Advance Mathematics
Assignment-1

Title: Learn Probability Density Functions using Roll-Number-Parameterized Non-Linear Model

Dataset: Consider NO2 as feature (x).
Link: https://www.kaggle.com/datasets/shrutibhargava94/india-air-quality-data

Tasks to be performed

➜ **Step-1:** Transform each value of x into z using the transformation function given below.

$$z = T_r(x) = x + a_r \sin(b_r x) \tag{1}$$

where $a_r = 0.05 * (r \bmod 7), b_r = 0.3 * (r \bmod 5 + 1)$

where, mod returns remainder and **r is your UNIVERSITY ROLL NUMBER.**

➜ **Step-2:** Learn parameters of the following probability density function using any estimation technique or by using any machine learning technique.

$$\hat{p}(z) = c * e^{-\lambda(z-\mu)^2} \tag{2}$$

Where, $\hat{p}(z)$ is the predicted probability of the transformed variable z.
In this step, you have to learn parameters $\lambda, \mu \ and \ c$ in Eq.(2).

➜ **Step-3:** Submit the values of the parameters ($\lambda, \mu \ and \ c$) through the submission link on course home page.

Important Instructions

- **Deadline:** 04 Feb 2026
- Submissions after the deadline will be awarded zero.
- Technical issues will **not** be accepted as an excuse unless reported **before the deadline**.
- **Use of AI-based tools (text, code, or solution generators) is NOT allowed.**
- Submissions showing **AI-generated style, explanations, or code patterns** will be considered **academic misconduct**.
- If AI use is detected: Marks will be **reduced to zero**