Fall 2016 MSAN 604

Assignment 1

Due Date:

Submit a hard copy in person to me by **5:00pm on Thursday, November 3rd**

Instructions:

Indicated below are a series of problems from *Introduction to Time Series and Forecasting*, 2nd edition. A teaching assistant and I will grade a random subset of these problems. The "Additional Questions", on the other hand, will both be graded. To facilitate efficient grading, your weekly homework should satisfy the following properties:

1. Turn in the problems in the order in which they were assigned.
2. Clearly indicate your name and student ID number on the upper right-hand corner of the first page.
3. Staple your homework assignment in the upper left-hand corner.
4. In general, do not print out entire data sets.
5. In general, do not print out reams of R output. Everything should be orderly and easy for me to read.

Textbook Problems

1.1, 1.3, 1.4, 1.7, 2.3

Additional Problems

1. Consider an $MA(q)$ process, for general q.
   (a) Find the *autocovariance function* of $\{X_t\}\sim MA(q)$.
   (b) Find the *autocorrelation function* of $\{X_t\}\sim MA(q)$.
   (c) Using your answer in part (b), deduce that an $MA(q)$ process is q-correlated.

2. The file SALES.txt includes 12 years of monthly sales (in thousands of dollars) beginning from January 1999 for a company that produces an accounting software. Interest lies in modeling the data as a function of time and predicting the future sales. Use the following command lines to read the data into R and format it as a time series object:

```
sales <- read.table('SALES.txt')
sales <- ts(sales, start=1999, frequency=12)
```

   (a) Fit a "trend only" model to the data where the trend component is quadratic in time, and comment on the fit of the model. For full marks, you should fit the model (provide your commented R code along with the R output), and provide full residual diagnostics.

(b) In accordance with a classical decomposition model, add a seasonal component to the quadratic regression model above, and comment on the fit of the model. Here, the seasonal component should capture the effect of month through the use of indicator variables. For full marks, you should fit the model (provide your commented R code along with the R output), and provide full residual diagnostics.
(c) Compare the fit of the model in (b) to the model in part (a).
(d) Which (if either) of the two models above satisfies the fundamental assumptions of least squares regression?
(e) Regardless of your response to (d), use the fitted model from (b) to predict the monthly sales data for the year 2011. Add these predictions and the corresponding 95% prediction intervals to a time series plot of the raw data.