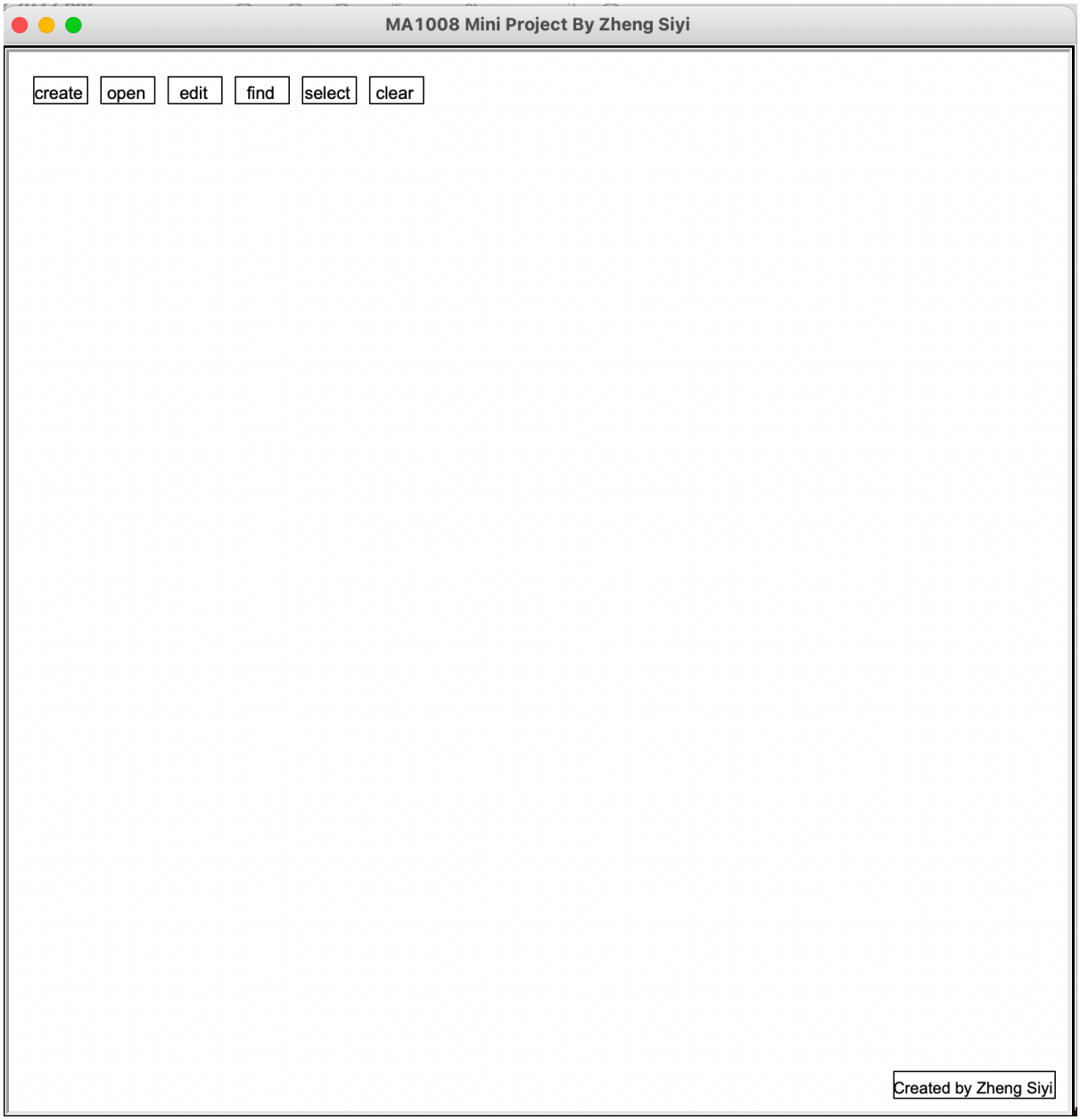
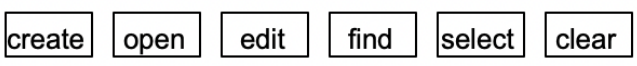
MA1008 Mini Project Report



This is the turtle display screen after running the program. On the top left corner is a user interface with six buttons.

User Interface



Create Button

To create a polygon, click on the create button. Options for creating a polygon will pop up in the **IDLE window**. It provides two ways for creation:

1. create polygon by enter coordinate
2. create polygon by mouse click

Enter the corresponding number to start creation. Any wrong input will be handled.

1. Create by Enter Coordinate

When 1 is entered, please enter the coordinate of the vertex of polygon in the **correct format**. **The x coordinate should be entered first followed by a comma then the y coordinate**. For example, the point (0,0) should be entered as **0,0** and the point (-50,-50) should be entered as **-50,-50**. Coordinate entered in the wrong format will be rejected. When all vertices of a polygon are entered, **press enter to close the polygon and finish creation**. Any self-intersection during creation will be handled. A **name** needs to be assigned to the file before it can be saved. Any wrong input will be handled. Then the polygon will be saved and **cleared** from the screen.

```
1 - Create by enter coordinate
2 - Create by mouse click enter
Input: 1
Enter coordinate of vertex: 0,10
Enter coordinate of vertex: 100,-100
Enter coordinate of vertex: 0,-200
Enter coordinate of vertex:
[[0, 10], [100, -100], [0, -200]]
Polygon Creation Completed!
Enter file name to save polygon: polygon2
Polygon saved!
```

2. Create by Mouse Click

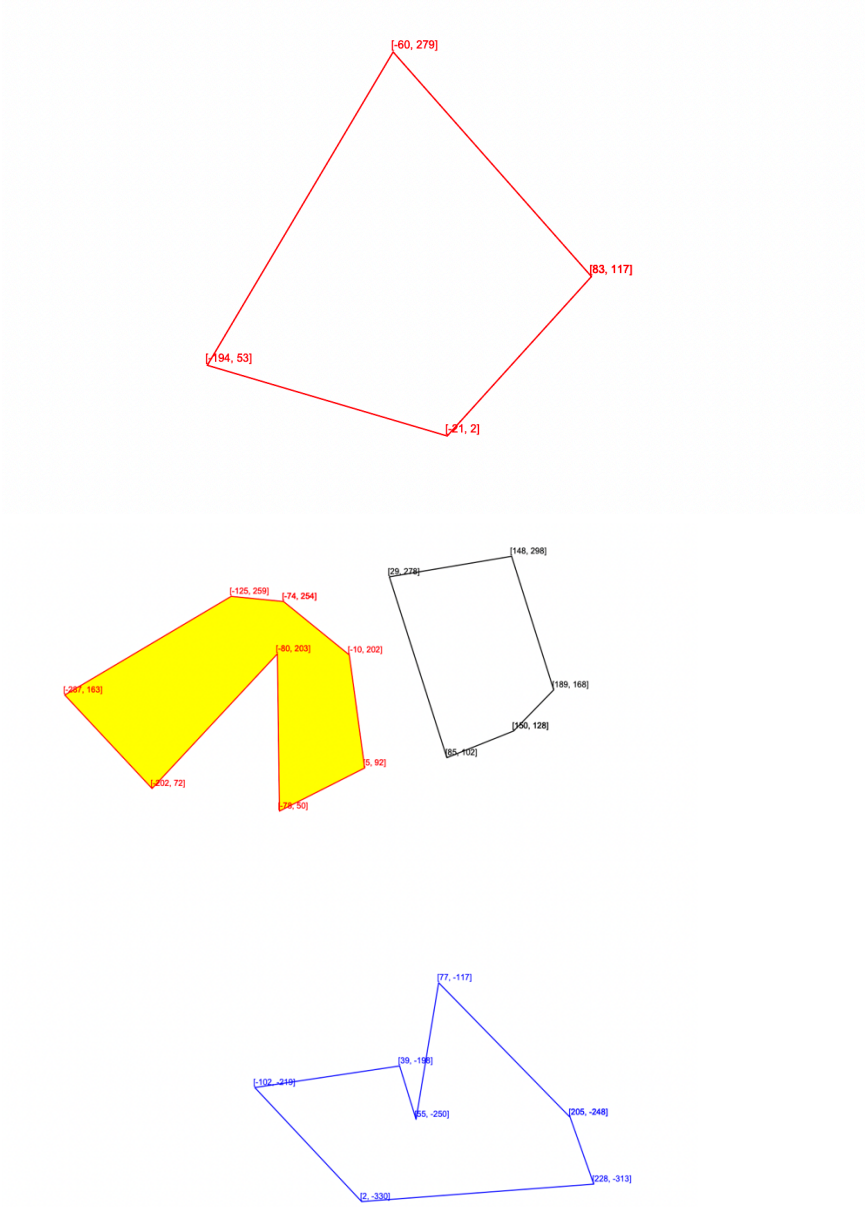
When 2 is entered, simply **click on the display screen** to start creating polygon. Self-intersection during creation will be handled. Same as the previous on, a **name** needs to be assigned to the file before it can be saved. Any wrong input will be handled. Then the polygon will be saved and **cleared** from the screen.

```
1 - Create by enter coordinate
2 - Create by mouse click enter
Input: 2
Click to enter point, press enter to finish.
Polygon Creation Completed!
Enter file name to save polygon: polygon1
Polygon saved!
```

Open Button

To open a polygon, click on the open button. Enter the file name in the **IDLE window** to open a polygon. Then you will be asked whether you want to **colour the outline and/or the interior** of the polygon. A sample have been given below. **Multiple polygons** can be opened at the same time and each polygon can have **its own outline and interior colour**.

```
Enter name of file: p1
Do you want to colour the outline of the polygon?
Y/N: Y
Do you want to colour the interior of the polygon?
Y/N: N
Enter outline colour: red
```



Edit button

The edit button provides edit functions including:

1. Delete/Add a Vertex
    1.1. Add a Vertex
    1.2. Delete a Vertex
2. Move a Polygon
3. Rotate a Polygon
4. Scale a Polygon
5. Linear Pattern
6. Rotational Pattern

To edit a polygon, you need to open a polygon first. After that you need to **select it**. Simply click on the **select button** on the display screen and then click on the **inside of the polygon** you want to edit to select it. Upon successful selection, there will be a successfully selected message in the IDLE window. You then can proceed to click on the edit box to edit the polygon selected. **All edits done will be saved in the corresponding file**.

```
Click inside a polyon once to select it
Polygon 1 selected!
1 - Delete/Add Vertex
2 - Move Polygon
3 - Rotate Polygon
4 - Scale Polygon
5 - Linear Pattern
6 - Circular Pattern
Enter corresponding number to edit polygon:
```

Enter the corresponding number to edit the polygon. Invalid input will be handled.

1. Delete/Add Vertex

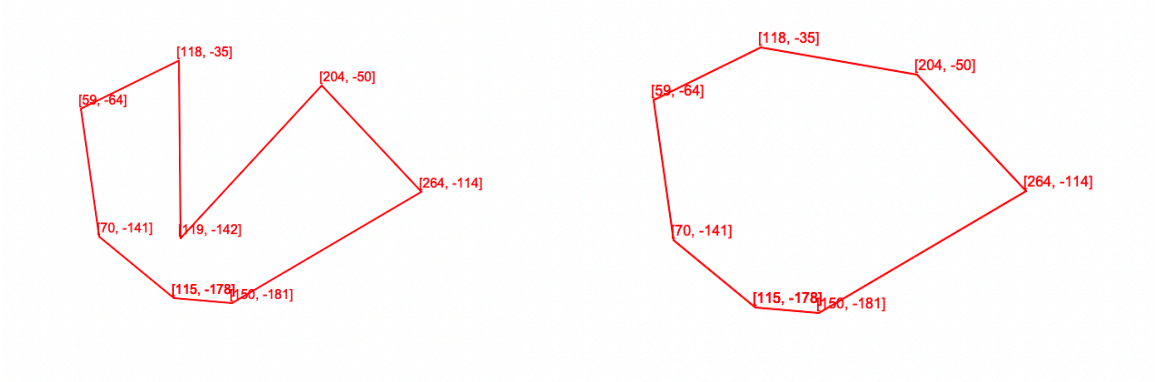
Two options are available, delete a vertex or add a vertex.

To add a vertex, enter the point you want to add in the **format x,y**. Then enter the coordinate of the two vertices on the polygon you want to connect to. Self-intersection will be checked. Note that the two vertices on the polygon **must be next to each other**.

```
1 - Add vertex
2 - Delete vertex
Enter corresponding number: 1
Enter coordinate of new vertex: -100,100
Enter coordinate of first vertex to be connected to: 0,60
Enter coordinate of second vertex to be connected to: -60,-120
```


To delete a vertex, enter the coordinate of the vertex you want to delete in the **correct format**.

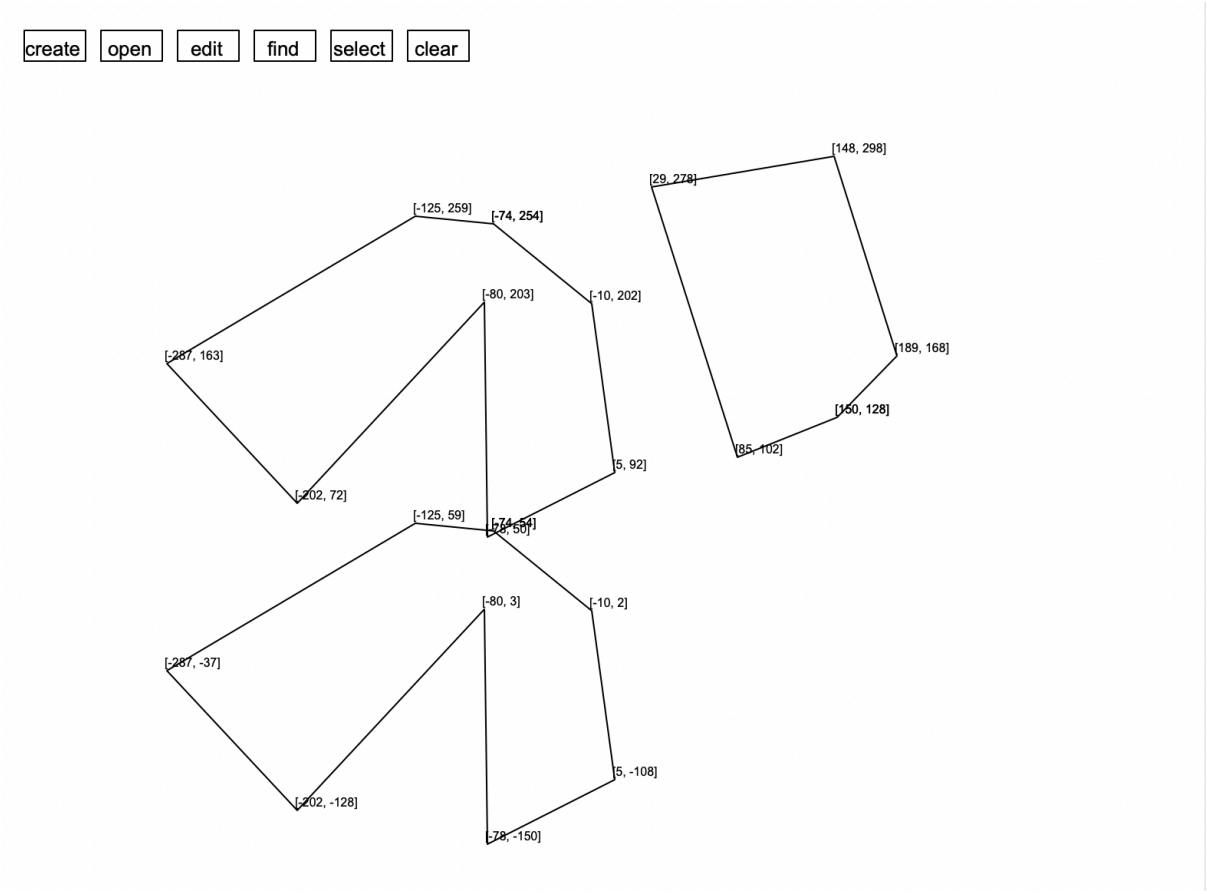
```
1 - Add vertex
2 - Delete vertex
Enter corresponding number: 2
Enter coordinate of vertex you want to delete: 119,-142
```



2. Move a polygon

To move a polygon, enter the **direction** you want to move in. The range is **0-360 degree measured anticlockwise**. 0 degree represent positive x direction, 180 represent negative x direction. Then enter the distance you want to move it. The distance must be **positive**. The previous polygon will be move to the new position and the **change will be saved** to the file. The diagram below is not erased as it is only an **illustration**.

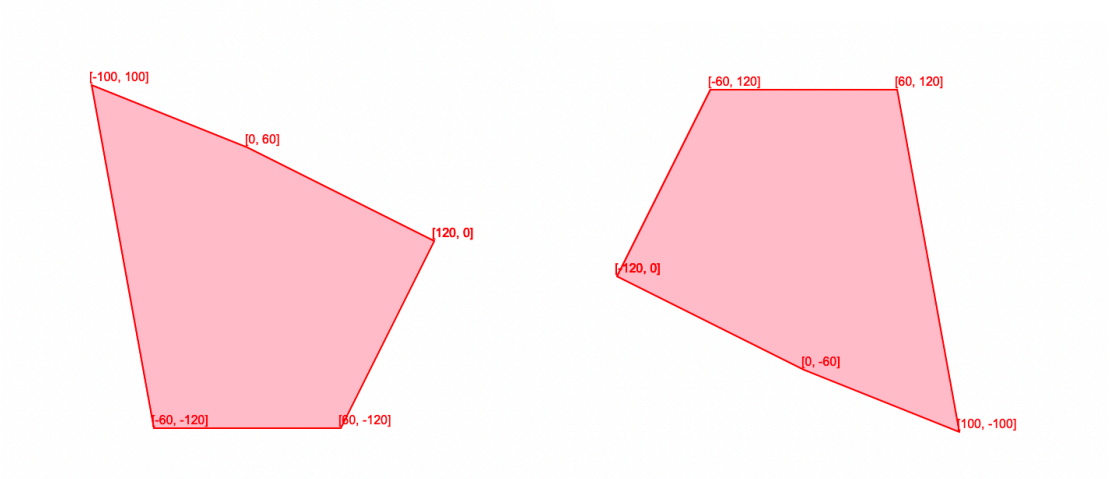
```
Enter corresponding number to edit polygon: 2
Enter the direction to move the polygon in degree (0-360): 270
Enter the distance to move the polygon: 200
```



3. Rotate a polygon

To rotate a polygon, enter the **point of rotation** and the degree to rotation the polygon **clockwise**.

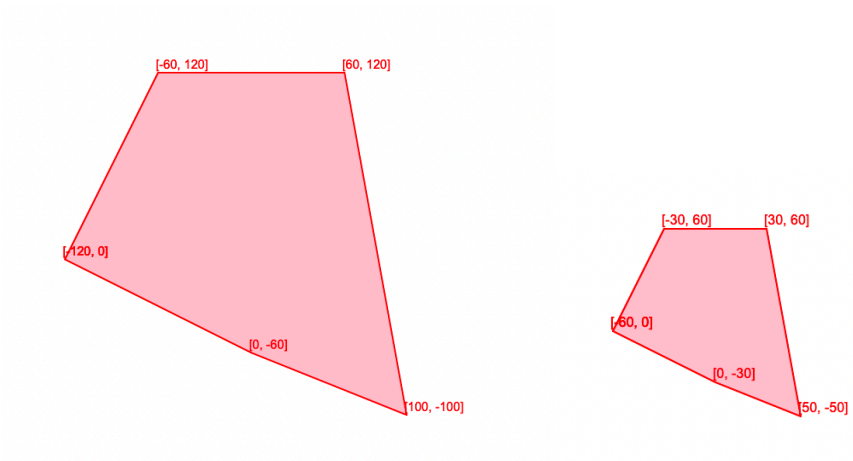
```
Enter corresponding number to edit polygon: 3
Enter coordinate of point of rotation for polygon: 0,0
Enter the rotation angle clockwise in degree (0-360): 180
```



4. Scale a polygon

To scale a polygon, enter the scale factor. The scale factor must be a **positive number**.

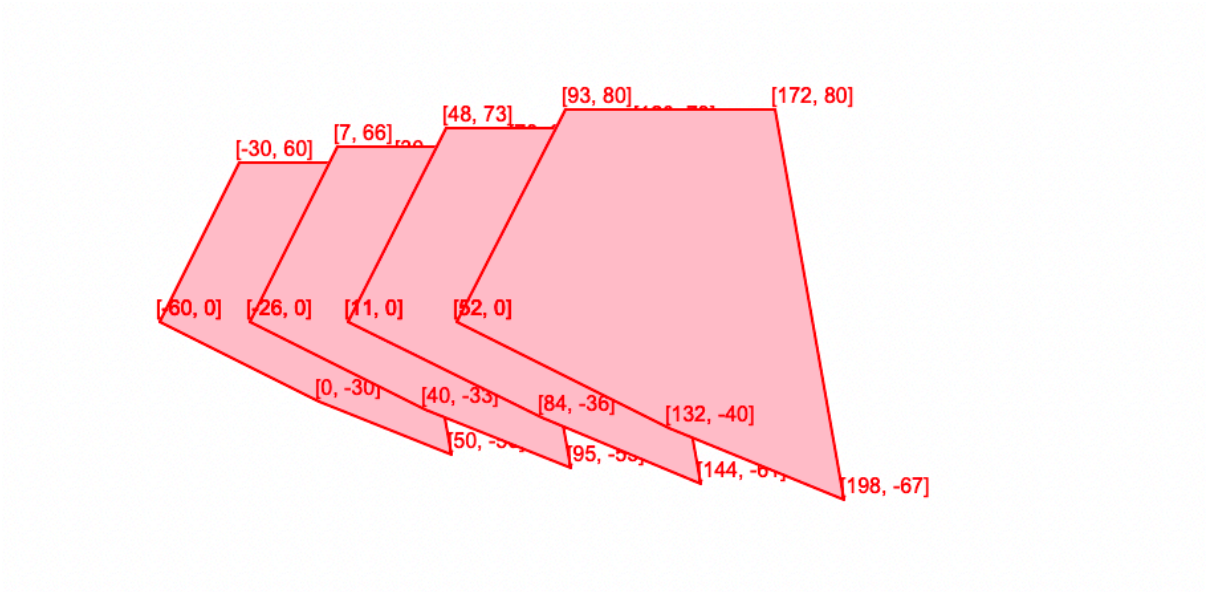
```
Enter corresponding number to edit polygon: 4
Enter scale factor to scale polygon: 0.5
```



5. Linear Pattern

The linear pattern copies the polygon in a specific direction with/without scaling. Enter the direction to copy the polygon, number of new copies, and the scale factor. If you do not wish to scale the polygon, enter 1. Note that this edit functino **will not change the file**.

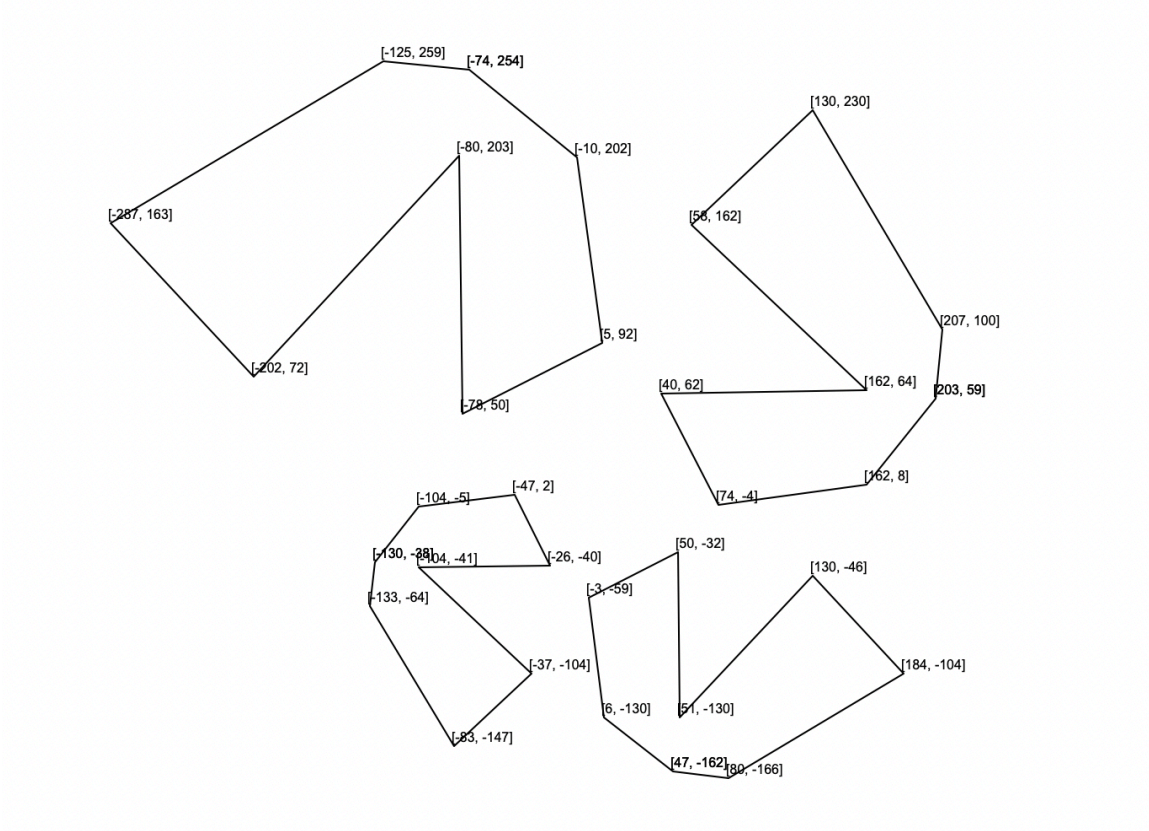
```
Enter corresponding number to edit polygon: 5
Enter the direction to move the polygon in degree (0-360): 0
Enter the distance to move the polygon: 40
Enter the number to copy: 3
Enter the scale to copy: 1.1
```



6. Circular pattern

The circular pattern copy the polygon about a point. Enter the point of rotation, the degree for a single rotation, the number of copies and the scale factor. If you do not wish to scale the polygon, enter 1. Note that this edit functino **will not change the file**.

```
Enter coordinate of point of rotation: : 0,0
Enter the direction to rotate the polygon in degree (0-360): 90
Enter the number to copy: 3
Enter the scale to copy: 0.8
```



Find Button

The find button provides the following functions:

1. Find the perimeter of a polygon
2. Find the area of a polygon
3. Find whether a click point is inside or outside a polygon

Note that a polygon needs to be **opened** and **selected** before using this find button. Multiple polygons can be opened at the same time. Simply select each polygon to find their corresponding perimeter or area, which will be printed in the **IDLE window**.

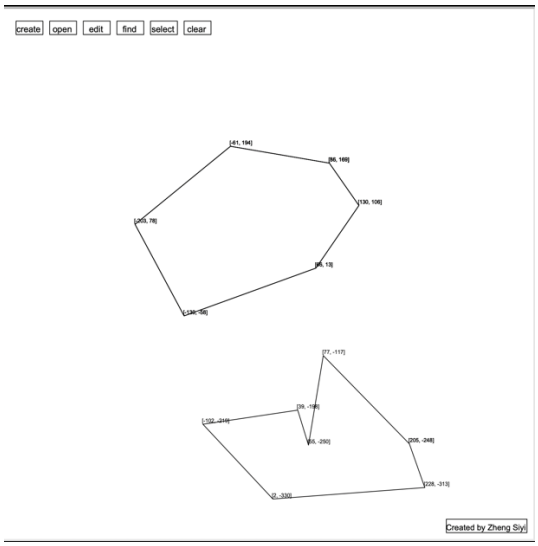
```
1 - Find perimeter
2 - Find area
3 - Point inside/outside polygon
Enter corresponding number: 1
Perimeter of polygon is 885.02
Click inside a polyon once to select it
Polygon 2 selected!
1 - Find perimeter
2 - Find area
3 - Point inside/outside polygon
Enter corresponding number: 2
Area of polygon is 51914.5
```

For the function to determine whether click point is inside or outside a polygon, you also need to **select** a polygon. However, the selection **will not affect** the output of this function. This function can be used for either **one polygon or multiple polygons**. In the case show below, two polygons are opened. I clicked three times on the screen. This first click is inside polygon 1 and ouside polygon2. The second click is outside polygon 1 and inside polygon 2. My third click is outside both polygons. **To exit this mode, press enter**.

```
Clikc mouse on screen to find if click point is inside or outside polygon
, press Enter key to exit this mode.
Inside polygon 1
Outside polygon 2

Outside polygon 1
Outside polygon 2

Outside polygon 1
Inside polygon 2
```



Select Button

Just as mentioned above, the select button is to select a polygon. A polygon needs to be selected before the **edit** or the **find** button can be used to that polygon.

Clear Button

This button is used to **clear the display** screen or in the case of an **unexpected output**, clear button can **initialise** the program.

Strengths and Limitations of the program

Strengths

1. My program provides a relatively easy-to-use user interface.
2. My program provides creation of polygon by mouse click, which is a much more intuitive and efficient way to create a polygon.
3. My program is able to handle the situation where multiple polygons are opened at the same time. The user can select each polygon and edit or analyse it separately.
4. My program handles most invalid inputs by the user gracefully.

Limitations

1. There is a delay in showing the edited polygon due to the speed limit of turtle.
2. There may still be errors arise when using the program since it is not check thoroughly.
3. My display screen is fixed to one size. It cannot adjust the scale size to adapt different polygon sizes.
4. For the situation where only one polygon is opened, the selection is redundant.