

## Sheet 2 (Forecasting)

### Exercise 1

A retail company has collected the following demand information for umbrellas during the last 5 years.

Year	2007	2008	2009	2010	2011
Demand	1200	1100	1000	960	850

Given this information, you are asked to determine the ex-post single-period forecasts using the following methods:

- Moving average over 2 years.
- Exponential smoothing with  $\alpha=0.2$  and starting value=1300.
- Trend model with  $\alpha=0.2$ ,  $\beta=0.1$  and starting values  $a=1300$ ,  $b=20$ .

Evaluate the performance of your forecasts in a), b) and c):

- Calculate the MAD with exponential smoothing ( $\gamma=0.1$  and starting value=0).
- Monitor the forecast accuracy by calculating the error signal SIG ( $\gamma=0.1$ ,  $\sigma=0.1$ ) and interpret your result in terms of demand over- or underestimation.

### Exercise 2

Provigo sells a variety of excellent chocolate desserts. A major problem with these desserts is their short shelf-life. Therefore, the retail chain wants to improve its forecast accuracy. From the products' sales history, it can be observed that demand strongly increased during promotions and went down when prices were high. You are given the following demand observations and the corresponding prices of one of their bestselling products French Mousse au Chocolat:

Week	1	2	3	4	5	6	7	8	9	10	11	12
Demand	1500	2000	500	600	550	3000	3100	1800	700	200	1600	800
Price (\$)	2.49	1.99	3.49	3.59	3.59	1.49	1.49	2.49	3.29	3.59	2.49	3.19

- Visualize the relationship between demand and price.
- Calculate the regression function using least squares estimation.
- How well does the function fit past observations?
- Which demand can be predicted for the following week when price is 1.49?

### Exercise 3

During your internship with the service parts division of a TV manufacturer, you are asked to forecast the parts demand for an after series part. A previous intern has already prepared the data, however failed to come up with a reasonable forecast as he was only aware of simple exponential smoothing techniques.

Day	12	18	35	47	61
Demand	7	8	5	3	5

At the days not shown in the table, there was no demand for the part. Explain the problem that the previous intern faced and apply an appropriate method to overcome the problem. Any required smoothing constant should have the value 0.2. Your supervisor tells you that her experience suggests that there will be a demand of 5 units every 14 days.

### Exercise 4

CampingPlus sells waterproof tents for which parts are first produced in its Austrian factory, then parts are assembled to tents and the complete tents are finally sold to the end-customers in stores for outdoor equipment in Austria, Germany and Switzerland. Stores in the three countries usually review their inventory once a week ( $R_s=1$ ) and CampingPlus then immediately supplies the stores with the amount of tents ordered ( $L_s=0$ ). CampingPlus itself continuously reviews its inventory, but it takes one week until the tents ordered arrive at the assembly center. All parties in the supply chain are supposed to satisfy a non-stockout probability target of 80 % in the off-season (September – February). Demand at the stores is aggregated so that you are given the following information that has been observed by all local stores during the last four weeks. Demand is assumed to be normally distributed with unknown level (initial guess 50) and known standard deviation 15.

Week Number	40	41	42	43
Demand	55	48	57	58

- Depict the supply chain described in the exercise graphically.
- Perform an ex-post forecast for the local stores using exponential smoothing with  $\alpha=0.1$  and determine the order-up-to level that would have been optimal given the forecast. Calculate the aggregate order quantity to be placed by the local stores.
- Perform an ex-post forecast for CampingPlus using exponential smoothing with  $\alpha=0.3$  and determine the order-up-to level that would have been optimal given the forecast. Calculate CampingPlus' order quantity.