## Individual Homework Assignment 1

#### Overview

This assignment must be completed **individually**. Collaboration is not allowed.

Assignments are due one week after being assigned.

Your work should be clearly documented, and commit messages must be descriptive.

#### Task

Write a Python script that estimates the value of two definite integrals using Monte Carlo integration.

### Part 1: Estimating Pi

Estimate the value of the following integral:

$$\int_0^1 \frac{1}{1+x^2}, dx$$

This integral evaluates to  $\frac{\pi}{4}$ . Multiply your result by 4 to estimate  $\pi$ .

You should define a function named estimate pi(num points).

### Part 2: Second Integral

Estimate the value of the following integral:

$$\int_0^1 \frac{10}{1+100x^2}, dx$$

This function has a sharper peak and a wider y-range, making it a more challenging Monte Carlo problem.

You should define a function named estimate\_second\_integral(num\_points).

## Implementation Instructions

Create a Python script named assignment.py containing:

- The function estimate\_pi(num\_points) for Part 1.
- The function estimate\_second\_integral(num\_points) for Part 2.
- Comments explaining your logic.
- At least **three test cases** for each integral (you can split them between the functions). You should use assert for your test cases.

#### Documentation

Include a README.md file containing adescription of the assignment and what is in the repository.

Instructions on how to run your script.

• A description of your test cases and why you believe they verify correctness.

Make sure your functions have docstrings to document their behavior.

# Grading

This assignment is worth 8% of your total grade.

#### Rubric

This assignment will be graded out of 20 points. See RUBRIC.pdf for a detailed breakdown of grading.