rectangles can be easily identified by finding the coordinates where their edges intersect, while doing so for more complex polygons might require advanced techniques. The accurate calculation of these overlapping areas enables realistic and interactive environments in computer-generated imagery and simulations.

PROBLEM & SPECIFICATIONS

Your task in this THE is to find overlap between two 2D shapes, namely, a quadrilateral and a triangle. You are given a convex quadrilateral $Q = [(x_1^Q, y_1^Q), (x_2^Q, y_2^Q), (x_3^Q, y_3^Q), (x_4^Q, y_4^Q)]$ and a triangle $T = [(x_1^T, y_1^T), (x_2^T, y_2^T), (x_3^T, y_3^T)]$ as a list of their corners in a clockwise order. See Figure 1 for some examples.

- Write a function named `area(Q, T)` which takes a quadrilateral Q (as a list of coordinates) as the first argument and a triangle T (as a list of coordinates) as the second argument. `area(Q, T)` is supposed to return the intersection area of the given quadrilateral and the triangle.
- Assume that the coordinates x_i and y_i are all integers both for the quadrilateral and the triangle. However, the overlapping area is a real number.
- You are guaranteed that no corner of the triangle is on any edge of the quadrilateral, and no corner of the quadrilateral is on any edge of the triangle.

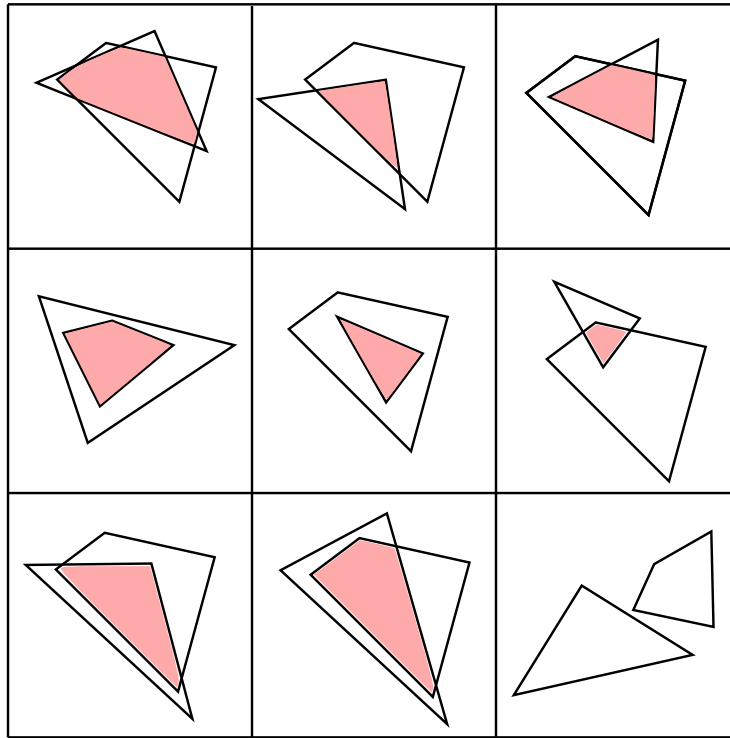


Figure 1: Some extreme and normal cases. Red highlights the overlapping regions, whose area you are expected to calculate.

EXAMPLE RUN

```
>>> area([(4,2), (1,7), (5,10), (11,5)], [(4,4), (5,8), (13,5)])
15.836363636363634
```

RESTRICTIONS and GRADING

- A set of arbitrarily selected students will be subject to oral examination about their solutions. The details will be announced on ODTUclass later.
- Your program will be graded through an automated process and therefore, any violation of the specifications will lead to errors (and reduction of points) in automated evaluation. You should especially avoid printing something on screen.
- Your solutions will not be tested with incorrect/erroneous inputs.
- Your program will be tested with multiple data (a distinct run for each data). Any program that performs only 30% and below will enter a glass-box test (eye inspection by the grader TA). The TA will judge an overall THE3 grade in the range of [0,30].
- A program based on randomness will be graded zero.
- The glass-box test grade is not open to discussion nor explanation.