Information Analysis and Visualisation

Laboratory Session 1

1. Familiarise with the PyCharm or Jupyter Notebook environments. Run several commands, such as:

```
print('Hello World')
a = 10
b = 5
print(a, '+', b, '=', a+b)
```

2. Define and test 4 functions in Python, which perform the arithmetic operations addition, subtraction, multiplication and division. While implementing the fourth function, avoid division by zero by using:

2.1 If statement

2.2 Exception Handling, such as:

```
a = 3
b = 10
try:
    c = a / b
    print(c)
except ZeroDivisionError:
    print('Division by zero')
```

3. A quadratic equation has the following general formula:

$ax^2 + bx + c = 0$

where a, b and c are the coefficients of the equation

In terms of real numbers, those equations can have 0, 1 or 2 solutions, which can be calculated by using the following formula:

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

3.1. Write a Python script, which reads the coefficients of a quadratic equation and calculates the solutions. Use real numbers only. Provide meaningful user input and output.

3.2. Explain what will happen if the discriminant, that is the expression under the square root $\boldsymbol{b^2-4ac}$, is equal to zero. Demonstrate such case.

3.3. Depending on the math library, if unchecked, the script might generate an error in case of a negative discriminant, for example with coefficients a=10, b=5, c=6. Explain why and provide a solution.

3.4. The script will also generate an error if a = 0. Explain why and provide a solution.

3.5. The two possible problems with the quadratic equation, negative discriminant and first coefficient equals to zero, can be handled by using a single IF statement, starting as follows:

```
if a == 0 or d < 0:
    print('Error')
else:
```

Implement this approach and describe a possible issue with it.