Cambridge International A Level

**Cambridge International Examinations**
Cambridge International Advanced Level

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| CANDIDATE NAME | |
| CENTRE NUMBER | CANDIDATE NUMBER |

*0635550837*

**MATHEMATICS** **9709/72**

Paper 7 Probability & Statistics 2 **(S2)** **October/November 2018**

**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 **12** printed pages.




CAMBRIDGE International Examinations

**1** The random variable $X$ has the distribution Po(2.3). Find $P(2 \leqslant X < 5)$. [3]

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**2** The standard deviation of the volume of drink in cans of Koola is 4.8 centilitres. A random sample of 180 cans is taken and the mean volume of drink in these 180 cans is found to be 330.1 centilitres.

**(i)** Calculate a 95% confidence interval for the mean volume of drink in all cans of Koola. Give the end-points of your interval correct to 1 decimal place. [3]

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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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**3** Sugar and flour for making cakes are measured in cups. The mass, in grams, of one cup of sugar has the distribution N(250, 10). The mass, in grams, of one cup of flour has the independent distribution N(160, 9). Each cake contains 2 cups of sugar and 5 cups of flour. Find the probability that the total mass of sugar and flour in one cake exceeds 1310 grams. [5]

**4** The time, $X$ hours, taken by a large number of runners to complete a race is modelled by the probability density function given by

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

where $k$ and $a$ are constants.

**(i)** Show that $k = \dfrac{a+1}{a}$. [3]

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**(ii)** State what the constant $a$ represents in this context. [1]

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Three quarters of the runners take half an hour or less to complete the race.

**(iii)** Find the value of $a$. [3]

**5** The numbers of basketball courts in a random sample of 70 schools in South Mowland are summarised in the table.

| Number of basketball courts | 0 | 1 | 2 | 3 | 4 | >4 |
|---|---|---|---|---|---|---|
| Number of schools | 2 | 28 | 26 | 10 | 4 | 0 |

**(i)** Calculate unbiased estimates for the population mean and variance of the number of basketball courts per school in South Mowland. [4]

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The mean number of basketball courts per school in North Mowland is 1.9.

**(ii)** Test at the 5% significance level whether the mean number of basketball courts per school in South Mowland is less than the mean for North Mowland. [5]

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**(iii)** State, with a reason, which of the errors, Type I or Type II, might have been made in the test in part **(ii)**. [1]

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**6** In the past, Angus found that his train was late on 15% of his daily journeys to work. Following a timetable change, Angus found that out of 60 randomly chosen days, his train was late on 6 days.

**(i)** Test at the 10% significance level whether Angus' train is late less often than it was before the timetable change. [5]

Angus used his random sample to find an $\alpha\%$ confidence interval for the proportion of days on which his train is late. The upper limit of his interval was 0.150, correct to 3 significant figures.

**(ii)** Calculate the value of $\alpha$ correct to the nearest integer. [5]

**7** The independent random variables $X$ and $Y$ have the distributions Po(2.1) and Po(3.5) respectively.

**(i)** Find $P(X + Y = 3)$. [2]

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**(ii)** Given that $X + Y = 3$, find $P(X = 2)$. [3]

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**(iii)** A random sample of 100 values of $X$ is taken. Find the probability that the sample mean is more than 2.2. [6]

## 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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