1 The production manager of a food manufacturing company wishes to take a random sample of a certain type of biscuit bar from the thousands produced one day at this factory, for quality control purposes. He wishes to check that the mean mass of the bars is 32 grams, as stated on the packets.

(i) State what it means for a sample to be random in this context. The masses, x grams, of a random sample of 40 biscuit bars are summarised as follows.

$$n = 40 \qquad \sum(x-32) = -7.7 \qquad \sum(x-32)^2 = 11.05$$

(ii) Calculate unbiased estimates of the population mean and variance of the mass of biscuit bars. [2]

(iii) Test, at the 1% level of significance, the claim that the mean mass of biscuit bars is 32 grams. You should state your hypotheses and define any symbols you use. [5]

(iv) Explain why there is no need for the production manager to know anything about the population distribution of the masses of the biscuit bars. [2]

[ALVL/2017/2/2]

2 On a remote island a zoologist measures the tail lengths of a random sample of 20 squirrels. In a species of squirrel known to her, the tail lengths have mean 14.0 cm. She carries out a test, at the 5% significance level, of whether squirrels on the island have the same mean tail length as the species known to her. She assumes that the tail lengths of squirrels on the island are normally distributed with standard deviation 3.8 cm.

(i) State appropriate hypotheses for the test. [1]

The sample mean tail length is denoted by $\bar{x}$ cm.

(ii) Use an algebraic method to calculate the set of values of $\bar{x}$ for which the null hypothesis would not be rejected. (Answers obtained by trial and improvement from a calculator will obtain no marks.) [3]

(iii) State the conclusion of the test in the case where $\bar{x} = 15.8$. [2]

[ALVL/2012/2/2]