

Statistics Projects

About This Repository

This folder contains Python implementations of statistical methods and models designed to solve advanced exercises. The projects demonstrate practical knowledge in statistical analysis, sampling methods, and probabilistic modeling.

Included Exercises

Exercise 1: Sampling from a Probability Distribution

Write a program that generates a sample of size 1000 from the probability density function $f(x)=3x+1$, where $0 < x < 1$, using the following methods:

1. The **Inverse Transform Method**
 2. The **Rejection Sampling Method**
 3. The **Metropolis Algorithm** for random walks
-

Exercise 2: Probabilistic Model Estimation

Given the following model:

$$y_t | a_t \sim \text{Binomial} \left(50, \frac{e^{a_t}}{1 + e^{a_t}} \right)$$

$$a_t | a_{t-1}, \varphi, \sigma \sim N(\varphi a_{t-1}, \sigma^2)$$

$$a_1 | \varphi, \sigma \sim N \left(0, \frac{\sigma^2}{1 - \varphi^2} \right), \quad \varphi \in (-1, 1),$$

Estimate the probabilities

$$p_t = \frac{e^{a_t}}{1 + e^{a_t}}, t = 1, 2, \dots$$

using the provided initial dataset.