TIME SERIES END SEMESTER EXAM -R

Ananya Kaushal

6CMS

1940233

10th May 2022

# Question 1

Discuss the components of the series by using a suitable technique in time series.

Conclusion

From the graph we can say the following:

* **Trend Component:** there is a clear negative trend seen in the data as the months have gone by
* **Seasonality Component:** there seems to be a seasonality seen in the data which is that it increases and then decreases alternatively
* **Periodic Component:** there is no periodic component seen in the data

# Question 2

Discuss about the stationarity behaviour of the data by using graphical technique as well as a statistical test.

Conclusion

**ACF PLOT**

All the values in the ACF plot lie above the threshold blue dotted lines hence the data is correlated and not stationary. The ACF plot shows that the correlation values decrease linearly which points at the trend component of the data.

**PACF PLOT**

The PACF plot cuts off after 2 value

**ADF TEST**

We **ACCEPT** the null hypothesis as the p-value (0.01) is less than 0.05 and can say that the data is stationary in nature.

# Question 3

Fit a suitable ARMA model by observing the ACF and PACF. Draw your conclusions.

Conclusion

The ACF plot shows a cut at lag 1 and the PACF plot shows a cut at lag 2. Hence an ARMA(1,2) model might be suitable for the chosen data.

Using auto.arima() function we see that the data follows an ARIMA(0,1,2) process. This is confirmed by plotting the ACF and PACF plots of the differenced data to remove the integrating factor

# Question 4

Fit a suitable non stationary model and suggest which among the fitted models would be preferred the most for the prediction purpose. Give your reasons.

Conclusion

We fit a ARIMA(0,1,2) model using the auto.arima where seasonality is not present.

Among the two model, we compare their aic values to determine which is fit for forecasting.

The AIC value for ARMA(0,1,2) is **2459.64** and for ARIMA(1,0,2) is 2466.72 **.** Hence we choose the ARIMA(0,1,2) model for forecasting and prediction as its AIC value is smaller.

# Question 5

For the best preferred model check the adequacy of the model by validating all the important model assumptions.

Conclusion

Having chosen the ARIMA(0,1,2) we perform Residual Analysis to check if it is a good fit

**TO CHECK FOR CORRELATION**

1. ACF Plot: The values for the ACF plot are mostly within the threshold, with a few values just touching or exceeding the blue dotted lines. The residuals may or may not be independent. They mostly show that they are uncorrelated, thus satisfying the first condition
2. PACF Plot: PACF plot also shows that the data has certain lags at which the values of correlation are greater than the threshold value. Thus the is stationary
3. Box Pierce Test: We fail to reject the null hypothesis as the p-value is 0.4189 that is greater than 0.05 which is the chosen alpha value and hence conclude that the data is independent in nature

RESIDUALS ARE INDEPENDENT AND UNCORRELATED

**TO CHECK FOR NORMALITY**

1. QQPLOT: From the plot we can see that the values that are in the extreme do not fall In line with the normality line and certain values are highly different. The residuals MAY NOT be normally distributed
2. Shapiro Wilk Test: We reject the null hypothesis as the obtained p-value is which is less than the chosen alpha value of 0.05 and hence we conclude that the given data is not normally distributed

# Question 6

Obtain the MMSE forecast for the next few values and plot the predicted values.

Conclusion

The values found using MMSE forecast do not correspond to the given data showing that it may be likely that the data has not been correctly fit