Hyndman and Athanasopoulos – Chapter 6 Exercises

1: Solved by pen and paper

2:

1. Plastics has a frequency of 12 (monthly sales). There is a clear seasonal effect, because the series always start to increase after February, peaking around August, and then it slowly decreases until February. The data also appears to be trending upwards, which means that the average of the distribution is shifting up with time.
2. Classical multiplicative decomposition is used because we assume that the variations in seasonal patterns are changing according to the level of the time series. The seasonal indices support the graphical interpretation of part a). September has the largest seasonal index, followed by August, while February has the smallest. The trend cycle also shows an upward trend, although it slowly ticks downward in the end of the series, reflecting the fact that it appears that the data for year 6 behaves slightly differently from past years.
3. Yes.
4. Plotted with script.
5. The outlier has a very large residual. The seasonal effect does not change considerably, but the estimate of the trend-cycle for that observation changes significantly.

3:

1. There are some large variations in the seasonal element, especially in December, January, and March.

4:

1. The decomposition shows that the trend-cycle component increases almost linearly. The seasonal component seems to be mostly stable throughout the series, although there is large variability in May and July. The scales suggest that there is very little variation in the seasonal component compared to the trend-cycle or even the residual component. Furthermore, it indicates that most of the variation in the series is caused by changes in the trend-cycle component.
2. Yes, there is a large negative remainder component in 1991/92, meaning that after removing the trend and the seasonal component there is a large unexplained variation in the series.

5:

1. The plots show that the seasonal component is not constant. It could be a result of economic conditions.
2. Done in R.
3. STL decomposition provides a much smoother estimate of the trend-cycle component, without following the other components too closely. Also, the estimate of the seasonal component seems to provide a much better representation of the seasonal variation existing in the data.

6:

1. Done in R
2. Done in R
3. Done in R
4. Done in R.
5. No. For both methods, we cannot reject the null hypothesis of residual autocorrelation. An analysis of the correlogram for the residuals shows dependency between the current value and the last two quarters.
6. –
7. The forecasts of the STLF method perform better on the test data. They have a much better performance across performance metrics. Furthermore, plotting the forecasts against the original data show that the STLF method provides a much better fit to the last two years of data.

7:

1. Variation is largest in the seasonal component compared to the variation in the remainder or trend-cycle component. The random walk with drift method seems to perform slightly better using a train/test split. It has a smaller test MAE, RMSE, and MAPE.

8:

1. Produced naïve and random walk with drift forecasts