Assignment 2 - Time Series Analysis of Climate Variables

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Note that after each step of analysis, you have to report on the results.

1. For this question you will need the files from the website named **ClementsGapWindFarmOutput.xlsx**.
   The tasks for this question are listed below.

   - Take the 2011 output (the training set) and find the best $ARMA(p,q)$ model for the data.
   - Take the noise Z_t from that model and check its SACF.
   - Calculate Z_t^2 and show that it has the ARCH effect.
   - Find the best ARCH or GARCH model for it.
   - Take the developed models for the output and also for the noise and apply them to the 2012 output data.
   - Evaluate the performance of the models for one step ahead forecasting with error bounds by calculating the coverage and mean prediction interval width, for both 90% and 95% values.
   - Compare the results with constructing the prediction intervals by using the appropriate quantiles.

   [15 marks]

2. For this question you will need the files from the website named **MelbourneAirportRain.xlsx**.
   The tasks for this question are listed below.

   - Test the months December, January, February, July, August for normality.
   - For the months that do not follow a normal distribution, test for a Gamma fit.
   - Test December, January, February for correlation, and July, August separately.

- Generate 1000 years of synthetic December, January, February, add the months to get seasonal totals, and generate empirical CDFs for the totals versus the CDFs for the real data.
- Do the same for July, August.

[15 marks]

3. For this question you will need the files from the website named **MtGambier-Rainfall.xlsx** and **MtGambierByMonthsTemperature.xlsx**.
   The tasks for this question are listed below.

   - Take the monthly rainfall data from **MtGambierRainfall.xlsx** and model the seasonality. Then subtract this from the data.
   - Use exponential smoothing to see the overall trend in the series - try various values of α below 0.2.
   - Find the trend for the whole series for the smoothed data, and then find the trends for any sections that you think display differing characteristics.
   - Take the data for the month of December and the Annual mean temperature from **MtGambierByMonthsTemperature.xlsx** and find the trend over time. How much has the mean temperature changed over time in each case?

   [15 marks]