Cambridge International A Level

Cambridge Assessment International Education
Cambridge International Advanced Level

CANDIDATE NAME	
CENTRE NUMBER	CANDIDATE NUMBER

2982679507

MATHEMATICS **9709/72**

Paper 7 Probability & Statistics 2 **(S2)** **May/June 2019**

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 in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.
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 **14** printed pages and **2** blank pages.

1 The random variable X has the distribution Po(5).

(i) Find $P(X = 2)$. [1]

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It is given that $P(X = n) = P(X = n + 1)$.

(ii) Write down an equation in n. [1]

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(iii) Hence or otherwise find the value of n. [1]

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2 The random variable X has mean 372 and standard deviation 54.

(i) Describe fully the distribution of the mean of a random sample of 36 values of X. [3]

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(ii) The distribution in part **(i)** might be either exact or approximate. State a condition under which the distribution is exact. [1]

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3 It is claimed that, on average, a particular train journey takes less than 1.9 hours. The times, t hours, taken for this journey on a random sample of 50 days were recorded. The results are summarised below.

$$n = 50 \qquad \Sigma t = 92.5 \qquad \Sigma t^2 = 175.25$$

(i) Calculate unbiased estimates of the population mean and variance. [3]

(ii) Test the claim at the 5% significance level. [5]

4 The heights of a certain variety of plant are normally distributed with mean 110 cm and variance 1050 cm^2. Two plants of this variety are chosen at random. Find the probability that the height of one of these plants is at least 1.5 times the height of the other. [7]

5 The manufacturer of a certain type of biscuit claims that 10% of packets include a free offer printed on the packet. Jyothi suspects that the true proportion is less than 10%. He plans to test the claim by looking at 40 randomly selected packets and, if the number which include the offer is less than 2, he will reject the manufacturer's claim.

(i) State suitable hypotheses for the test. [1]

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(ii) Find the probability of a Type I error. [3]

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On another occasion Jyothi looks at 80 randomly selected packets and finds that exactly 6 include the free offer.

(iii) Calculate an approximate 90% confidence interval for the proportion of packets that include the offer. [3]

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(iv) Use your confidence interval to comment on the manufacturer's claim. [1]

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6 X is a random variable with probability density function given by

$$f(x) = \begin{cases} \dfrac{a}{x^2} & 1 \leqslant x \leqslant b, \\ 0 & \text{otherwise,} \end{cases}$$

where a and b are constants.

(i) Show that $b = \dfrac{a}{a-1}$. [3]

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(ii) Given that the median of X is $\frac{3}{2}$, find the values of a and b. [3]

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(iii) Use your values of a and b from part **(ii)** to find $\mathrm{E}(X)$. [3]

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7 All the seats on a certain daily flight are always sold. The number of passengers who have bought seats but fail to arrive for this flight on a particular day is modelled by the distribution B(320, 0.005).

(i) Explain what the number 320 represents in this context. [1]

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(ii) The total number of passengers who have bought seats but fail to arrive for this flight on 2 randomly chosen days is denoted by X. Use a suitable approximating distribution to find $P(2 < X < 6)$. [3]

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(iii) Justify the use of your approximating distribution. [2]

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After some changes, the airline wishes to test whether the mean number of passengers per day who fail to arrive for this flight has decreased.

(iv) During 5 randomly chosen days, a total of 2 passengers failed to arrive. Carry out the test at the 2.5% significance level. [5]

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Additional Page

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