PH227: AI and Data Science

Tutorial Sheet 1: Python/Data-Science Part

Note: The problems of this tutorial sheet are simple programming exercises, with the aim of getting you started in Python coding. You have to submit the codes corresponding to the starred (*) problems to the TAs.

1. Write a Python program to calculate the area and perimeter of a given rectangle. Your program should ask the users to provide the length (say a) and width (say b), and write in the output the calculated values of the perimeter ($2a + 2b$) and area (ab).

2. * Consider the quadratic equation $ax^2 + bx + c = 0$. Write a Python program which will ask the user to give the values of the coefficients a, b, and, c, and print out the solutions according to the standard formula. While writing the final solution, you should consider the following three possibilities:

   (a) Two unequal real roots for $b^2 > 4ac$

   (b) Two equal real roots (also called a double root) if $b^2 = 4ac$

   (c) Two complex roots if $b^2 < 4ac$. In this case, you should print out both the real and imaginary parts of the roots.

3. * Write a Python program to reverse the digits of a number given as input by the user. For example, if the user gives 123 as the input, your code should print out 321. For this purpose, you will have to use the integer division operator // and remainder calculation operator %.

4. Write a Python program to sort a user-provided list of real numbers in the ascending order.

5. * This problem is about matrix multiplication of two matrices. Ask the user to provide a positive integer n, and generate two $n \times n$ matrices A and B whose matrix elements are defined by the formulas

$$A_{ij} = i + j$$
$$B_{ij} = i - j.$$

   The product matrix $C = AB$ is defined by the usual rules of matrix multiplication

$$C_{ij} = \sum_{k=1}^{n} A_{ik} B_{kj} \tag{1}$$

   Write a Python program to compute the C matrix using: (a) Eq. 1, and (b) using the numpy routine numpy.matmul().