Cambridge International A Level

Cambridge International Examinations
Cambridge International Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS **9709/72**

Paper 7 Probability & Statistics 2 **(S2)** **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.

This document consists of **11** printed pages and **1** blank page.

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1 **(a)** **(i)** A random variable X has the distribution B(2540, 0.001). Use the Poisson approximation to the binomial distribution to find $P(X > 1)$. [3]

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(ii) Explain why the Poisson approximation is appropriate in this case. [1]

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(b) Two independent random variables, S and T, have distributions Po(2.1) and Po(3.5) respectively. Find the mean and standard deviation of $S + T$. [2]

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2 The number of words in History essays by students at a certain college has mean μ and standard deviation 1420.

(i) The mean number of words in a random sample of 125 History essays was found to be 4820. Calculate a 98% confidence interval for μ. [3]

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(ii) Another random sample of n History essays was taken. Using this sample, a 95% confidence interval for μ was found to be 4700 to 4980, both correct to the nearest integer. Find the value of n. [3]

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3 The masses, m kg, of packets of flour are normally distributed. The mean mass is supposed to be 1.01 kg. A quality control officer measures the masses of a random sample of 100 packets. The results are summarised below.

$$n = 100 \qquad \Sigma m = 98.2 \qquad \Sigma m^2 = 104.52$$

(i) Test at the 5% significance level whether the population mean mass is less than 1.01 kg. [7]

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(ii) Explain whether it was necessary to use the Central Limit theorem in your answer to part **(i)**.
[1]

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4 The random variable X has probability density function given by

$$f(x) = \begin{cases} \dfrac{k}{\sqrt{x}} & 0 < x \leqslant a, \\ 0 & \text{otherwise,} \end{cases}$$

where k and a are constants. It is given that $E(X) = 3$.

(i) Find the value of a and show that $k = \frac{1}{6}$. [7]

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(ii) Find the median of X. [3]

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5 The marks in paper 1 and paper 2 of an examination are denoted by X and Y respectively, where X and Y have the independent continuous distributions $N(56, 6^2)$ and $N(43, 5^2)$ respectively.

(i) Find the probability that a randomly chosen paper 1 mark is more than a randomly chosen paper 2 mark. [5]

(ii) Each candidate's overall mark is M where $M = X + 1.5Y$. The minimum overall mark for grade A is 135. Find the proportion of students who gain a grade A. [5]

6 In a certain factory the number of items per day found to be defective has had the distribution Po(1.03). After the introduction of new quality controls, the management wished to test at the 10% significance level whether the mean number of defective items had decreased. They noted the total number of defective items produced in 5 randomly chosen days. It is assumed that defective items occur randomly and that a Poisson model is still appropriate.

(i) Given that the total number of defective items produced during the 5 days was 2, carry out the test. [6]

(ii) Using another random sample of 5 days the same test is carried out again, with the same significance level. Find the probability of a Type I error. [3]

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(iii) Explain what is meant by a Type I error in this context. [1]

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