**Communications and Information Engineering Program**

Probability and Stochastic Processes (CIE 327)

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Project link:

<https://github.com/Omar3yyad25/Letters-Probabilty-Project>

**1. Introduction**

This project aims to analyze a stochastic process by importing the data and performing various statistical analyses. The ensemble mean and autocorrelation function (ACF) will be calculated for the entire dataset, as well as the time mean and time ACF for individual segments of the data. The power spectral density (PSD) will also be calculated, along with the total average power of the process. Additionally, a graphical user interface (GUI) has been developed to facilitate user interaction and data visualization. The results of these analyses will provide insight into the underlying properties and behavior of the stochastic process, and the GUI allows for easy access and interpretation of the results.

**2. Code structure**

The code above is a graphical user interface (GUI) that is designed to analyze a stochastic process. The code imports various libraries such as matplotlib, tkinter, random, scipy.io, numpy, and pandas. The code loads the sample process data by using the scipy.io library. The data is then loaded into the GUI window and various variables such as ens\_mean, time\_mean, ACF\_arr, ACF\_plot, ACF, result, and time\_ACF are initialized. The GUI window is then created, with labels and entry boxes to allow the user to input parameters. The code is divided into several functions, such as the samples\_plot function, the calc\_ens\_mean function, the calc\_time\_mean function, and the calc\_ACF function. The samples\_plot function allows the user to plot a specified number of random sample functions from the data set. The calc\_ens\_mean function calculates the ensemble mean of the data set and plots it. The calc\_time\_mean function calculates the time mean of a specified sample function from the data set. The calc\_ACF function calculates the autocorrelation function for the specified sample function and plots it in 3D. The code is not yet completed, as you mentioned, so you may have additional functions or code snippets to add and improve the functionality of the GUI.