STAT 349 Assignment

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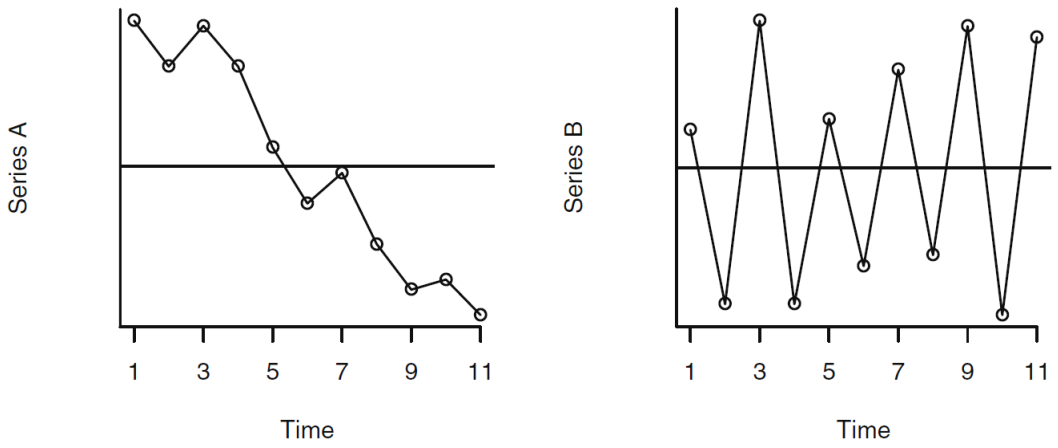
1. The time plots of two series are shown below.



   (a) For each of the series, describe r_1 using the terms strongly positive, moderately positive, near zero, moderately negative, or strongly negative. Do you need to know the scale of measurement for the series to answer this?

   (b) Repeat part (a) for r_2.

2. Simulate an AR(1) time series with $n = 48$ and with $\phi = 0.6$.

   (a) Calculate the theoretical autocorrelations at lag 1 and lag 5 for this model.

   (b) Calculate the sample autocorrelations at lag 1 and lag 5 and compare the values with their theoretical values. Use Equations (6.1.5) and (6.1.6) page 111, to quantify the comparisons.

   (c) Repeat part (b) with a new simulation. Describe how the precision of the estimate varies with different samples selected under identical conditions.

   (d) If software permits, repeat the simulation of the series and calculation of r_1 and r_5 many times and form the sampling distributions of r_1 and r_5. Describe how the precision of the estimate varies with different samples selected under identical conditions. How well does the large-sample variance given in Equation (6.1.5) on page 111, approximate the variance in your sampling distribution?

3. Simulate an MA(2) time series of length $n = 36$ with $\theta_1 = 0.7$ and $\theta_2 = -0.5$.

   (a) What are the theoretical autocorrelations for this model?

   (b) Calculate and plot the sample ACF for your simulated series. How well do the values and patterns match the theoretical ACF from part (a)?

   (c) Plot the theoretical partial autocorrelation function for this model. Plot sufficient lags until the correlations are negligible. (We do not have a formula for this PACF. Instead, perform a very large sample simulation, say n = 1000, for this model and calculate and plot the sample PACF for this simulation.)

   (d) Calculate and plot the sample PACF for your simulated series of part (a). How well do the values and patterns match the "theoretical" PACF from part (c)?

4. Simulate a mixed ARMA(1,1) model of length $n = 100$ with $\phi = 0.8$ and $\theta = 0.4$.

   (a) Calculate and plot the theoretical autocorrelation function for this model. Plot sufficient lags until the correlations are negligible.

   (b) Calculate and plot the sample ACF for your simulated series. How well do the values and patterns match the theoretical ACF from part (a)?

   (c) Calculate and interpret the sample EACF for this series. Does the EACF help you specify the correct orders for the model?

   (d) Repeat parts (b) and (c) with a new simulation using the same parameter values and sample size.

   (e) Repeat parts (b) and (c) with a new simulation using the same parameter values but sample size $n = 48$.

   (f) Repeat parts (b) and (c) with a new simulation using the same parameter values but sample size $n = 200$.