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 π.

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** total (you can split them between the two parts).

README.md

Include a `README.md` file containing:

- A description 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.

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.