

Object-oriented programming in Python



Objectives

Development of Python modules to solve complex problems

- Develop Python modules and classes
- Work with standard and compound data types in Python
- Use test-driven development
- Familiarize with special libraries e.g. matplotlib



Deadline

During **lab 6**: present class ***MyPoint***

During **lab 7**: present extra functions (defined in lab 7)

Beginning of **lab 8**: upload the whole solution



Requirements

1. Implement a solution for the following problem using **classes** and **feature driven development**
2. The solution should offer a console type interface that allows the user to input the data and visualize the output
3. Use only the standard and compound data types available in Python

The solution should ensure:

- Providing at least 10 data examples in the application
- Documentation and testing of each function
- Validation of data – when the user introduces invalid commands or data, a warning should be generated

Solve 3 from extra features in the 2nd iteration.

Use your registration number (n_{reg}) to define the number of exercises you have to solve: $n_{reg} \bmod 10 + 11$ is the number of the first exercise, then increase it by 3 till you get 3 numbers.

e.g. my registration number is 1491

$$1491 \bmod 10 + 11 = 1 + 11 = 12$$

⇒ I have to solve exercises: **12, 15, 18**



Problem specification

A math teacher needs a program that helps students perform simple operations with points in two-dimensional space.

1st. Iteration

A point (class ***MyPoint***) is identified by the following properties:

- *coord_x* given as a number
- *coord_y* given as a number
- *color* given as string (possible values 'red', 'green', 'blue', 'yellow' and 'magenta')

The following features are to be provided (at the level of class ***MyPoint***):

1. Get and set the value of all properties for a point.
2. Provide the string representation of a point.

For example, for a point with coordinates *coord_x* = 1, *coord_y* = 2 and *color* = 'red', the string format should be "Point (1, 2) of color red."

2nd. Iteration

The program manages several points (class ***PointRepository***) and allows operations such as:

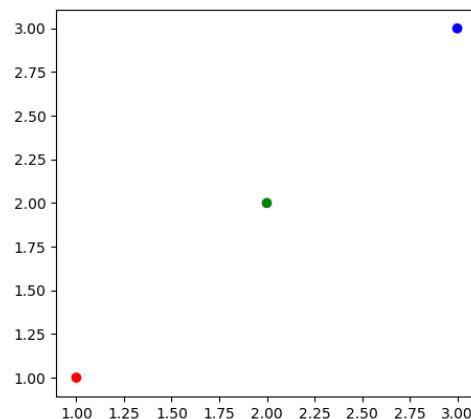
1. Add a point to the repository
 2. Get all points
 3. Get a point at a given index
 4. Get all points of a given color
 5. Get all points that are inside a given square (up-left corner and length given)
 6. Get the minimum distance between two points
 7. Update a point at a given index
 8. Delete a point by index
 9. Delete all points that are inside a given square
 10. Plot all points in a chart (using library matplotlib)) – no tests needed to this function
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11. Get all points that are inside a given circle (center of circle, radius given)
 12. Get all points that are inside a given rectangle (up-left corner, length and width given)
 13. Get the maximum distance between two points
 14. Get the number of points of a given color
 15. Update the color of a point given its coordinates
 16. Shift all points on the x axis

17. Shift all points on the y axis
18. Delete a point by coordinates
19. Delete all points that are inside a given circle
20. Delete all points within a certain distance from a given point

Note: Matplotlib (<https://matplotlib.org/index.html>) is a special library useful for creating quality figures such as plots, bar charts, scatterplots and histograms.

For example, to plot 3 points with coordinates (1,1), (2,2), (3,3) you can use a code like:

```
import matplotlib.pyplot as plt
x = [1, 2, 3]
y = [1, 2, 3]
col = ["red", "green", "blue"]
plt.scatter(x, y, c = col)
plt.show()
```



Submission

Total points: **10**

You need to submit an **archive** (e.g. .zip, .rar, etc) with the source code (**only** your own .py files created, without venv or other generated files) to the assignment on **Teams** before the deadline. Please use the following convention to name the archive file:

sfmie1234_A3.zip, where *s* – first letter of your surname
f – first letter of your first name
mie – stand for mathematics informatics in English
1234 – is your registration number
A3 – number of the assignment

If something is not clear, please ask me.



Key

- 1p Default
- 1p Work during lab 6
- 1p Work during lab 7
- 4p All features correctly implemented
- 1p At least 10 data examples for each iteration
- 1p At least 3 assertions for each function
- 1p Documentation