STA380 Time Series Analytics
Homework on Random Samples

Directions: *Be sure to show your work and explain your answer for each question, even if the question seems to require only a Yes or No answer. Your homework solutions are to be entirely your own effort. You may not communicate with anyone about the homework, except for the TA and/or the instructor. You may use the Canvas postings, in-class discussion, any of the recommended textbooks, and computer software, if necessary, but no other resources. In writing up your solutions for software-based questions, it is recommended to support your answers with cut-and-pasted output, provided your answers are clearly* labeled *and* circled *or* highlighted*. The grader will not search through unlabeled computer output to try to find your answers. You may find that some questions are most easily answered in Excel.*

Note on submission: You should assemble your solutions as a single editable file – editable in order to facilitate TA grading annotation; one file in order to ensure that the parts do not get lost – in addition, multiple files may result in overwriting some of them. I suggest embedding all in a single Excel or Word file. Scan any hand-written solutions and include the scan(s) in your master submission file.

Set-up for questions 1 – 9: The file HW1.xlsx contains data on weekly sales (in $1000s) of two furniture manufacturers: Firm 1 and Firm 2. Questions 1-6 concern Firm 1. Questions 7-9 concern Firm 2.

1. **[10 points]** Test the data visually for conformity with the L specification of the Random Sample model. Explain clearly whether you think L applies and why (no hedging – you must indicate a definite yes or no.)

2. **[10 points]** Test the data visually for conformity with the H specification of the Random Sample model. Explain clearly whether you think H applies and why (no hedging – you must indicate a definite yes or no.)

3. **[10 points]** Test the data quantitatively for conformity with the "I" specification of the Random Sample model. Explain clearly whether you think "I" applies and why (no hedging – you must indicate a definite yes or no.)

4. **[10 points]** Suppose that the Random Sample model is valid for these data. In addition, suppose that weekly sales are normally distributed. Forecast sales for week 61 and give an interval in which you can have approximately 95% confidence that actual sales for week 61 will lie.

5. **[10 points]** Suppose that the Random Sample model is valid for these data. In addition, suppose that weekly sales are normally distributed. Forecast sales for week 62 and give an interval in which you can have approximately 95% confidence that actual sales for week 62 will lie.

6. **[10 points]** Suppose that the Random Sample model is valid for these data. Estimate mean sales per week and give an interval in which you can have approximately 95% confidence that the actual mean of the distribution of weekly sales will lie.

7. **[10 points]** Regress weekly sales as Y on the week number as X. Test the residuals visually for conformity with the L specification of the Random Sample model. Explain clearly whether you think L applies and why (no hedging – you must indicate a definite yes or no.)

8. **[10 points]** Regress weekly sales as Y on the week number as X. Test the residuals visually for conformity with the H specification of the Random Sample model. Explain clearly whether you think H applies and why (no hedging – you must indicate a definite yes or no.)

9. **[10 points]** Regress weekly sales as Y on the week number as X. Test the residuals quantitatively for conformity with the "I" specification of the Random Sample model. Explain clearly whether you think "I" applies and why (no hedging – you must indicate a definite yes or no.)

10. **[10 points]** Suppose that $Y_1, Y_2, ..., Y_n, ...$ is a Random Sample time series of non-degenerate random variables (i.e., the variance of each is positive [not zero]). Consider the time series of period-to-period changes in $Y_1, Y_2, ..., Y_n, ...$ - namely, $Y_2 - Y_1, Y_3 - Y_2, ..., Y_n - Y_{n-1}, ...$. Is the time series of changes ($Y_2 - Y_1, Y_3 - Y_2, ..., Y_n - Y_{n-1}, ...$) …

(A) … always a Random Sample?
(B) … never a Random Sample?
(C) … sometimes a Random Sample and sometimes not a Random Sample?

If your answer is (A) or (B), present a compelling argument for your position. Your argument need not be a mathematical proof – a clear intuitive argument will suffice.

If your answer is (C), present an example of a Random Sample time series whose changes are also a Random Sample, and a different example of a Random Sample whose changes are not a Random Sample.