Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

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2609555932

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 2 **May/June 2022**

1 hour 15 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

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1 **(a)** A javelin thrower noted the lengths of a random sample of 50 of her throws. The sample mean was 72.3 m and an unbiased estimate of the population variance was 64.3 m^2.

Find a 92% confidence interval for the population mean length of throws by this athlete. [3]

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(b) A discus thrower wishes to calculate a 92% confidence interval for the population mean length of his throws. He bases his calculation on his first 50 throws in a week.

Comment on this method. [1]

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2 In the past, the mean height of plants of a particular species has been 2.3 m. A random sample of 60 plants of this species was treated with fertiliser and the mean height of these 60 plants was found to be 2.4 m. Assume that the standard deviation of the heights of plants treated with fertiliser is 0.4 m.

Carry out a test at the 2.5% significance level of whether the mean height of plants treated with fertiliser is greater than 2.3 m. [5]

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3 It is known that 1.8% of children in a certain country have not been vaccinated against measles. A random sample of 200 children in this country is chosen.

(a) Use a suitable approximating distribution to find the probability that there are fewer than 3 children in the sample who have not been vaccinated against measles. [4]

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(b) Justify your approximating distribution. [2]

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4 The number of cars arriving at a certain road junction on a weekday morning has a Poisson distribution with mean 4.6 per minute. Traffic lights are installed at the junction and a council officer wishes to test at the 2% significance level whether there are now fewer cars arriving. He notes the number of cars arriving during a randomly chosen 2-minute period.

(a) State suitable null and alternative hypotheses for the test. [1]

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(b) Find the critical region for the test. [4]

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The officer notes that, during a randomly chosen 2-minute period on a weekday morning, exactly 5 cars arrive at the junction.

(c) Carry out the test. [2]

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(d) State, with a reason, whether it is possible that a Type I error has been made in carrying out the test in part **(c)**. [1]

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The number of cars arriving at another junction on a weekday morning also has a Poisson distribution with mean 4.6 per minute.

(e) Use a suitable approximating distribution to find the probability that more than 300 cars will arrive at this junction in an hour. [3]

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5 A random variable X has probability density function given by

$$f(x) = \begin{cases} \frac{3}{16}(4x - x^2) & 2 \leqslant x \leqslant 4, \\ 0 & \text{otherwise.} \end{cases}$$

(a) Show that $E(X) = \frac{11}{4}$. [3]

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(b) Find $\text{Var}(X)$. [3]

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(c) Given that the median of X is m, find $\mathrm{P}(m < X < 3)$. [3]

6 The masses, in kilograms, of large and small sacks of grain have the distributions N(53, 11) and N(14, 3) respectively.

(a) Find the probability that the mass of a randomly chosen large sack is greater than four times the mass of a randomly chosen small sack. [5]

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(b) A lift can safely carry a maximum mass of 1000 kg.

Find the probability that the lift can safely carry 12 randomly chosen large sacks and 25 randomly chosen small sacks. [5]

7 X is a random variable with distribution Po(2.90). A random sample of 100 values of X is taken.

Find the probability that the sample mean is less than 2.88. [5]

Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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