Resit - Assignment 2

Applied Forecasting in Complex Systems 2021

January, 3, 2022

Background on how to work effectively on this assignment:

1. Follow the Guideline of Assignment 1 to 3.
2. Please explain all solutions, show the calculations and write down your foundations and reflections. When necessary, reduce your plot.

Use library(fpp3) to get the dataset unless specified as a file.

Exercise 1 (5 pts.)

The data set `souvenirs` concerns the monthly sales figures of a shop which opened in January 1987 and sells gifts, souvenirs, and novelties. The shop is situated on the wharf at a beach resort town in Queensland, Australia. The sales volume varies with the seasonal population of tourists. There is a large influx of visitors to the town at Christmas and for the local surfing festival, held every March since 1988. Over time, the shop has expanded its premises, range of products, and staff.

1.1) (0.5 pt.) Describe the patterns and identify any unusual or unexpected fluctuations in the time series.

1.2) (0.5 pt.) Explain why it is necessary to take logarithms of these data before fitting a model.

1.3) (2 pt.) Fit a regression model to the logarithms of these sales data with a linear trend, seasonal dummies and a "surfing festival" dummy variable. Plot the residuals against time and against the fitted values. Do these plots reveal any problems with the model?. Do boxplots of the residuals for each month. Does this reveal any problems with the model?

1.4) (0.5 pt.) What does the Ljung-Box test tell you about your model?

1.5) (1.5 pt.) Regardless of your answers to the above questions, use your regression model to predict the monthly sales for 1994, 1995, and 1996. Produce prediction intervals for each of your forecasts. How could you improve these predictions by modifying the model?

Exercise 2 (3 pts.)

Compute the total domestic overnight trips across Australia from the `tourism` dataset from`fpp3 package`.

2.1) (0.5 pt.) Describe the main features of the series and decompose the series using STL and obtain the seasonally adjusted data.

2.2) (1 pt.) Forecast the next two years of the series using an additive damped trend method applied to the seasonally adjusted data. (This can be specified using `decomposition_model()`.)

2.3) (1 pt.) Forecast the next two years of the series using an appropriate model for Holtâ€™s linear method applied to the seasonally adjusted data (as before but without damped trend). Then, use `ETS()` to choose a seasonal model for the data. Compare the forecasts from the three approaches? Which seems most reasonable?

2.4) (0.5 pt.) Check the residuals of your preferred model.

Exercise 3 (2 pts.)

Consider `aus_arrivals`, the quarterly number of international visitors to Australia from several countries for the period 1981 Q1 – 2012 Q3 from Japan. `aus_arrivals %>% filter(Origin == "Japan")`

3.1) (1 pt.) Use differencing to obtain stationary data. Then plot What from the ACF and PACF graph of the differenced data. Elaborate what you interpret. What ARIMA model do these graphs suggest? Does `ARIMA()` give the same model that you chose? If not, which model do you think is better? Elaborate and reflect on your answer.

3.2) (1 pt.) Write the model in terms of the backshift operator, then without using the backshift operator.