

Assignment 3: Time Series

This folder contains the problem statement and the basic code for the assignment. You must attempt this assignment only in python. You are provided with minimum boilerplate code to begin with, and you need to fill up the missing code such that all conditions mentioned in the question are met.

You will also need to provide a follow up PDF report for the same.

Part 1: ARIMA Model

Complete the function provided in the python boilerplate for the ARIMA forecast, where P , D and Q are given. Your program should output a list containing **only** the new terms in the predicted sequence. Complete this function from scratch.

The function to complete is `ARIMA_Forecast` in the file `forecasting.py`. You can test the function by running the `tests.py` file. The main function calls the `Plot()` function to plot the original and the predicted sequence for a given sample series and the given parameters of the function.

Part 2: Holt-Winter's Forecast

Complete the function provided in the python boilerplate for the Holt-Winter forecast, with given α , β , γ and L (Seasonality duration) values provided. Your program should output a list containing **only** the new terms in the predicted sequence. Complete this function from scratch.

The function to complete is `Holtwinter_Forecast` in the file `forecasting.py`. You can test the function by running the `tests.py` file. The main function calls the `Plot()` function to plot the original and the predicted sequence for a given sample series and the given parameters of the function.

Part 3: Forecast the series provided in the program

In the file `tests.py`, there are 5 initialised series, namely `S1`, `S2`, `S3`, `S4`, `S5`. Use the appropriate function defined previously to forecast the next 20 values for each of these series. For this, you will need to arrive at the correct hyper-parameters.

The functions to complete are `ARIMA_Parameters` which returns the tuple of (P, D, Q) and `Holtwinter_Parameters` which returns a tuple of $(\alpha, \beta, \gamma, L)$ in this specific order. These functions are to be completed in the file `forecasting.py`.

You may use any 3rd party libraries for this task, or add more custom functions in the same file. You are expected to explain these used functions briefly in your report.

You are advised to edit the main function in the file `tests.py` and make use of the predefined `Plot()` function to visualise your results on each of the series in the same format as the previous questions. In the report, mention the obtained parameters for the forecast method being used.

General Guidelines for the assignment

- This assignment is to be done in python. No dependency/packages for the first two parts should be used. For Part 3, any 3rd party library is allowed, but the overall functionality must be described in the report.
- For plotting the sequence, the provided `Plot()` function uses the `plotly` package. You can install this package using

```
pip3 install plotly
```

- Complete the given source code file, and upload it along with the report. (**Do NOT compress in a zip file** or include any additional folders). Upload the following on google classroom

```
├─ forecasting.py
└─ Report.pdf
```

- For evaluation of your assignment, your code will be tested with additional hidden test statements. They will be of the same format as the test cases provided to you. So ensure that the provided test cases are passing in your machine.
 - Do not edit the file `tests.py`. Do not add any other file than the ones already present in the boilerplate code.
 - Needless to say, you should also not edit the defined name of the functions in the file `forecasting.py`. Doing so will ensure that your code will fail the hidden test cases once you submit your code.
 - The hidden tests will only use valid types, so there is no need for error handling within the code. There is also no need for any performance optimisation. Your code is only expected to return the correct answer for queries on the functions that you need to complete, and you will be graded accordingly.
 - For students working in a group, only one submission per group is required. The group members' names and roll numbers must be mentioned in the PDF.
 - All students are expected to maintain their integrity and do the assignment on their own. Any cases of cheating/copying will be awarded 0 marks.
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