Exercise 3 - Forecasting

Inventory Management

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Forecasting for dense time series (I)

The following time series shows 30 daily measures of a society process.

Day	Value
1	2,082
2	2,486
3	2,866
4	3,380
5	3,609
6	2,458
7	1,775
8	1,785
9	2,237
10	2,352
11	2,337
12	2,055
13	1,737
14	1,018
15	1,144
16	1,304
17	1,478
18	1,639
19	945
20	793
21	679
22	685
23	947
24	1,284
25	1,209
26	1,251
27	667
28	357
29	933
30	798

1. Apply 1st-order exponential smoothing (with $\alpha = 0.25$ and initial forecast $2,500$) and moving averages (with $n = 7$).
2. Plot the time series. Which structural properties do you observe? Are the aforementioned forecasting models appropriate to forecast the time series?

3. Do you recognize the time series?

Forecasting for dense time series (II)

The following table contains the total production of wine in 1000 hectolitres (hl) in the UK since 2009 on a quarterly basis (see here.

quarter	year	wine (in 1k hl)
Q1	2009	2,433
Q2	2009	3,263
Q3	2009	3,135
Q4	2009	3,849
Q1	2010	2,900
Q2	2010	3,170
Q3	2010	3,177
Q4	2010	3,653
Q1	2011	2,933
Q2	2011	2,913
Q3	2011	3,185
Q4	2011	3,829
Q1	2012	3,152
Q2	2012	2,681
Q3	2012	3,038
Q4	2012	3,913

1. Display the time series graphically. Which typical pattern becomes obvious in the time series?
2. Calculate forecasts for the time series with 2nd-order and 3rd-order exponential smoothing (with $\alpha = \beta = \gamma = 0.3$). Display the forecasts in the same diagram. *Hint*: Initialize the forecasts with the average over all observations for a_0, the average slope ($b_0 = \frac{y_{16} - y_1}{16}$, and $c_{-3:0} = (-340, -200, -50, +600)$)
3. Compare the forecasts' accuracies by an appropriate measure. Which forecasting method should be chosen for the time series?

Forecasting sporadic time series (intermittent demands)

The following table shows monthly lubricant sales of a oil company.

month	year	sales quantities
Jan	2005	0
Feb	2005	2
Mar	2005	0
Apr	2005	1
May	2005	0
Jun	2005	11
Jul	2005	0
Aug	2005	0
Sep	2005	0
Oct	2005	0
Nov	2005	2
Dec	2005	0

month	year	sales quantities
Jan	2006	6
Feb	2006	3
Mar	2006	0
Apr	2006	0
May	2006	0
Jun	2006	0
Jul	2006	0
Aug	2006	7
Sep	2006	0
Oct	2006	0
Nov	2006	0
Dec	2006	0
Jan	2007	0
Feb	2007	0
Mar	2007	0
Apr	2007	3
May	2007	1
Jun	2007	0
Jul	2007	0
Aug	2007	1
Sep	2007	0
Oct	2007	1
Nov	2007	0
Dec	2007	0

1. Calculate forecasts for the year 2008 at the of Dec. 2007.
2. Assume that in the first 3 months of 2008 no lubricants are sold. What are the forecasts for the next 3 months in 2008?
3. Another approach to forecast sporadic tiem series is proposed by Croston (see here for an brief introduction). Calculate forecasts by based on Croston's method for the first 3 month of 2008 either by hand or by using R.