United States International University-Africa

Education to take you places

SCHOOL OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF DATA SCIENCE AND ANALYTICS

SUMMER 2024

END SEMESTER EXAM

COURSE CODE: STA 3050A **UNIT NAME:** TIME SERIES AND FORECASTING

DATE: 8TH AUGUST 2024 **TOTAL MARKS**: 55 MARKS

INSTRUCTIONS:

For this exercise:

1. ANSWER ALL QUESTIONS
2. Do all your work in the Rmarkdown (.rmd).
3. Submissions should be in either a **`.rmd` file**
4. NO SUBMISSIONS SHOULD BE DONE VIA EMAIL

PACKAGES: forecast and tseries

QUESTIONS:

1. Load the `AirPassengers` dataset in R. (2 marks)
2. Plot the time series. Comment on any visible trends, seasonality, or anomalies that might affect your modeling strategy. (3 marks)
3. Check the stationarity of the `AirPassengers` time series. (3 marks
4. If the series is non-stationary, apply necessary transformations to make it stationary. Show the transformed series. (3 marks)
5. Use the ACF and PACF plots to suggest possible values of p and q for an ARMA model on the stationary series. (3 marks)
6. Think about the seasonality in the original series. How might this influence your choice of p and q? (3 marks)
7. Based on your plots and seasonal considerations, fit an appropriate ARMA model. (4 marks)
8. Fit an ARIMA model to the original `AirPassengers` series. Discuss your process to automatically select the best model. (4 marks)
9. Display the model summary and interpret the results. Think about the ARIMA specifications of the model and if you agree with the choice. (5 marks)
10. Perform diagnostic checks on your fitted ARIMA model. Are there any hidden patterns that might have been missed? (3 marks)
11. Discuss the results of your diagnostic checks. Are there any indications that your model is not adequate? How would you address these issues? (4 marks)
12. Generate and plot a 12-month forecast using your fitted ARIMA model. Consider the uncertainty in your forecast. (5 marks)
13. Interpret the forecast results. How accurate are they, and what do they suggest about future values of the series? Discuss the limitations and potential improvements. (5 marks)
14. Fit a seasonal ARIMA model to the `AirPassengers` dataset. (3 marks)
15. Compare the seasonal ARIMA model with the non-seasonal ARIMA model in terms of AIC/BIC values and forecast accuracy. Consider if seasonality is being captured adequately by the seasonal model. (5 marks)