104283 - Introduction to Numerical Analysis

Spring Semester, 2023

Python Assignment 1
Introduction | Bisection

Instructions:

1. Assignment is done in singles only and submitted through Moodle.
2. Submit the following two files ONLY:
   2.1. Report – including your code, results, derivations, explanations, etc.
   Saved as a single *.pdf file: **report.pdf**
   2.2. Single .ZIP file with your Python code.
3. Python files should be stored as a *.py files inside the zip file. Pay attention - your code must be included in the report as well (as image or text).
4. The zip file name format is as follows:
   4.1. HW
   4.2. Assignment number
   4.3. Underscore
   4.4. Student name (first and last name with no spaces, last name in CAPITAL letters)
   4.5. Underscore
   4.6. Student number

Example:
"**HW1_LinZHANG_999333666.zip**"

5. The submission should include only the required submission files and nothing else. No subfolders or any unnecessary files should appear in the zip file. Do not use rar file or anything other than zip.
6. Submissions not following this format will not be accepted.
7. Late submissions policy – given n days late submission, $2n$ points reduction penalty.
8. Make sure you adhere to all the principles learned in class. Using specialized external Python libraries is not allowed (unless otherwise specified).

Part I

Write a function in Python: **bisection(a, b, func, tol)**

The function gets the following parameters as input:

- Parameters a, b representing the interval.
- Some function f(x) defined by func.
- Convergence tolerance - tol.

Using the Bisection method, the function searches for a root $f(x) = 0$ in the interval [a,b] (page 49 algorithm 2.1 in the textbook).

The function will output the following:

- List of approximations x_i.
- Final approximation x for which the method converges (if it converges.
- Number of iterations.

Part II

Find solutions (if found) to the following problems using bisection in the given intervals:

a) $2x^3 - 2x - 5 = 0\ ;\ \ 1 \leq x \leq 2$
b) $e^x - x^2 + 3x - 2 = 0\ ;\ \ 0 \leq x \leq 1$
c) $-3.55x^3 + 1.1x^2 + 0.765x - 0.74 = 0\ ;\quad -1 \leq x \leq 1$
d) $x^6 + 6x^5 + 9x^4 - 2x^3 - 6x^2 + 1 = 0\ ;\ \ -3 \leq x \leq -2$

Note:

1. Use tolerance of 10^{-5}.
2. For each problem, define the mathematical function as a Python function.
3. If a solution is not found, explain shortly in the report.

Deliverables:

1. PDF file including your code, results, and output.
2. ZIP file with your Python code.