**Module 4 Assignment Exercise: Spectral Analysis**

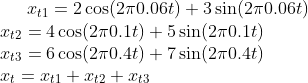
The assignment for this module is a mixture of programming and written work. Complete this assignment in R Markdown. You will need to include the question and number that you are answering within your submitted assignment. For programming answers using R, **answers should be written in R Markdown and ‘knitted’ to a Word/PDF file**.

The written work can be answered by filling in your answers on the Module 4 Assignment Word Doc. For math questions this includes the numerical answer, and may also include multiple-choice questions about how you solved the problem.

**Textbook Exercises (Pages 144-146 and 172-174):**

**6.1** Repeat the simulations and analyses in Example 6.1 and Example 6.2 with the following changes:

1. **[5 Points]** Change the sample size to n=128 and generate and plot the same series as in Example 6.1.



What is the difference between these series and the series generated in Example 6.1? (Hint: the answer is fundamental).

1. **[5 Points]** As in Example 6.2, compute and plot the periodogram of the series, *xt* generated in a) and comment.

**6.3 [5 Points]** The data in star are the magnitude of a star taken at midnight for 600 consecutive days. The data are taken from the classic text, *The Calculus of Observations, a Treatise on Numerical Mathematics*, by E.T. Whittaker and G. Robinson (1923, Blackie and Son, Ltd.). Plot the data, and then perform a periodogram analysis on the data and find the prominent periodic components of the data. Remember to remove the mean from the data first.

**7.1 [5 Points]** Figure A.4 shows the biyearly smoothed (12-month moving average) number of sunspots from June 1749 to December 1978 with n=459 points that were taken twice per year; the data are contained in sunspotz. With Example 7.4 as a guide, perform a periodogram analysis identifying the predominant periods and obtain confidence intervals. Interpret your findings.

**7.2** **[5 Points]** The levels of salt concentration known to have occured over row, corresponding to the average temperature levels for the soil science are in salt and saltemp. Plot the series and then identify the dominant frequencies by performing separate spectral analysis on the two series. Include confidence intervals and interpret your findings.

**7.5 [5 Points]** Repeat problem 7.2 using a nonparametric spectral estimation procedure. In addition to discussing your findings in detail, comment on your choice of a spectral estimate with regard to smoothing and tapering.