Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2670890949

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 2 **May/June 2024**

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 **12** pages.

1 A random variable X has the distribution $\mathrm{Po}(145)$.

(a) Use a suitable approximating distribution to calculate $\mathrm{P}(X \leqslant 150)$. [4]

(b) Justify the use of your approximating distribution in this case. [1]

2 Henri wants to choose a random sample from the 804 students at his college. He numbers the students from 1 to 804 and then uses random numbers generated by his calculator. The first 20 random digits produced by his calculator are as follows.

5 6 7 1 0 9 8 4 3 1 0 9 6 6 5 0 2 1 7 6

Henri's first two student numbers are 567 and 109.

(a) Use Henri's digits to find the numbers of the next two students in the sample. [2]

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There were 30 students in Henri's sample. He asked each of them how much time, X hours, they spent on social media each week, on average. He summarised the results as follows.

$$n = 30 \qquad \Sigma x = 610 \qquad \Sigma x^2 = 12405$$

(b) Use this information to calculate an unbiased estimate of the mean of X and show that an unbiased estimate of the variance of X is less than 0.1 . [3]

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(c) Henri's friend claims that Henri has probably made a mistake in his calculation of Σx or Σx^2.

Use your answer to part **(b)** to comment on this claim. [1]

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[Turn over

3 A student wishes to estimate the proportion, p, of students at her college who have exactly one brother. She surveys a random sample of 50 students at her college and finds that 18 of them have exactly one brother. She calculates an approximate α% confidence interval for p and finds that the lower limit of the confidence interval is 0.244 correct to 3 significant figures.

Find α correct to the nearest integer. [4]

4 A random variable X has the distribution N(10, 12). Two independent values of X, denoted by X_1 and X_2, are chosen at random.

(a) Write down the value of $\mathrm{P}(X_1 > X_2)$. [1]

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(b) Find $\mathrm{P}(X_1 > 2X_2 - 3)$. [5]

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5 The number of goals scored by a sports team in the first half of any match has the distribution $X \sim \text{Po}(3.1)$. The number of goals scored by the same team in the second half of any match has the distribution $Y \sim \text{Po}(2.4)$. You may assume that the distributions of X and Y are independent.

(a) Find $\text{P}(X < 4)$. [2]

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(b) Find the probability that, in a randomly chosen match, the team scores at least 5 goals. [3]

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(c) Given that the team scores a total of 5 goals in a randomly chosen match, find the probability that they score exactly 3 goals in the first half. [4]

6 The masses of cereal boxes filled by a certain machine have mean 510 grams. An adjustment is made to the machine and an inspector wishes to test whether the mean mass of cereal boxes filled by the machine has decreased.

After the adjustment is made, he chooses a random sample of 120 cereal boxes. The mean mass of these boxes is found to be 508 grams.

Assume that the standard deviation of the masses is 10 grams.

(a) Test at the 2.5% significance level whether the mean mass of cereal boxes filled by the machine has decreased. [5]

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Later the inspector carries out a similar test at the 2.5% significance level, using the same hypotheses and another 120 randomly chosen cereal boxes.

(b) Given that the mean mass is now actually 506 grams, find the probability of a Type II error. [5]

7 The probability density function, f, of a random variable X is given by

$$f(x) = \begin{cases} k(1+\cos x) & 0 \leqslant x \leqslant \pi, \\ 0 & \text{otherwise,} \end{cases}$$

where k is a constant.

(a) Show that $k = \frac{1}{\pi}$. [3]

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(b) Verify that the median of X lies between 0.83 and 0.84 . [3]

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(c) Find the exact value of $\mathrm{E}(X)$. [4]

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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