



Rewarding Learning

ADVANCED  
General Certificate of Education  
2013

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## Mathematics

Assessment Unit S4

*assessing*

Module S2: Statistics 2

[AMS41]

FRIDAY 21 JUNE, MORNING

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### 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 a 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 seven 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 **Table 1** below is a table of random digits. You have been tasked to select six employees from a group of 75 employees to represent the company.

(i) Describe carefully how you would make your selection. [5]

(ii) Starting at the digit highlighted in **Table 1** make your selection showing clearly how you arrived at your selection.

**Table 1**

5	8	0	8	9	5	8	7	0	8
8	3	3	3	1	1	0	0	2	5
3	2	9	4	8	3	2	5	7	3
8	4	7	8	6	1	2	9	0	2
3	9	3	7	0	2	9	5	2	0
9	7	3	9	4	8	0	5	4	6
3	8	3	7	3	8	9	4	7	7
0	2	2	0	1	3	4	4	2	6
6	2	2	0	1	6	3	1	8	5
1	0	8	3	6	4	8	8	1	1

[3]

2 In an experiment to investigate the link between two variables  $y$  and  $x$  the values recorded are shown in **Table 2** below:

**Table 2**

$x$	20	30	40	50	60	70
$y$	1255	1907	2420	3036	3629	4281

The summary statistics are:

$n$	$\Sigma x$	$\Sigma y$	$\Sigma x^2$	$\Sigma y^2$	$\Sigma xy$
6	270	16528	13900	51781972	848320

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

(ii) Estimate  $y$  when  $x$  is 45 [2]

- 3 Horticulturist Tomás is investigating a possible correlation between the hours of sunlight,  $x$  hours, and the height,  $y$  cm, of a variety of gladioli. His readings are taken from a number of gardens around Northern Ireland. His summary statistics are:

$n$	$\Sigma x$	$\Sigma y$	$\Sigma x^2$	$\Sigma y^2$	$\Sigma xy$
15	458	287	14 148	5 595	8 818

On closer examination of his data Tomás decides that one data pair, (24, 22), is an outlier and is to be ignored.

He also receives two additional results (28, 17) and (31, 18).

- (i) Re-calculate Tomás's summary statistics. [5]
- (ii) Calculate the product-moment correlation coefficient for the revised data. [4]
- (iii) Comment on the value obtained in (ii). [1]
- 4 Alice is a diabetic. She checks and records her blood sugar level,  $x$  mmol/l, every morning. After a six-week period her summary statistics are:

$$\Sigma x = 372.9 \quad \Sigma x^2 = 3\,429.15$$

- (i) Find a 95% confidence interval for the mean of Alice's blood sugar level. [7]
- (ii) Suppose a confidence interval had instead been based on data over a ten-week period. In what ways might this confidence interval differ from that in (i)? Explain your answer. [4]
- 5 (i) Explain clearly the term *one-tailed test*. [2]

Laura is unhappy with the low fat minced beef she buys at the supermarket because it seems fatter than what is stated on the label: "10% fat". She decides to ask an independent food agency to test the product to see if she is correct. They calculate the fat content,  $x\%$ , of forty packs chosen at random. The summary statistics are:

$$\Sigma x = 408.1 \quad \Sigma x^2 = 4\,183.89$$

- (ii) Test the "10% fat" claim at 5% level. [11]

- 6 Two independent Normal random variables  $X$  and  $Y$  are such that  $X \sim N(11, 1.5)$  and  $Y \sim N(8, 1)$ .

Find:

(i)  $P(X + Y > 21)$ ; [5]

(ii)  $P(2X < 3Y)$ . [7]

- 7 Ten patients agree to take part in a trial of a new drug for lowering cholesterol levels. Their cholesterol readings are recorded prior to the trial and again following the period of time during which they took the new drug. The results are given in **Table 3** below.

**Table 3**

Patient	A	B	C	D	E	F	G	H	I	J
Reading before trial (mmol/l)	6.5	6.2	7.1	8.0	5.8	6.4	6.5	7.5	5.9	5.5
Reading after trial (mmol/l)	6.6	6.0	6.8	8.2	4.9	6.2	6.6	7.2	5.8	5.0

Test at 5% level if the drug is successful in lowering cholesterol levels. [13]

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**THIS IS THE END OF THE QUESTION PAPER**

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