Functions and Libraries - Geometrical Procedures with Spatial Coordinates

C++ Training for Space Engineering

August 8, 2024

Exercises

Exercise 1

Given three points $A(x_1, y_1)$, $B(x_2, y_2)$, and $C(x_3, y_3)$ in 2D space, write a C++ program to calculate the area of the triangle formed by these points using the formula:

$$\text{Area} = \frac{1}{2} |x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$$

Exercise 2

Write a C++ program to check if three given points $A(x_1, y_1)$, $B(x_2, y_2)$, and $C(x_3, y_3)$ are collinear. Points are collinear if the area of the triangle formed by them is zero.

Exercise 3

Given two lines defined by the equations $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$, write a C++ program to find their intersection point. If the lines are parallel, the program should indicate this.

Exercise 4

Write a C++ program to compute the centroid C of a polygon given its vertices (x_1, y_1), (x_2, y_2), ..., (x_n, y_n). The centroid C is given by:

$$C_x = \frac{1}{6A} \sum_{i=1}^{n-1} (x_i + x_{i+1})(x_i y_{i+1} - x_{i+1} y_i)$$

$$C_y = \frac{1}{6A} \sum_{i=1}^{n-1} (y_i + y_{i+1})(x_i y_{i+1} - x_{i+1} y_i)$$

where A is the area of the polygon.

Exercise 5

Create a C++ interface for a class ‘Point‘ that represents a point in 2D space. The interface should include methods for setting and getting the coordinates, calculating the distance to another point, and checking equality between two points.

Exercise 6

Create a C++ interface for a class ‘Line‘ that represents a line in 2D space. The interface should include methods for setting the line's coefficients a, b, and c for the line equation $ax + by = c$, and a method to check if another line is parallel to it.