

### Question 3 (Chapter 13 A Look Back)

This final TMA question for the course anticipates the style of question you can expect in the end-of-year examination. Only short answers are expected, and only short answers are required! You should take the opportunity where appropriate to practise your calculator skills and use of statistical tables: none of the questions is intended to involve use of SSC.

- Find the sample mean and the sample variance for the data list 1, 4, 10, 15, 15. [2]
- Give an example from your own experience of a sequence of observations that may be modelled as a sequence of Bernoulli trials, and include in your description your estimate of the parameter  $p$ . [3]
- Assuming that particular recurrent events occurring in time may adequately be modelled as occurring as a Poisson process at an average rate of 10 instances a week, find (i) the mean number of events over any period of 24 hours, and (ii) the probability that not more than one event occurs during the next 24 hours. [3]
- Continuation of part (c). Find the expected number of events to occur during 1997, and use the central limit theorem and your tables to estimate the probability that there will be more than 600 instances. [3]
- If the random variable  $X$  is normally distributed with mean 1000 and variance 230, find  $q_{0.95}$ , the 95% quantile of  $X$ . [3]
- Suppose that it is required to estimate the parameter  $\theta$  for a uniform distribution  $U(0, \theta)$ . State shortcomings of both the moment estimator  $2\bar{X}$  and the maximum likelihood estimator  $X_{\max}$ . [4]
- Give an example (real or, if you prefer, artificial, but in either case different from those examples given in the course text) of a sampling experiment resulting in the collection of some censored data. [4]
- Comment on the following statement given at the close of a weather forecast: '... and average temperatures at 4 °C will be twice as warm as yesterday's'. [2]
- Obtain an approximate 95% confidence interval for a binomial probability  $p$ , based on observing 18 successes in 125 trials. [3]
- In a test that a coin is fair, it comes up Heads only 13 times in 40 tosses. Find the value of the test statistic in a chi-squared test, and use your tables to reach a conclusion about the coin. [3]
- Briefly, describe how you might explore the extent to which the cost of public transport journeys by road depends on the distance travelled (say, in a particular area). [4]
- Illustrate with a scatter plot a data situation where two random variables are strongly associated but are not strongly correlated. [2]
- In Milton Keynes data collected over a short time interval (the past twenty days) suggest that the probability that tomorrow is wet, given that today is wet, is 0.6; while the probability that tomorrow is dry, given that today is dry, is 0.25. Use these probabilities to estimate the proportion of wet days in Milton Keynes, in the long run. [3]