Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International Advanced Level

Centre Number | Candidate Number

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 6 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.
- Good luck with your examination.

Turn over ▶

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1. A plant biologist claims that as the percentage moisture content of the soil in a field increases, so does the percentage plant coverage. He splits the field into equal areas labelled A, B, C, D and E and measures the percentage plant coverage and the percentage moisture content for each area. The results are shown in the table below.

	A	B	C	D	E
Coverage %	10	12	25	0	6
Moisture %	30	20	40	10	25

(a) Calculate Spearman's rank correlation coefficient for these data.

(5)

(b) Stating your hypotheses clearly, test at the 5% level of significance, whether or not these data provide support for the plant biologist's claim.

(4)

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Question 1 continued

(Total for Question 1 is 9 marks)

2. A doctor believes that the diet of her patients and their health are not independent.

She takes a random sample of 200 patients and records whether they are in good health or poor health and whether they have a good diet or a poor diet. The results are summarised in the table below.

	Good health	**Poor health**
Good diet	86	8
Poor diet	91	15

Stating your hypotheses clearly, test the doctor's belief using a 5% level of significance. Show your working for your test statistic and state your critical value clearly.

(9)

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Question 2 continued

(Total for Question 2 is 9 marks)

3. Components are manufactured such that their length in mm is normally distributed with mean μ and variance σ^2. Below is a 95% confidence interval for μ calculated from a random sample of components.

$$(11.52, 13.75)$$

Using the same random sample,

(a) find a 90% confidence interval for μ.

(6)

Four 90% confidence intervals are found from independent random samples.

(b) Calculate the probability that only 3 of these 4 intervals will contain μ.

(2)

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Question 3 continued

(Total for Question 3 is 8 marks)

4. A college runs academic and vocational courses. The college has 1680 academic students and 2520 vocational students.

(a) Describe how a stratified sample of 70 students at the college could be taken.

(3)

All students at the college take a basic skills test. A random sample of 50 academic students has a mean score of 57 and a variance of 60. An independent random sample of 80 vocational students has a mean score of 62 with a variance of 70

(b) Stating your hypotheses clearly, test at the 5% level of significance, whether or not the mean basic skills score for vocational students is greater than the mean basic skills score for academic students.

(7)

(c) Explain the importance of the Central Limit Theorem to the test in part (b).

(2)

(d) State an assumption that is required to carry out the test in part (b).

(1)

All the academic students at the college take a basic skills course. Another random sample of 50 academic students and another independent random sample of 80 vocational students retake the basic skills test. The hypotheses used in part (b) are then tested again at the same level of significance.

The value of the test statistic z is now 1.54

(e) Comment on the mean basic skills scores of academic and vocational students after taking this course.

(2)

(f) Considering the outcomes of the tests in part (b) and part (e), comment on the effectiveness of the basic skills course.

(1)

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Question 4 continued

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Question 4 continued

(Total for Question 4 is 16 marks)

5. A researcher is looking into the effectiveness of a new medicine for the relief of symptoms. He collects random samples of 8 people who are taking the medicine from each of 50 different medical practices. The number of people who say that the medicine is a success, in each sample, is recorded. The results are summarised in the table below.

Number of successes	0	1	2	3	4	5	6	7	8
Number of practices	4	6	3	12	10	7	4	2	2

The researcher decides to model this data using a binomial distribution.

(a) State two necessary assumptions that the researcher made in order to use this model.

(2)

(b) Show that the mean number of successes per sample is 3.54

(2)

He decides to use this mean to calculate expected frequencies. The results are shown in the table below.

Number of successes	0	1	2	3	4	5	6	7	8
Expected frequency	0.47	2.96	8.23	13.07	f	8.23	3.27	0.74	g

(c) Calculate the value of f and the value of g. Give your answers to 2 decimal places.

(4)

(d) Stating your hypotheses clearly, test at the 10% level of significance, whether or not the binomial distribution is a suitable model for the number of successes in samples of 8 people.

(8)

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Question 5 continued

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Question 5 continued

(Total for Question 5 is 16 marks)

6. A baker produces bread buns and bread rolls. The weights of buns, B grams, and the weights of rolls, R grams, are such that $B \sim N(55, 1.3^2)$ and $R \sim N(51, 1.2^2)$

A bun and a roll are selected at random.

(a) Find the probability that the bun weighs less than 110% of the weight of the roll.

(5)

Two buns are chosen at random.

(b) Find the probability that their weights differ by more than 1 gram.

(6)

The baker sells bread in bags. Each bag contains either 10 buns or 11 rolls. The weight of an empty bag, S grams, is such that $S \sim N(3, 0.2^2)$

(c) Find the probability that a bag of buns weighs less than a bag of rolls.

(6)

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Question 6 continued

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Question 6 continued

Question 6 continued

(Total for Question 6 is 17 marks)

TOTAL FOR PAPER: 75 MARKS

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