**Problem Description:**

The role of temperature in economic development has been an important question. It is often documented that hot countries (or countries closer to equator) tend to be poor. In recent decades, with the warming at a global scale, scientists and policy makers are increasingly concerned about the economic consequence of warmer and drier weather.

In this assignment, you are given historical data on temperature, precipitation, and economic outcomes for a sample of 106 countries. You are required to analyse the impact of temperature, precipitation on income levels (measured by per capita GDP in natural logarithm), and more important, on income growth (measured by annual growth of per capita GDP).

Each question is described below (2 + 3 + 4 + 6 + 8 + 4 + 1+ 4 = 32 marks; professional report = 8 marks):

Locate the data file (IndividualBusStats.xls) on CANVAS.

1. Has the globe been becoming warmer and drier over 1950-2000? Draw evidence on the descriptive statistics of relevant variables in the dataset.
2. Do hot countries tend to be poor (with lower per capita GDP)? Do dry countries tend to be poor? Use appropriate graphs to interpret the relationship between relevant variables. You only need to present **two** relationships. Carefully interpret and explain.
3. Calculate the sample covariance and correlation for the two relationships in question 2 above using Data Analysis Tool Pack or Excel statistical functions. In addition, you are required to calculate the sample covariance and correlation using a second method (using basic Excel formulae without Data Analysis Tool Pack). The calculations by the second method should be carefully laid out in Excel and should NOT use any hard-wired Excel statistical functions e.g. COVARIANCE.S, CORREL, et al. You can use the Excel sort command, the sum command, and any other non-statistical excel commands. Carefully interpret your results.
4. Use **simple** regression to explore the relationship between (i) annual growth of per capita GDP over 1990-2000 (Y) and mean temperature over 1990-2000 (X); (ii) annual growth of per capita GDP over 1990-2000 (Y) and mean precipitation over 1990-2000 (X), respectively. You may use Data Analysis Tool Pack for this. Based on the excel regression output, first write down the estimated regression equations, then carry out any relevant two-tailed hypothesis tests using the **critical value** approach at the 5% significance level. Carefully interpret your hypothesis test results.
5. Now use **multiple** regression to explore the relationship of annual growth of per capita GDP over 1990-2000 (Y) with, mean temperature over 1990-2000 (X1), and mean precipitation over 1990-2000 (X2). You may use Data Analysis Tool Pack for this. Based on the excel regression output, first write down the estimated regression equation, then interpret the estimated coefficients on the mean temperature over 1990-2000 (X1), and mean precipitation over 1990-2000 (X2). Carry out any relevant two-tailed hypothesis tests using the **p-value** approach at the 5% significance level, and an overall significance test using the **p-value** approach. Carefully interpret your hypothesis test results.
6. Write down a paragraph or two to illustrate: a) why the hypothesis test is required in the above regression analysis (either simple or multiple); b) the underlying mechanism/intuition of a two-tailed hypothesis test in the context of regression analysis. Aid your illustration with appropriate diagrams.
7. Carefully interpret the adjusted R-squared in the **multiple** regression analysis.
8. If you could request additional data to study the factors that influence the annual growth of per capita GDP, what extra variables would you request? Illustrate **two** such variables. Carefully explain why you choose these two variables (by drawing evidence from the literature such as journal articles, newspapers, et al), types of your proposed variables (e.g. numerical or categorical), and how each of your proposed variables will be measured in the regression model.