Prediction of time series via ARIMA model

For the prediction of time series with trend and cyclical periodicity is possible to use not only neural networks, but also the Box-Jenkins methodology represented by autoregressive - integrated - moving average model ARIMA (p, d, q). The model can be expressed as two models, where the first one is nonstationary

$$Y_t = (1 - L)^d X_t$$

and the second one stationary

$$(1 - \sum_{i=1}^{p} \varphi_i L^i) Y_t = \left(1 + \sum_{i=1}^{q} \theta_i L^i\right) \varepsilon_t.$$

The prediction is possible to states for Y_t by means of generalised method of autoregressive prediction. Sibyl program for prediction was used. Real data of history of number of bobsleigh rides per day were used. See bobsleigh track on figure 1.

Fig. 1 Bobsleigh track

The program Sibyl was used for the calculation of prediction for the next four days based on historical data. The bobsleigh track is operating on Fridays, Saturdays, Sundays and holidays in winter. The time series shows the non-seasonality and seasonality with 3 day periodicity. The bobsleight track is on fig.2.

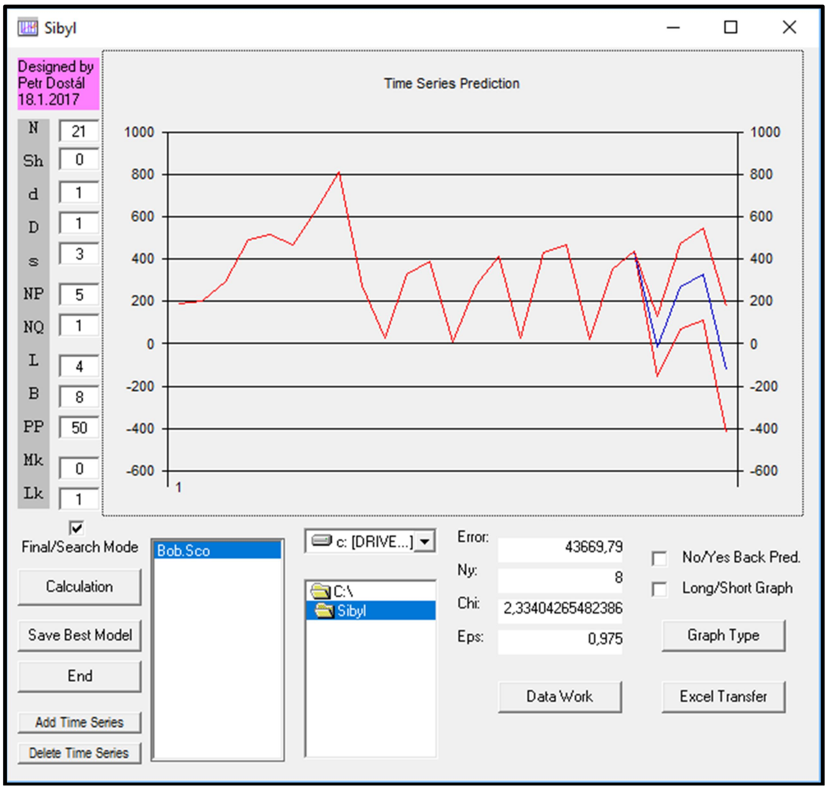

Fig. 2 The forecast of number of bobsleigh rides

The time series $z_t = (z_1, z_2, \ldots, z_N)$ of number of bobsleigh rides was differenced according formula $w_t = \Delta^d \Delta_S^D z_t$ with the parameters d=1, D=1, s=3. The ARIMA model for this data has a form $w_t = \phi_1 w_{t-1} + \phi_2 w_{t-2} + \phi_3 w_{t-3} + \phi_4 w_{t-4} + \phi_5 w_{t-5} + a_t - \theta_1 a_{t-1}$ and prediction for time L=4 has a form $w_{t+L} = \phi_1 w_{t-1+L} + \phi_2 w_{t-2+L} + \phi_3 w_{t-3+L} + \phi_4 w_{t-4+L} + \phi_5 w_{t-5+L} + a_{t+L} - \theta_1 a_{t-1+L}$.