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Rewarding Learning

ADVANCED

General Certificate of Education

2018

Mathematics

Assessment Unit S4

assessing

Module S2: Statistics 2

[AMS41]

FRIDAY 15 JUNE, AFTERNOON

AMS41

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number on the Answer Booklet provided.

Answer **all eight** 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 $\ln z \equiv \log_e z$

Answer all eight questions.

Show clearly the full development of your answers.

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

Normal and t-distribution values should be read from the tables provided.

1 A physicist is interested in the accuracy of a voltmeter used in her laboratory. Using a carefully calibrated voltage source she sets voltages across a circuit and takes readings using the voltmeter being tested.
The results are given in **Table 1** below.

Table 1

Actual voltage (x)	1	2	3	4	5	6	7	8	9	10
Voltmeter reading (y)	1.4	2.2	2.4	4.2	5.3	5.8	7.4	8.1	8.9	9.7

Summary values are

n	$\sum x$	$\sum y$	$\sum x^2$	$\sum y^2$	$\sum xy$
10	55	55.4	385	385.6	384.8

(i) Find the regression equation of y on x. [6]

(ii) Estimate the voltmeter reading for an actual voltage of 7.5 [2]

2 A sofa retailer would like to know the impact that advertising has on his sales. Over a six-month period, he keeps a record of the number of advertisements placed in the local papers and the number of sofas sold.
The information is given in **Table 2** below.

Table 2

Month	1	2	3	4	5	6
Number of advertisements	2	5	3	7	8	7
Number of sofas sold	8	11	10	7	13	12

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

(ii) What conclusions could the sofa retailer make from this value? [2]

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3 A town planner is looking at car parking provision for her local town. She commissions a survey of the number of cars (x) parked on n streets in the town centre.
The summary values are given below.

$$n = 50 \qquad \sum x = 8314 \qquad \sum x^2 = 1466390$$

Calculate (to 4 significant figures) a 95% confidence interval for the mean number of cars parked on the streets in the town centre. [8]

4 Ten students volunteer to take part in an experiment to test the effect of taking caffeine. Having avoided taking caffeine for a number of days, they are each given a set of puzzles to do and their times, in minutes, to complete them are noted.
A couple of weeks later they return, but this time, before doing a similar set of puzzles, they consume a number of cups of coffee. Their times to complete the new set of puzzles are noted.
The results are given in **Table 3** below.

Table 3

Student	A	B	C	D	E	F	G	H	I	J
First time	23	31	27	36	28	30	24	27	25	32
Second time	19	29	27	33	30	31	21	26	23	29

Test at 5% level if caffeine affects the time to do puzzles. [13]

5 (a) Two random variables X and Y are such that $X \sim N(200, a)$ and $Y \sim N(150, 2a)$

Given that $P(2X - 2Y > 115) = 0.0668$, find the value of a. [8]

(b) Two random variables S and T are such that $S \sim N(12, 3)$ and $T \sim N(15, 4)$

Find $P(3S < 2T)$. [7]

6 The company cars used by salespeople for a number of local businesses are supplied and maintained by Quality Cars Ltd. The owner suspects that the monthly mileage figures are higher this year compared to last year. She examines the average monthly mileage figures, x, for a sample of 53 of the cars.
Her findings are:

$$\sum x = 106\,190 \qquad \sum x^2 = 216\,864\,465$$

The previous year's average was 1952 miles per month.

By carrying out a test at 5% level, what conclusion can be drawn? [12]

7 Sweets having a mean mass of 23.2 grams and standard deviation of 0.8 grams are used for making up party bags. Each party bag contains 10 sweets. A party bag is chosen at random.

Find the probability that the mean mass of its sweets is greater than 23.4 grams. [6]

8 The pupils of a Statistics class are preparing to carry out a survey in their school. The theme of the survey is "food preferences". The school has 853 pupils covering Years 8 to 14
The class has to make decisions about choosing their sample.

What factors should they be taking into consideration? [6]

THIS IS THE END OF THE QUESTION PAPER