

Assignment 1

Description

The purpose of this assignment is to apply concepts taught in class through programming exercises while being cautious of the precision.

For full credit on this assignment, the following is required:

- create standard structure with a single main file
- ensure there's a readme with instructions on how to compile
- every output for each question is correct
- Name the repository **"cot-4500-as1"**

Constraints

Standard Structure

For this assignment, you will need the following structure:

Top Level

```
|-- src/  
|   |-- main/  
|   |   |-- __init__.py  
|   |   |-- assignment_1.py  
|   |-- test/  
|   |   |-- __init__.py  
|   |   |-- test_assignment_1.py  
|-- requirements.txt  
|-- README.md
```

Compilation Instructions

Akin to industry standards, it is required to include a README file per repository. A README is a file used to describe a repo's purpose including compilation instructions and purpose of project. A proper README.md is typically filled out with sections (like an outline of an essay). However, this will not be required.

For this assignment, a README is required. The amount of information you put into the README is up to you, but you will need to include the following:

- Mention of requirements.txt
 - Since this is part of the structure, you will need to figure out how to incorporate and use requirements.txt (hint: it's used to install third party libraries in python)
- Mention of running python
 - Since we require instructions on to run, you will need the bare minimum command to run the script

Questions

- 1) Use double precision, calculate the resulting values (format to 5 decimal places)
 - a) 010000000111111010111001
- 2) Repeat exercise 1 using three-digit chopping arithmetic
- 3) Repeat exercise 1 using three-digit rounding arithmetic
- 4) Compute the absolute and relative error with the exact value from question 1 and its 3 digit rounding
- 5)

Consider the infinite series:
$$f(x) = \sum_{k=1}^{\infty} (-1)^k \left(\frac{x^k}{k^3} \right)$$

What is the minimum number of terms needed to compute $f(1)$ with error $< 10^{-4}$?

- 6) Determine the number of iterations necessary to solve $f(x) = x^3 + 4x^2 - 10 = 0$ with accuracy 10^{-4} using $a = -4$ and $b = 7$.
 - a) Using the bisection method
 - b) Using the newton Raphson method

Example Output (not the actual values for the problems)

Please print all output to the console (not to a file). Each answer should be separated by a newline and an example is shown below:

```
12.34567
```

```
1.23
```

```
1.23
```

```
.04
```

```
32
```

```
45
```

```
73
```