Forecasting Financial Time Series

The project consists of three parts. The submission of this project will consist of two attachments:

Project: Part 1: Short-term Forecasting:

(i) Use a simple line plot of both time series to detect seasonal, irregular, or trend behaviors if any. Write a summary of your observations of both time series in your report.

(ii) Perform exponential smoothing to forecast both prices for period ***253***. Use successive values of **0.33, 0,50, 0.66, and 0.75** for the smoothing parameter α. Next, calculate the **MAPD** (Mean Absolute Percentage Deviation) of each forecast; and based on the MAPEs, determine the value of α that has yielded the most accurate forecast for each stock. In your report, describe your results; and explain why in your opinion such values of α have yielded the most accurate forecasts for the two stocks.

(iii) Use your exponential smoothing forecast of part (ii) with α**=0.50** and perform an adjusted exponential smoothing to forecast both prices for period ***253***. Use successive values of **0.33, 0.50, 0.66, and 0.75** for the trend parameters β for both stocks. Next, calculate the **MAPD**s of your forecasts and determine the values of β that have provided the most accurate forecasts for both stocks. In your report, describe your results and explain why, in your opinion, such values of β have yielded the most accurate forecasts.

Part 2: **Long-term Forecasting**

(i) For each stock, use a **4-period** weighted moving averages to forecast its value during periods 1 through 50. Use the weights 0.4 (for the most recent period t-1), 0.3 (for the period before the most recent t-2), 0.2 & 0.1 (for t-3 & t-4). Next, use the observed value for period 51 as the base of a linear trend, and use that linear trend to forecast the values of both stocks for periods 51 through 262. Write a summary of your results in your report. Describe how accurate this method of forecasting has been by comparing the forecasted values for periods 253-262 with their actual "Close" values on those specific day.

(ii) Calculate the MAPDs of your forecasts in question (i) above for periods through 5 to 262 and compare them with the values obtained for your forecasts in Part 1. For each stock, describe which method has yielded a most accurate forecast.

Part 3: Regression:

(i) For each stock, use simple regression of stock values versus the time periods to predict its values for periods 1 through 262. In your report, describe how the accuracy of this prediction(MAPDs) has been compared to the methods used in Parts 1 and 2 of the project.

(ii) Perform a residual analysis of your simple regression to verify whether regression is appropriate to use for each of the given data. In particular, determine:

- Whether the residuals are independent
- Whether the residuals are homoscedastic.
- Whether the residuals are normally distributed by plotting a normal probability plot of the residuals
- Whether the residuals are normally distributed by performing a Chi-square test for normality of the residuals.

Part 4: Baseline Model:

(i) Use the most recent price as the prediction of current price for periods 2 through 262. Calculate the MAPDs.
(ii) Find which forecasting method(s) can outperform the benchmark.