Rewarding Learning

ADVANCED
General Certificate of Education
2012

Mathematics

Assessment Unit S4

assessing

Module S2: Statistics 2

[AMS41]

AMS41

FRIDAY 22 JUNE, AFTERNOON

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number on the Answer Booklet provided.
Answer **all seven** questions.
Show clearly the full development of your answers.
Answers should be given to three significant figures unless otherwise stated.
You are permitted to use a graphic or scientific calculator in this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A copy of the **Mathematical Formulae and Tables booklet** is provided.
Throughout the paper the logarithmic notation used is $\ln z$ where it is noted that $\ln z \equiv \log_e z$

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Answer all seven questions.

Show clearly the full development of your answers.

Answers should be given to three significant figures unless otherwise stated.

1 Thomas is investigating the correlation between the height, x cm, and weight, y kg, of Sixth Year students. His results are given in **Table 1** below.

Table 1

Student	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Height (x, cm)	162	174	186	158	165	175	175	166	182	174
Weight (y, kg)	62	85	95	72	58	94	78	58	73	80

Summary values of these data are:

n	Σx	Σy	Σx^2	Σy^2	Σxy
10	1717	755	295511	58655	130384

(i) Calculate the product-moment correlation coefficient for these data. [5]

(ii) Comment on the value obtained in part **(i)**. [1]

2 Evelyn is an office manager. She investigates the length of telephone calls at the office. Evelyn records the length, x minutes, of a sample of 40 calls.

Her summary values are:

$$\Sigma x = 288 \qquad \Sigma x^2 = 2818$$

Find a 95% confidence interval for the mean length of calls. [8]

3 Carol is investigating the link between air temperature, y °C, and height above ground level, x m. Her data are given in **Table 2** below.

Table 2

Height (x, m)	50	100	150	200	250	300
Temperature (y, °C)	24.6	21.7	18.5	15.4	12.5	9.2

Summary values of these data are:

n	Σx	Σy	Σx^2	Σy^2	Σxy
6	1050	101.9	227500	1896.35	15140

(i) Find the regression equation of temperature on height above ground level. [6]

(ii) Estimate the temperature at 220 m above ground level. [2]

Based on her equation, Carol estimates the temperature at 400 m above ground level to be 3 °C.

(iii) Why might this value be unreliable? [1]

4 **(i)** Carefully explain the meaning of the term *'Null Hypothesis'*. [2]

A Statistics class is testing the claim that the average amount of weekly pocket money given to teenagers is £12.50
They asked a sample of 50 teenage pupils in their school how much weekly pocket money, £x, they each received.

A summary of the results is as follows:

$$\Sigma x = 596 \qquad \Sigma x^2 = 7576$$

(ii) Test the claim at 5% level. [13]

5 A bakery produces buns whose mass is Normally distributed with mean 50 g and standard deviation 2.1 g. The buns are sold in packs of 4.
Find the percentage of packs in which the buns have an average mass between 49 g and 51 g. [8]

6 Jack suspects that the amount of instant coffee in jars of his favourite brand is less than the 100 g stated on the label. He weighs the contents of nine jars.
His results are given below:

102.4	97.9	99.5	100.2	98.7	99.1	97.8	100.5	99.6

Assuming Normality, test Jack's suspicion at 5% level. [13]

7 The Normally distributed random variable X is such that $X \sim N(75, 6)$.
Also $S = X_1 + X_2 + X_3$ and $T = 3X$, where X_1, X_2 and X_3 are three independent random variables each with the same distribution as X.

Find:

(i) $P(S \geq 235)$; [6]

(ii) $P(T \geq 235)$. [4]

A second Normally distributed variable Y, independent of X, is such that $Y \sim N(60, 8)$

(iii) Find $P(4Y - 3X \leq 10)$. [6]

THIS IS THE END OF THE QUESTION PAPER