

Examination

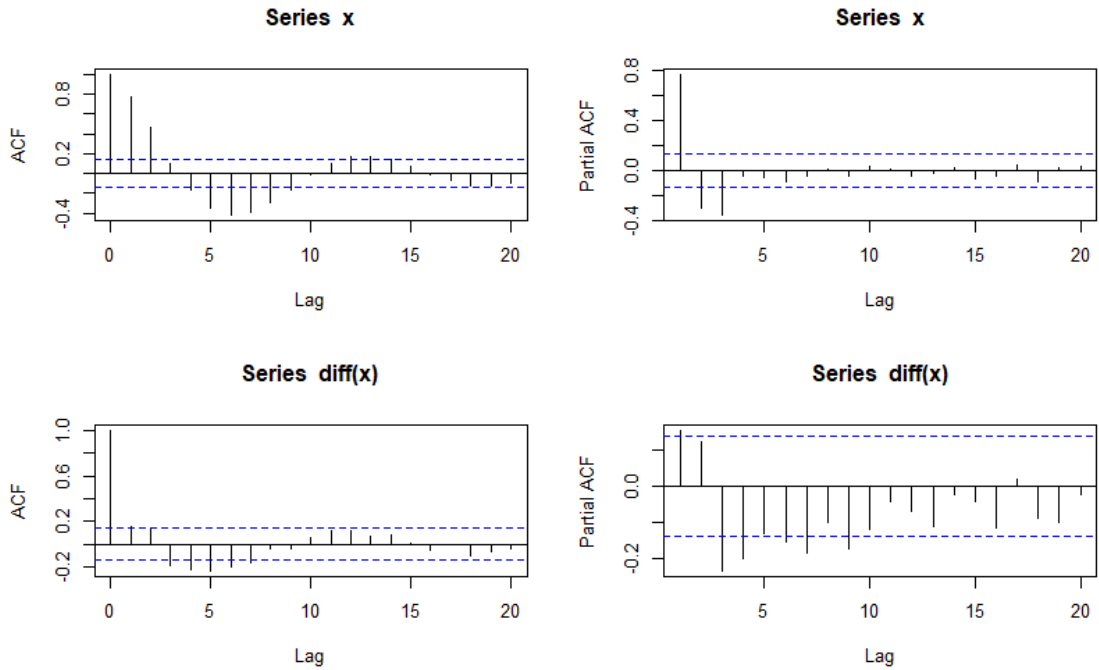
Linköping University, Department of Computer and Information Science, Statistics and Machine Learning

Course code and name	732A62 Time Series Analysis
Date and time	2018-02-23, 08.00-12.00
Assisting teacher	Oleg Sysoev
Allowed aids	“Time series analysis and its application” by Shumway & Stoffer or/and “Time series analysis” by Cryer and Chan, Information Sheet, Calculator.
Grades:	A=19-20 points B=16-18 points C=13-15 points D=11-12 points E=9-10 points F=0-8 points

Give motivated answers to the questions. If an answer is not motivated, the points are reduced.

1. Fit an AR(2) model to the data set $D = (1, 10, 3, 6, 0, 4)$ containing 6 observations by means of applying Yule-Walker equations. Report the estimated coefficients of the model. **(3p)**
2. Consider the process $z_t = x_t + 2y_t$ where x_t is AR(1) with $\phi = 0.3$, y_t is MA(1) with $\theta = 0.5$ and processes x_t and y_t are independent, consider $\sigma_w^2 = 1$ in both processes. Is resulting process z_t stationary? Compute its autocovariance. **(2p)**
3. Explain why the process $x_t = 5x_{t-1} + w_t$ is unusable for time series prediction **(1p)**
4. Assume that AR(1) process $x_t = -0.5x_{t-1} + w_t$ was estimated from the dataset $D = (-4, 1, 3, -2, -5, 1, 6)$ containing 7 observations. Compute the model residuals, sketch the time series plot of residuals and conclude whether the model seems to be a good fit to the data **(3p)**
5. Estimate the coefficient of AR(1) model, a confidence interval for this coefficient, and the variance of the noise component by using conditional least squares method and the data set $D = (-1, -1, 2)$ containing 3 observations. Assume that this process has zero mean. **(4p)**
6. Determine $ARIMA(p, d, q) \times (P, D, Q)_s$ orders from the following equation: $x_t - x_{t-1} - x_{t-8} + x_{t-9} = w_t - 4w_{t-1} - 5w_{t-16} + 20w_{t-17}$ **(2p)**

7. Given a Fourier expansion for the data set with four points: $x_t = 2 \cos(0.5\pi t) + 3 \sin(0.5\pi t) + \cos(\pi t)$, sketch a scaled periodogram for this series. **(1p)**
8. According to the figure below, which of the following ARMA models is the most suitable **(1p)**:
 a) $ARIMA(0,1,0) \times (0,0,1)_5$ b) $ARIMA(3,0,0)$, c) $ARIMA(3,0,0) \times (0,0,1)_{12}$



9. Assume now that the figure above comes from a GARCH process. Estimate the orders of the GARCH process and write down its model equation. **(2p)**
10. What conclusions can be done from the analysis of the following plot computed from residuals? **(1p)**

