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Pearson Edexcel International Advanced Level

Time 1 hour 30 minutes

Paper
reference

WST03/01

Mathematics

International Advanced Subsidiary/Advanced Level
Statistics S3

You must have:

Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Values from the statistical tables should be quoted in full. If a calculator is used instead of the tables, the value should be given to an equivalent degree of accuracy.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 7 questions in this question paper. The total mark for this paper is 75.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

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1. The Headteacher of a school is thinking about making changes to the school day. She wants to take a sample of 60 students so that she can find out what the students think about the proposed changes.

The names of the 1200 students of the school are listed alphabetically.

(a) Explain how the Headteacher could take a systematic sample of 60 students. (3)

(b) (i) Explain why systematic sampling is likely to be quicker than simple random sampling in this situation. (1)

(ii) With reference to this situation,
• explain why systematic sampling may introduce bias compared to simple random sampling
• give an example of the bias that may occur when using this alphabetical list (2)

When the Headteacher completes the systematic sample of size 60 she finds that 6 students were to be selected from Year 9.

The Head of Mathematics suggests that a stratified sample of size 60 would be a more appropriate method.

There were 200 students in Year 9.

(c) Explain why this suggests that a stratified sample of size 60 may be better than the systematic sample taken by the Headteacher. (2)

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3. The table shows the time, in seconds, of the fastest qualifying lap for 10 different Formula One racing drivers and their finishing position in the actual race.

Driver	A	B	C	D	E	F	G	H	I	J
Fastest qualifying lap	62.94	63.92	63.63	62.95	63.97	63.87	64.31	64.64	65.18	64.21
Finishing position	1	2	3	4	5	6	7	8	9	10

- (a) Calculate the value of Spearman’s rank correlation coefficient for these data. (4)

- (b) Stating your hypotheses clearly, test at the 1% level of significance, whether or not there is evidence of a positive correlation between the fastest qualifying lap time and finishing position for these Formula One racing drivers. (4)

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- 4. A manager at a large estate agency believes that the type of property affects the time taken to sell it.

A random sample of 125 properties sold is shown in the table.

	Type of property			Total
	Bungalow	Flat	House	
Sold within three months	7	29	46	82
Sold in more than three months	9	19	15	43
Total	16	48	61	125

Test, at the 5% level of significance, whether there is evidence for an association between the type of property and the time taken to sell it.

You should state your hypotheses, expected frequencies, test statistic and the critical value used for this test.

(10)

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5. A dog breeder claims that the mean weight of male Great Dane dogs is 20kg more than the mean weight of female Great Dane dogs.

Tammy believes that the mean weight of male Great Dane dogs is **more than** 20kg more than the mean weight of female Great Dane dogs.

She takes random samples of 50 male and 50 female Great Dane dogs and records their weights.

The results are summarised below, where x denotes the weight, in kg, of a male Great Dane dog and y denotes the weight, in kg, of a female Great Dane dog.

$$\sum x = 3610 \quad \sum x^2 = 260955.6 \quad \sum y = 2585 \quad \sum y^2 = 133757.2$$

- (a) Find unbiased estimates for the mean and variance of the weights of
- (i) the male Great Dane dogs,
 - (ii) the female Great Dane dogs.
- (5)

- (b) Stating your hypotheses clearly, carry out a suitable test to assess Tammy's belief. Use a 5% level of significance and state your critical value.
- (7)

- (c) For the test in part (b), state whether or not it is necessary to assume that the weights of the Great Dane dogs are normally distributed. Give a reason for your answer.
- (2)

- (d) State an assumption you have made in carrying out the test in part (b).
- (1)



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6. The number of emails per hour received by a helpdesk were recorded. The results for a random sample of 80 one-hour periods are shown in the table.

Number of emails per hour	0	1	2	3	4	5	6
Frequencies	1	10	23	15	19	9	3

- (a) Show that the mean number of emails per hour in the sample is 3 (1)

The manager believes that the number of emails per hour received could be modelled by a Poisson distribution.

The following table shows some of the expected frequencies.

Number of emails per hour	Expected Frequencies
0	r
1	11.949
2	17.923
3	17.923
4	13.443
5	s
≥ 6	t

- (b) Find the values of r , s and t , giving your answers to 3 decimal places. (4)
- (c) Using a 10% significance level, test whether or not a Poisson model is reasonable. You should clearly state your hypotheses, test statistic and the critical value used. (7)

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Question 6 continued

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7. A market stall sells vegetables. Two of the vegetables sold are broccoli heads and cabbages.

The weights of these broccoli heads, B kilograms, follow a normal distribution

$$B \sim N(0.588, 0.084^2)$$

The weights of these cabbages, C kilograms, follow a normal distribution

$$C \sim N(0.908, 0.039^2)$$

- (a) Find the probability that the total weight of two randomly chosen broccoli heads is less than the weight of a randomly chosen cabbage.

(4)

Broccoli heads cost £2.50 per kg and cabbages cost £3.00 per kg.

Jaymini buys 1 broccoli head and 2 cabbages, chosen randomly.

- (b) Find the probability that she pays more than £7

(4)

The market stall offers a discount for buying 5 or more broccoli heads. The price with the discount is £ w per kg.

Let £ D be the price with the discount of 5 broccoli heads.

- (c) Find, in terms of w , the mean and standard deviation of D

(2)

Given that $P(D < 6) < 0.1$

- (d) find the smallest possible value of w , giving your answer to 2 decimal places.

(4)



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Question 7 continued

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(Total 14 marks)

TOTAL FOR PAPER: 75 MARKS

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