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Geometric and Graphing Algorithms Exercise #1

Implementing a Geometric Algorithm:

Scenario

You are working on a project which requires you to work with geometric algorithms. You have been asked to explore an algorithm that checks if two lines intersect.

Objectives:

After completing this lab, you will be able to:

1. Check if two line segments intersect.

Setup:

Before you begin this lab, you must complete the following steps:

1. Go to jupyter.org
2. On the Jupyter homepage, scroll down and click **Try it in your browser**.
3. On the Try Jupyter page, click **Try Classic Notebook**.

Exercise 1:

In this exercise, you will check if two line segments intersect.

Task 1: Checking if two lines intersect

1. On the Jupyter Index page, click **File > New Notebook > Python 3**.
2. Copy the following code into the notebook

```
class Point:

    def __init__(self, x, y):
```

```
self.x = x

self.y = y

def subtract(self, p):

    return Point(self.x - p.x, self.y - p.y)

def cross_product(p1, p2):

    return p1.x * p2.y - p2.x * p1.y

def direction(p1, p2, p3):

    return cross_product(p3.subtract(p1), p2.subtract(p1))

def on_segment(p1, p2, p):

    return min(p1.x, p2.x) <= p.x <= max(p1.x, p2.x) and min(p1.y, p2.y) <= p.y <= max(p1.y, p2.y)

def intersect(p1, p2, p3, p4):

    d1 = direction(p3, p4, p1)

    d2 = direction(p3, p4, p2)

    d3 = direction(p1, p2, p3)

    d4 = direction(p1, p2, p4)

    if ((d1 > 0 and d2 < 0) or (d1 < 0 and d2 > 0)) and ((d3 > 0 and d4 < 0) or (d3 < 0 and d4 > 0)):
```

```
        return True

    elif d1 == 0 and on_segment(p3, p4, p1):

        return True

    elif d2 == 0 and on_segment(p3, p4, p2):

        return True

    elif d3 == 0 and on_segment(p1, p2, p3):

        return True

    elif d4 == 0 and on_segment(p1, p2, p4):

        return True

    else:

        return False

#False

point1 = Point(1,1)

point2 = Point(10,1)

point3 = Point(1,2)

point4 = Point(10,2)

result = intersect(point1, point2, point3, point4)

print(result)

#True

point1 = Point(10,1)
```

```
point2 = Point(0,10)

point3 = Point(0,0)

point4 = Point(10,10)

result = intersect(point1, point2, point3, point4)

print(result)


#False

point1 = Point(-5,-5)

point2 = Point(0,0)

point3 = Point(1,1)

point4 = Point(10,10)

result = intersect(point1, point2, point3, point4)

print(result)
```

1. To run the code, click **Run**.
2. View the results.

Lab Review

In this lab you used Python code to check whether two line segments intersect.

Discussion Forums

Go to the discussion forums to discuss your results.



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