

**Old Dominion University**  
**Mathematics-Statistics Department**  
**Fall 2009 Semester**  
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**Stat 630 Homework 3**

Due date: October 6<sup>th</sup>

Explain your answers.

Solve problems 1 up to 6, and choose 4 of the last 6 problems to solve.

1. Problem 2.2
2. Problem 2.3
3. Problem 2.4
4. Problem 2.9
5. Problem 2.21
6. Problem 2.22
7. Consider the two MA(2) denoted

$$X_t = Z_t + 0.3Z_{t-1} - 0.4Z_{t-2}, \quad Z_t \sim WN(0, 1)$$

and

$$Y_t = \tilde{Z}_t - 1.2\tilde{Z}_{t-1} - 1.6\tilde{Z}_{t-2}, \quad \tilde{Z}_t \sim WN(0, 0.25).$$

- (a) Show that the 2 processes have the same auto-covariance function.
  - (b) Provide a justification for the answer in 7a.
8. Consider the temperature data of a city between Jan 1964 and Dec 1975, n=144.
    - (a) Fit an AR(2) model, and estimate the parameters.
    - (b) Suppose we fit the model given by:

$$X_t = \beta_0 + \beta_1 \cos\left(\frac{2\pi t}{12}\right) + \beta_2 \sin\left(\frac{2\pi t}{12}\right)$$

Estimate the parameters of the model.

- (c) Compare the fits in (a) and (b).

9. Simulate an AR(1) with parameter  $\phi = 0.8$  and mean  $\mu = 75$  of size  $n = 58$ .
  - (a) Using the first 50 observations, fit an AR(1) and get the estimates of the parameters and the goodness of fit of the model.
  - (b) Forecast the next 8 observations and compare with the actual 8 values that were generated.
  - (c) Will the answer on 9b change if the sample is larger?
10. Redo problem 9 for a MA(2) with  $\theta_1 = -1$  and  $\theta_2 = 0.6$  and same mean value.
11. Redo problem 9 for an ARMA(1,1) with  $\phi = 0.5$  and  $\theta_2 = 1/3$  and same mean value.
12. Consider the data set called "data electricity" which is the data electricity demand of a company, beginning January 1980. It is posted on Blackboard. Analyze the data and provide a time series model. Give the one year prediction.

Let me know if you have any questions.