Regular glasses

We are given the daily demand data about the last year's sales of regular glasses for Luxe. We take the average of each week to obtain weekly average demand. Figure 1 shows the time series of weekly average demand.

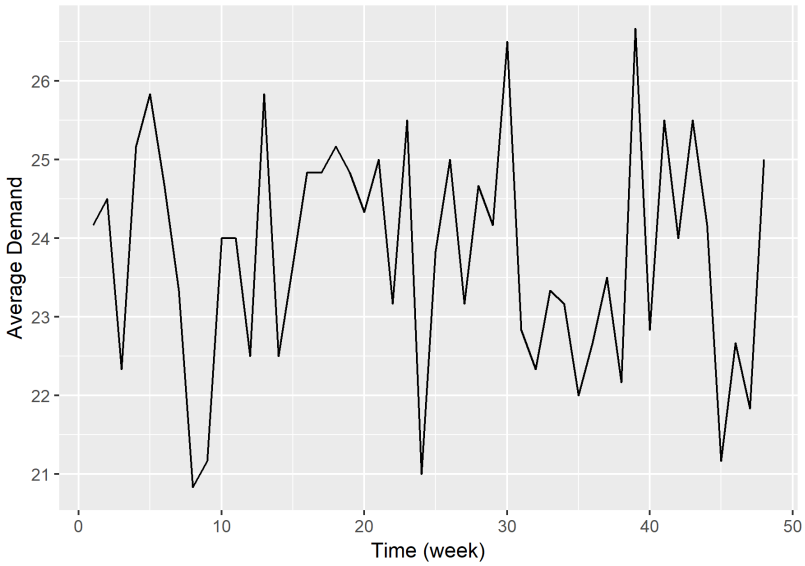

Figure 1: Regular glasses' demand time series

Forecasting methods that are applicable for the given time series are Moving Average (MA) [1, pp. 66–69], Exponential Smoothing (ES) [1, pp. 69–73], Linear Regression [1, pp. 77–79], and Double Exponential Smoothing Using Holt's Method [1, pp. 79–80]. We use the first 36 weeks as training data and the rest as the test data.

We determined Double Exponential Smoothing with MAD of 0.056 as the best model. The parameters of this model are as follows:

S_0	G_0	α	β
24.17	0.33	0.969	0.05

Using this best fitted model, we forecast the demand of regular glasses for weeks 49 to 54. These forecasts are reported below. Based on these results, the forecast demand of week 49 is 25.09 and the total demand over the lead-time (from week 49 through week 54) is 152.

Week 49	Week 50	Week 51	Week 52	Week 53	Week 54
25.09	25.19	25.28	25.38	25.48	25.57

Sunglasses

We are given the monthly demand data about the last three year's sales of sunglasses for Luxe. Figure 2 shows time series of sunglasses demand. Figure 3 indicates the decomposition of this time series into components of **seasonality**, **trend**, and **error term**.

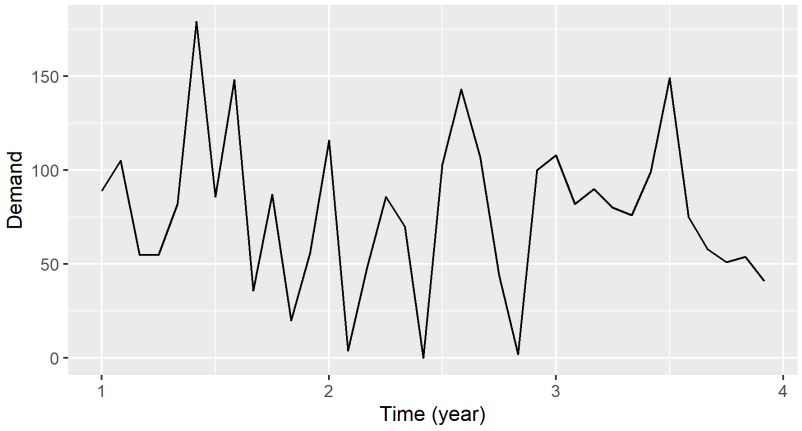

Figure 2: Sunglasses' demand time series

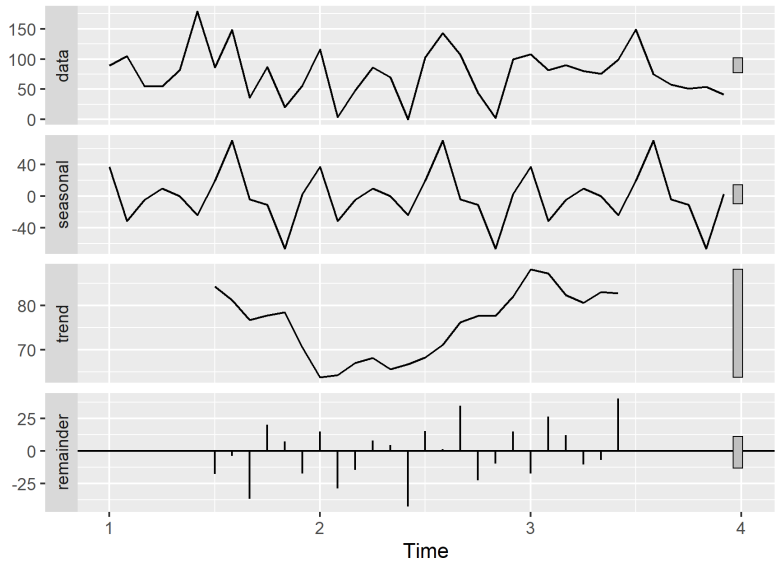

Figure 3: Decomposition of sunglasses' demand time series

There is a strong indication as can be observed in Figure 3 that the seasonality is significant in this time series. We therefore apply the related forecasting methods of Seasonal Factors [1, pp. 81–83], Deseasonlized Series [1, pp. 83–84], and Winter's method [1, pp. 85–90]. We choose the best method by comparing the MAD calculated on the test data, that is year 3. We detect Seasonal Factor as the best method with MAD of 26.96 and report the seasonal factors (SFs) as well as the forecast for the demand of sunglasses for all months of the fourth year in the following table:

Month	SF	Forecast
January	1.35	104.33
February	0.82	63.67
March	0.83	64.33
April	0.95	73.67
May	0.98	76.00
June	1.20	92.67
July	1.46	112.67
August	1.58	122.00
September	0.87	67.00
October	0.78	60.67
November	0.33	25.33
December	0.85	65.67

Therefore, the forecast for the demand of sunglasses for January and February of the fourth year are 104.33 and 63.76, respectively. Also, the total demand over the fourth year is 928.

References

[1] Steven Nahmias and Tava Lennon Olsen. *Production and Operations Analytics*. Waveland press, Edition 7.