University of Huddersfield
School of Computing and Engineering

CFM2103 Mathematical Programming

Practical **Week 8**

Work through the questions included below. If you get stuck, please revisit the information on the slides from the previous weeks before you ask for help.

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1. Implement a class `Circle`; the objects from this class have two attributes: the centre of the circle, and the circle radius. Add an additional method for displaying on the screen the attributes of any object instantiated from this class. Alternatively, you may want to make your class 'printable' as discussed in the lectures (see the next example as well).

2. Implement a class `BeverageCan` with methods '`getSurfaceArea`' and '`getVolume`', which are used for computing, respectively, the surface area and the volume of objects from the aforementioned class; assume that the can is cylindrical. In the constructor supply the height and radius of the can. Add also an `__str__` method that displays on the computer screen the dimensions of the can and its content (this last part is asking you to make your objects 'printable').

3. Make a (basic) function class that implements the usual Gaussian,

$$g(x;\sigma,\mu) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/(2\sigma^2)} .$$

   Add a plotting method in your class that produces a graphical representation of this function. By taking $\mu = -2$ and $\sigma = 1/\sqrt{2}$, plot this function for $-5 \leq x \leq 5$. Use as a model the example discussed in the notes.

4. (a) Implement a class `Line`; your class should take a couple of 2D points and produce the line passing through them. Add the special method `__init__` to initialize your objects at the same time they are created. In addition, your class must contain three different methods: `getGrad()`, `getIntcpt()` and `getInfo()` that allow users to access information about: the gradient of your line, the intercept, and the equation of the line, respectively.

   (b) In addition to the above methods, add another one for drawing the line. A copy of your plot should be saved to a PDF file.

   (c) Test your class and its methods on several examples.

5. Implement a class `Triangle` that constructs triangle objects. Make the vertices of such triangles attributes in your class (to be initialised as the objects are being constructed). Add the methods `getArea()` and `getPerimeter()`. Test your computer code on several examples for which you can find the answer by using different means (e.g., consider an equilateral triangle, a right-angled triangle, etc).

   [Optional: You can also think about adding a method to plot the triangle using `matplotlib`.]

Optional question:
If you would like to receive additional feedback on your work, you should attempt the questions included below and submit your computer code in a zipped folder on Brightspace by no later than 5:00 PM next Tuesday.

Write a class called '`Quadratic`' that implements a quadratic function.

1. If the quadratic is $ax^2 + bx + c$, then make the coefficients a, b, and c the attributes of the objects instantiated from this class.

2. Add a suitable method to make your objects printable.

3. Add a method called '`findRoots`' which displays on the screen the roots of the quadratic.

4. Add another method called '`getVertex`' which displays on the screen the coordinates of the vertex of the parabola described by the equation $y = ax^2 + bx + c$.

5. Write an additional method that uses an appropriate range for the x-values in order to plot the graph of the parabola mentioned above (you may want to make sure that what is displayed on the screen includes at least the posible intercepts with the horizontal axis and the vertex of the parabola).