ME1 Computing- Session 7: Object Oriented Programming (Part I)

Learning outcomes:

- Understanding the definition of classes and objects
- Understanding the definition of methods
- Being able to implement the basic use of objects and methods

Before you start

In your H drive create a folder *H:\ME1MCP\Session7* and work within it.

Task 1: Class definition

Define a class *Euclidean*, representing a geometrical shape, with attributes: *name* and *shape*.

Define a class *Point*, representing a point in 2D space, with attributes: *x*, *y*.

Define a class *Line,* representing a line in 2D space, with attributes: *Poin1, Point2*.

Define a class *Polygon*, representing a polygon, with attributes: *nsides, vertex*.

Task 2: Constructor

For each of the three classes define the initialising constructor __init__.

Task 3: Method definition

For the class *Polygon*, define the following methods:

- *Perimeter*: to calculate the perimeter of the shape
- *Area*: to calculate the area of the shape
- *Centroid*: to calculate the centroid of the polygon
- *Plot*: to plot the shape and the centroid of the shape, with an assigned colour

For the class *Euclidean*, define the following methods:

- *Shift*: to shift the shape to a new centre (cx_n, cy_n)
- *Mirror*: to mirror the shape either about the x or y axis
- *Join*: to join the centroid of two shapes with a line
- *Duplicate*: to duplicate a shape and position the copy across a new centre (cx_n, cy_n)

The area of a polygon can be found as:

$$A = \frac{1}{2}\sum_{0}^{N-1}(x_{i-1}y_i - x_i y_{i-1})$$

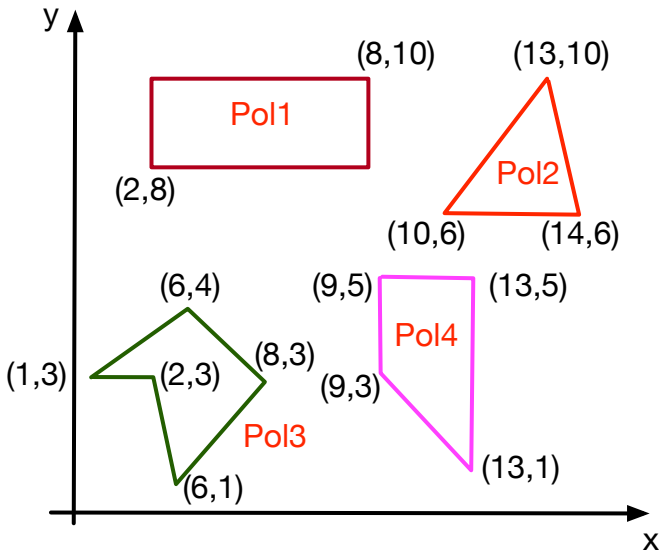
The centroid of a polygon can be found as:

$$C_x = \frac{1}{6A}\sum_{0}^{N-1}(x_{i-1} + x_i)(x_{i-1}y_i - x_i y_{i-1})$$

$$C_y = \frac{1}{6A}\sum_{0}^{N-1}(y_{i-1} + y_i)(x_{i-1}y_i - x_i y_{i-1})$$

Task 4: Create objects

Create, and initialise, instances of the above classes, to represent the shapes as in the figure below (not in scale):



Task 5: Use of methods

Perform the following tasks (and plot the outcome, after every task):

- Move Pol1 over Pol2 (overlapping the centroid of the two shapes).
- Mirror Pol4 around the y axis.
- Join the centroid of the mirrored Pol4 with that of Pol3.
- Determine perimeters of all shapes.
- Duplicate Pol3, positioning the new shape across the new centroid (-4,-5).