

Homework 6

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1. Consider three separate AR(1) models: $\phi = 0.1$, $\phi = 0.5$, and $\phi = 0.8$.

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phi1 <- 0.1  
phi2 <- 0.5  
phi3 <- 0.8
```

- (a) For each model, calculate ρ_1 and ρ_7 .
- (b) For each model, calculate $Var(r_1)$ and $Var(r_7)$.
- (c) For each model, use the `arma.sim` function to simulate a time series of length $n = 60$. Then use the `acf` function to calculate r_1 and r_7 . Remember to set up a random seed for your simulation.
- (d) Based on your results in parts (a) and (b), are r_1 and r_7 from part (c) within 2 standard deviations of ρ_1 and ρ_7 respectively?
- (e) Repeat part (c) for 1000 times. Draw histograms for r_1 's and r_7 's for each model. What proportion of r_1 's and r_7 's are within 2 standard deviations of ρ_1 and ρ_7 ?

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2. Consider an $AR(1)$ model with $\phi = 0.6$.

(a) Use the `arma.sim` function to simulate three time series of lengths $n = 15$, 75, and 100.

(b) For each set of simulated data, calculate r_1 .

(c) For each n , what is $Var(r_1)$? Is r_1 within 2 standard deviations of ρ_1 for each sample?

(d) Repeat part (a) for 1000 times. For each n , draw a histogram of the 1000 r_1 's, and find what proportion of r_1 's are within 2 standard deviations of ρ_1 .

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3. Consider an MA(1) model with $\theta = 0.6$

(a) Use the `arma.sim` function to simulate three time series of lengths $n = 15$, 75, and 150. Note that **R** uses the negative of the MA coefficients.

(b) For each set of simulated data, calculate r_1 .

(c) For each n , what is $Var(r_1)$? Is r_1 within 2 standard deviations of ρ_1 for each sample?

(d) Repeat part (a) for 1000 times. For each n , draw a histogram of the 1000 r_1 's, and find what proportion of r_1 's are within 2 standard deviations of ρ_1 .

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4. The dataset `days` contains accounting data. The data is the number of days it took to receive payment for 130 consecutive orders from a particular distributor.

(a) Plot the times series. Are there any unusual values?

(b) Draw the sample ACF and sample PACF plots. What do you find?

(c) Replace the unusual values with a value of 35 days. Redraw the sample ACF and sample PACF plots. Are they different from part (b)?

(d) What ARMA model would you specify for this series after removing the outliers? Explain.

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