Problem Description

The attached data table contains the demand data for one product of a company from the last two years. In the previous two years, they used the [t; q] inventory control strategy, but the company's management feels that the inventory-related costs are too high. The management decided to examine last year's data to develop a new inventory control mechanism. You need to help them with this and answer the questions below!

There are two main types of products: some of the products are handled in weight units, and some of the products are handled in pieces. These include quantities handled in pallet units or in pieces/weight units. In the first case, only whole pallet units can be handled, and the minimum order quantity is given, while in the latter case, only whole numbers of pieces or whole weight units can be ordered. The expected value and the standard deviation of the lead time are given in the data table. The distribution of the customer demands, and the lead times can be considered normal in the calculations, and the company plans its processes with 95% reliability.

Questions

1. Perform the data preprocessing (**data cleaning**) if it is necessary! During data cleaning, check whether there are any **data errors, missing data, or outliers** in the data series you are examining. During data cleaning, pay particular attention to the sporadicity of the demands and the systematic nature of phenomena that are suspected to be data errors.

2. Is it **worth aggregating the data by time period**? Which time period (week, month, quarter, year) would you like to choose if it is necessary to aggregate and why? **Aggregate the demand data if it is needed!** If aggregation was performed, carry out further data cleaning following the principles given in question 1.

3. For the **D0d0, D0d1, D1d0, and D1d1** time series of the given product (looking at the aggregation level selected in the previous step), calculate the **autocorrelation functions (ACF)**! In your calculations, consider both **the normal and Bartlett's error** and **draw conclusions about the significance values based on the charts**.

4. Calculate the autocorrelation functions by using the Wessa.net online application as well for the four cases and calculate the values of the partial autocorrelation function! Compare the results obtained in Excel and in the application, and if you find any differences (in the values obtained or in the number of values obtained), revise the calculations. Draw conclusions about the significant values of the partial autocorrelation functions.

5. What are the expected demands for the next year? Which forecasting method would you use? Choose the SOFT forecasting methods to be used considering the trend and the

seasonality, and examine at least three ARIMA models as well, including at least one where Bmax=4! For the parameterization and the comparison of the models, consider the first and the second year as well, but at the comparison, do not consider the data used for initialization! Save the results so that the Solver parameters are always visible! Select the most suitable models by considering several error indicators using a multi-criteria evaluation. Test at least one ARIMA model in Wessa.net and compare the results with the results obtained in Excel.

6. What would be the optimal parameters for the current [t, q] inventory control strategy based on the past data (considering both the models without and with backlog to determine the economic order quantity)? The cost parameters for the calculation can be found in the attached Excel file!

7. Investigate the feasibility of using the [s, q] inventory control strategy based on the past data, considering the characteristics of the lead time and also the standard deviation and distribution of the demands. What would be the optimal parameters in this case?