University of Huddersfield
School of Computing and Engineering

CFM2103 Mathematical Programming

Practical **Week 9**

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. Write a class named `Person` with data attributes for a person's name, address, and telephone number. Next, write a class named `Customer` that is a subclass of the `Person` class. The `Customer` class should have a data attribute for a customer number, and a Boolean data attribute indicating whether the customer wishes to be on a mailing list. Demonstrate an instance of the `Customer` class in a simple program.

2. Write an `Employee` class that keeps data attributes for the following pieces of information:

   - employee name;
   - employee number.

   Next, write a class named `ProductionWorker` that is a subclass of the `Employee` class. The former class should keep data attributes for the following information:

   - shift number (an integer, such as 1, 2, or 3);
   - hourly pay rate.

   The workday is divided into two shifts: day and night. The shift attribute will hold an integer value representing the shift that the employee works. The day shift is shift 1, while the night shift is shift 2. Write appropriate accessor and mutator methods for each class.

   Once you have written the classes, write a program that creates an object of the `ProductionWorker` class and prompts the user to enter data for each of the object's data attribute. Store the data in the object, then use the object's accessor methods to retrieve it and display it on the screen.

3. Implement as a class the following function

$$f(x) = \begin{cases} x^2 - (b-1)x - b & \text{if} \quad x < b\,, \\ a \sin\left[\pi(x-b)\right] & \text{if} \quad x \geq b\,, \end{cases}$$

   where a, $b \in \mathbb{R}$ are arbitrary. Write a short demo code to test your class (e.g., by plotting several instances from this class – as in the example discussed last week).

4. Write a class called '`Quadratic`' that implements a quadratic function. In the definition of your class add also a method called '`getVertex`' which displays on the screen the coordinates of the vertex of the parabola described by the equation $y = ax^2 + bx + c$. Write a short demo code to test your class.

5. Write as a class the following function

$$f(t) = \cos(\pi\omega_1 t)\sin(2\pi\omega_2 t)\,, \qquad -10 \le t \le 10\,,$$

where ω_1 and ω_2 are arbitrary positive numbers. Add a plotting method in your class and then test it (e.g., use $\omega_1 = 0.3$ and $\omega_2 = 3.5$, etc).

6. Extend the `Integral` class in your notes by adding an additional method called '`simpson`'. Your class should allow the user to choose between the two integration methods available ('trapezium' or 'simpson'). Test your code on suitably chosen functions.

7. Use the original `Integral` class from Brightspace to evaluate to 3 d.p. accuracy the following definite integrals

$$\int_1^3 \frac{e^x - 2}{e^x + 6}\,\mathrm{d}x\,; \qquad \int_{-1}^6 \sin(x^2 - 6x + 4)\,\mathrm{d}x\,.$$