Assignment for MTMG37

Data analysis for weather and climate research

The England and Wales Precipitation (EWP) dataset is a single time series of rainfall amounts constructed from about 60 rain gauges. The file `ewp.txt` (available from the module web page) contains the seasonal and annual rainfall totals (in millimetres) for the years 1767 to 2001. The four seasons are winter (December, January, February), spring (March, April, May), summer (June, July, August) and autumn (September, October, November).

The assignment is to perform a statistical analysis of the EWP data and to summarise your analysis in a written report. The assignment will be assessed based on your report, which should address in separate sections each of the five points listed below, and should not exceed 10 pages (including figures).

The assignment represents 100% of the marks for this course and your work should be done individually. Marks will be awarded for appropriate choices of method, correct implementation, and quality of interpretation and presentation. The report must be submitted to the Department Office before 5pm on Thursday 8 April 2004.

P.T.O.

1. Summarise the main features of the data and compare the rainfall in the four seasons. [5 marks]

2. If total annual rainfall is less than 700mm then drought measures need to be taken. How often, on average, has this situation arisen? Drought measures are to be imposed in summer depending on the total rainfall in December to May. Estimate an amount of rainfall such that if the total rainfall in December to May falls below this amount then the probability that annual total rainfall will be less than 700mm is 0.5. [5 marks]

3. A colleague used a Normal distribution as a probability model for total autumn rainfall and used the model to estimate the probability of exceeding the amount recorded in autumn 2000. Fit this model and estimate the probability. Now estimate the probability using a Gamma distribution. (Note that in MINITAB the 'first shape parameter' is the parameter α in the lecture notes and the 'second shape parameter' is $1/\beta$.) Comment on the reliability of these two probability estimates. [10 marks]

4. Assess the evidence for the hypothesis that winter and summer rainfall totals have equal population means. Provide point and interval estimates for the difference in means. [10 marks]

5. Describe and assess the strength of evidence for time trends in rainfall in each of the four seasons. [20 marks]