AQA/

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

STATISTICS   **SS04**
Unit Statistics 4

Thursday 8 June 2006   9.00 am to 10.30 am

For this paper you must have:
- an 8-page answer book
- the **blue** AQA booklet of formulae and statistical tables

You may use a graphics calculator.

Time allowed: 1 hour 30 minutes

Instructions
- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Write the information required on the front of your answer book. The *Examining Body* for this paper is AQA. The *Paper Reference* is SS04.
- Answer **all** questions.
- Show all necessary working; otherwise marks for method may be lost.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.

Information
- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.

Advice
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.

SS04

Answer **all** questions.

1 The weights, in grams, of six bananas selected at random from Shahara's shop were

$$167 \quad 176 \quad 149 \quad 155 \quad 163 \quad 157$$

(a) Calculate a 95% confidence interval for the mean weight of the bananas in Shahara's shop. Assume that the sample is from a normal distribution. *(6 marks)*

(b) Using the given data and your answer to part (a), comment on Shahara's claim that her bananas weigh at least 150 grams. *(2 marks)*

2 Ernie is the manager of a holiday camp. He is considering providing improved facilities in the chalets. He estimates that this would not be worthwhile unless more than 25 per cent of current guests would be willing to pay an increased weekly rent for the improved facilities.

Ernie improves the facilities in one chalet. He then asks 14 randomly selected guests to inspect this chalet and tell him whether or not they would be prepared to pay an increased rent for the improved facilities. Nine of the guests say they would be willing to pay an increased rent.

(a) Using the 1% significance level, examine whether the proportion of guests willing to pay an increased rent for the improved facilities exceeds 25 per cent. *(7 marks)*

(b) Following this trial, Ernie carries out a further evaluation. He asks each of 124 randomly selected guests the following two questions:

Question 1: Would you be prepared to pay £10 extra to rent the improved chalet?
Question 2: Would you be prepared to pay £40 extra to rent the improved chalet?

Sixty-five guests answered 'yes' to question 1. Eleven guests answered 'yes' to question 2.

Calculate approximate 90% confidence intervals for the proportions of guests willing to pay:

(i) £10 extra rent;

(ii) £40 extra rent. *(8 marks)*

(c) Summarise, for Ernie, your findings in parts (a) and (b). *(3 marks)*

3 As a fire precaution, a hotel owner is considering buying a large number of safety devices to install in all rooms of the hotel. The devices are designed to activate sprinklers if the temperature in a room reaches 60 °C. A sample of the devices was tested by steadily increasing the temperature and noting the temperatures, in °C, at which the sprinklers were activated. The results were as follows:

$$52.9 \quad 58.1 \quad 58.6 \quad 66.8 \quad 55.4 \quad 64.7 \quad 59.8 \quad 60.3$$

(a) Use a *t*-test and the 10% significance level to examine whether the mean temperature at which the sprinklers are activated is 60 °C. Regard the data as a random sample from a normal distribution. *(9 marks)*

(b) Give **one** reason why it is desirable that:

   (i) a device should not activate a sprinkler at too low a temperature; *(2 marks)*

  (ii) a device should activate a sprinkler before too high a temperature has been reached; *(2 marks)*

 (iii) the standard deviation of the temperatures at which a sprinkler is activated should be small; *(2 marks)*

 (iv) only a small number of devices should be tested. *(2 marks)*

4 Maev, who works in a supermarket, was recently appointed to be responsible for fresh fruit and vegetables. During the previous year, the supermarket received an average of 8 emails per week complaining about the quality of the fruit and vegetables sold. The number of such emails may be modelled by a Poisson distribution.

(a) During the week before Maev's appointment, 16 such emails were received. Examine, using exact probabilities and the 5% level, whether there is significant evidence that, immediately before Maev's appointment, the mean number of such emails received exceeded 8 per week. *(6 marks)*

(b) On her appointment, Maev introduced changes to the methods of storing and displaying the fruit and vegetables. Following these changes, 38 emails of complaint were received during a six-week period.

Examine, using a suitable approximation and the 5% level, whether there is significant evidence that, following the changes introduced by Maev, the mean number of such emails received was less than 8 per week. *(9 marks)*

(c) Comment on the effectiveness of the changes introduced by Maev. *(2 marks)*

Turn over for the next question

Turn over ▶

5 A senior citizens' club raises funds by holding bring-and-buy sales. Past experience suggests that the profits from bring-and-buy sales may be modelled by a normal distribution with mean £206 and standard deviation £28.

(a) Find the probability that the profit from the next bring-and-buy sale will exceed £250.
(3 marks)

(b) The senior citizens' club is aiming to raise £300 to pay for a coach outing to Southport and intends to hold two bring-and-buy sales.

  (i) State the distribution of the total profit from the two bring-and-buy sales assuming that the profits of each are independent.

  (ii) Hence find the probability that the total profit from the two bring-and-buy sales will **not** be sufficient to pay for the coach outing. *(5 marks)*

(c) Vijay, the owner of a local convenience store, offers to match any money that the senior citizens' club raises. (For example, if the club raises £200, then Vijay will also contribute £200.) Following this offer, the senior citizens' club decides to hold only one bring-and-buy sale.

  (i) State the distribution of the total of the profits from the bring-and-buy sale and Vijay's contribution.

  (ii) Hence find the probability that the profit from one bring-and-buy sale plus Vijay's contribution will **not** be sufficient to pay for the coach outing. *(5 marks)*

(d) Compare the probabilities calculated in parts (b)(ii) and (c)(ii). Comment on the advisability of holding only one bring-and-buy sale. *(2 marks)*

END OF QUESTIONS