

## Introduction

#### What is Python?

- Python is one of the many high-leveled programming languages that was created in the late 1980s by Guido van Rossum.
- The objective of this project is to create a function that will compute the area of the file co\_bounds script that has coordinates attached to them.



## Research Data

#### Shoelace Formula

- Also known as the shoelace algorithm is a mathematical algorithm to determine the area of a simple polygon whose vertices are described by their Cartesian coordinates in the plane.
- Consists of cross-multiplying corresponding coordinates of the different vertices of a polygon to find its area.

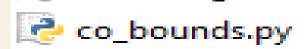
Area = 
$$\frac{1}{2} \Big| \sum_{i=1}^{n-1} x_i y_{i+1} + x_n y_1 - \sum_{i=1}^{n-1} x_{i+1} y_i - x_1 y_n \Big|$$
  
Area =  $\frac{1}{2} \Big| x_1 y_2 + x_2 y_3 + \dots + x_{n-1} y_n + x_n y_1 - x_2 y_1 - x_3 y_2 - \dots - x_n y_{n-1} - x_1 y_n \Big|$ 

Vertices	x	у
A	2	7
В	10	1
С	8	6
D	11	7
E	7	10

ADD A FOOTER

## Research Data

## GH Counties . PV



- Python code contains a list of all Georgia counties and the coordinate data of each one.
- Use the code to test your function, but don't implement it into your code.
- The data is in meters, and the objective is to make the output in meters squared.

\_ Ø xo\_beunds.py + P\co\_beunds.py (3.7.4)

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# Methodology

- 1) First step is you must import the co\_bounds function from the co\_bounds module.
  - 2) Next, you begin creating the function; you define calc\_area(poly) so that the function will calculate the area of a polygon.(poly is the source that the function references too)
- 3) Set the area to zero since that is what we are looking for, and makes the function simple to calculate.

```
from co_bounds import co_bounds
```

```
#area of polygon = abs(((xly2-ylx2) + (x2y3-y2x3))
+ (xn-1)(yn)+(xn)(yl)-(xn)(yn-1)-(xl)(yn)/2)))
```

```
area = 0
#Initialize the area
```

ADD A FOOTER

# Methodology Cont..

3) Now, we begin the for loop for the function; the values in the tuples are stored as the Cartesian coordinates are cross multiplied with the corresponding coordinates in order to find the area encompassing the polygon and then subtracting it from the surrounding polygon.

4) Instead of x,y, I use the variables p1, and p2 just to stay in commonality of poly.

```
for i in range(len(poly)-1):
    #Creating a range that corresponds to the index
    #find the area encompassing the polygon and then subtracting it from the surrounding polygon
    #Loop through the polygon points
```

```
pl = poly[i]
#Set the first point variable
p2 = poly[i+1]
#Set the second point variable
area = area +(p1[0] * p2[1] - p1[1] * p2[0])
#calculate x1y2-y1x2 and add it to the area
```

## Methodology

- 5) Now, the for loop is now finished, area is printed and the. The final value will be written as an absolute value and since the area cannot be negative and then in order to find the area within it is divided by two.
  - 6) Below, I have set poly to equal random vertices of a quadratic to test the function running outside of co\_bounds module.

```
area = abs(area/2)

#This ends the for loop

#Return the absolute value of the area

return area
```

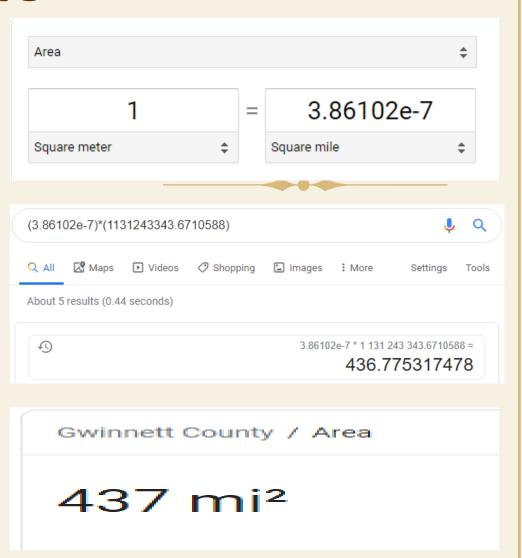
```
#Test out function with random vertices
#Initialize the points
poly = [(2, 3), (11, 8), (12, 25), (4, 9)]
#Run the function to print
print("The area is", calc_area(poly))
```

The area is 82

### Results

```
File Edit Format Run Options Window Help
#Import the co bounds function from the co bounds module
from co bounds import co bounds
def calc area(poly):
   \frac{1}{2} area of polygon = abs(((xly2-ylx2) + (x2y3-y2x3)) + (xn-1)(yn)+(xn)(yl)-(xn)(yn-1)-(xl)(yn)/2)
   area = 0
   #Initialize the area is zero beacsue thats what were looking to find
   for i in range(len(poly)-1):
       #Creating a range thacorresponds to the indexes
       #find the area encompassing the polygon and then subtracting it from the surrounding polygon
       #Loop through the polygon points
        pl = poly[i]
       #Set variable p as a point
       p2 = poly[i+1]
       #Set variable p2 as another point
       area = area +(p1[0]*p2[1]-p1[1]*p2[0])
        #calculate xly2-ylx2 and add it to the area
   area = abs(area/2)
   #This ends the for loop
   #Return the absolute value of the area
   return area
print("The area is", calc area(co bounds["Gwinnett"]), 'meters')
#prints the area
```

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## Ways to Improve

- Be able to let the script format so that the output is able to convert to square miles itself.
- Let you be able to type the name of the city and it already identifies the county and states info.
- Run two county scripts and allow it to compare area to each other.

## Works Cited

- \* "Area of a Polygon (Coordinate Geometry)." Area of Any Polygon (Coordinate Geometry) Math Open Reference, <a href="https://www.mathopenref.com/coordpolygonarea.html">www.mathopenref.com/coordpolygonarea.html</a>.
- \* "Generate Points That Lie inside Polygon." *Geographic Information Systems Stack Exchange*, 1 Apr. 1961, gis.stackexchange.com/questions/6412/generate-points-that-lie-inside-polygon.
- Marsh, Charles. "Computational Geometry in Python: From Theory to Application." Toptal Engineering Blog, Toptal, 21 Jan. 2014, <a href="https://www.toptal.com/python/computational-geometry-in-python-from-theory-to-implementation">www.toptal.com/python/computational-geometry-in-python-from-theory-to-implementation</a>.

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```
def calc area(poly):
   \#area of polygon = abs(((xly2-ylx2) + (x2y3-y2x3)) + (xn-1)(yn)+(xn)(yl)-(xn)(yn-1)-(xl)(yn)/2)
   area = 0
   #Initialize the area is zero beacsue thats what were looking to find
   for i in range (len (poly)-1):
       #Creating a range thacorresponds to the indexes
       #find the area encompassing the polygon and then subtracting it from the surrounding polygon
       #Loop through the polygon points
       pl = poly[i]
       #Set variable p as a point
       p2 = poly[i+1]
       #Set variable p2 as another point
       area = area +(p1[0]*p2[1]-p1[1]*p2[0])
       #calculate xly2-ylx2 and add it to the area
   area = abs(area/2)
   #This ends the for loop
   #Return the absolute value of the area
   return area
print("The area is", calc area(co bounds["Gwinnett"]), 'meters')
#prints the area
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                                                                    Gwinnett County / Area
```

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from co bounds import co bounds

#Import the co bounds function from the co bounds module

- First step is you must in co\_bounds function from module.
- Next, you begin creating define calc\_area(poly) seems of will calculate the area of the source that the functions
- 3) Set the area to zero sin are looking for, and mak simple to calculate.3) Now, we begin the for least control of the simple to calculate.
- 3) Now, we begin the for lot the values in the tuples a Cartesian coordinates a with the corresponding to find the area encompand then subtracting it follows to surrounding polygon.
- Instead of x,y, I use the p2 just to stay in common
- Now, the for loop is now printed and the. The fin written as an absolute varied cannot be negative
- to find the area within it 6) Below, I have set poly t vertices of a quadratic to running outside of co