Assignment 0: Warm-up & Math Review

Course: From Zero to Hero Training

Due Date: 29/01/2026

Overview

This assignment helps you get familiar with **Python**, **NumPy**, and basic mathematical concepts (Probability & Linear Algebra) covered in Lecture 0.

Tools Required: Python 3, NumPy.

---

1 Part 1: Probability Simulation (40 Points)

Review concepts: Random Variables, Discrete RV, Expected Value (Slides 8, 14).

Q1.1: Rolling Dice (20 Points)

As mentioned in the lecture, a discrete random variable X can represent the result of rolling a die [Slide 8].

1. Write a Python function using `numpy.random` to simulate rolling a 6-sided die **100 times**.
2. Print the first 10 results.

Q1.2: Expected Value (20 Points)

The expected value (Mean) is the average value we hope to obtain [Slide 14].

1. Calculate the average (mean) of the 100 results from Q1.1 using `numpy.mean()`.
2. Compare it with the theoretical expected value of a fair die (which is 3.5). Are they close?

2 Part 2: Linear Algebra with NumPy (60 Points)

Review concepts: Vector, Matrix, Transpose, Identity, Norms (Slides 17-20).

Q2.1: Matrices & Shapes (20 Points)

1. Create a matrix A of size 3×3 with values from 1 to 9.
2. Print the shape of matrix A.
3. Create an **Identity Matrix** I of size 3×3 [Slide 18].

Q2.2: Transpose (20 Points)

1. Find the transpose of matrix A (denoted as A^T) [Slide 19].
2. Verify that the element at row i, column j of A is equal to the element at row j, column i of A^T.

Q2.3: Calculating Norms (20 Points)

Given a vector $v = [3, -4, 0]$. Implement the formulas from [Slide 20] to calculate:

1. L_1 **Norm (Manhattan):** $\sum |v_i|$
2. L_2 **Norm (Euclidean):** $\sqrt{\sum v_i^2}$
3. L_∞ **Norm (Max Norm):** $\max |v_i|$

Hint: You can use `np.abs()`, `np.sqrt()`, `np.max()` *or write simple for-loops.*

Submission: Submit your `.ipynb` file to GitHub Classroom.