Cambridge International A Level

Cambridge International Examinations
Cambridge International Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

0634967628

MATHEMATICS **9709/71**

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

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1 A random sample of 75 values of a variable X gave the following results.

$$n = 75 \qquad \Sigma x = 153.2 \qquad \Sigma x^2 = 340.24$$

Find unbiased estimates for the population mean and variance of X. [3]

2 A six-sided die is suspected of bias. The die is thrown 100 times and it is found that the score is 2 on 20 throws. It is given that the probability of obtaining a score of 2 on any throw is p.

(i) Find an approximate 94% confidence interval for p. [3]

(ii) Use your answer to part **(i)** to comment on whether the die may be biased. [1]

3 The number of e-readers sold in a 10-day period in a shop is modelled by the distribution Po(5.1). Use an approximating distribution to find the probability that fewer than 140 e-readers are sold in a 300-day period. [4]

4 The volume, in millilitres, of a small cup of coffee has the distribution N(103.4, 10.2). The volume of a large cup of coffee is 1.5 times the volume of a small cup of coffee.

(i) Find the mean and standard deviation of the volume of a large cup of coffee. [3]

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(ii) Find the probability that the total volume of a randomly chosen small cup of coffee and a randomly chosen large cup of coffee is greater than 250 ml. [4]

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5 The mass, in kilograms, of rocks in a certain area has mean 14.2 and standard deviation 3.1.

(i) Find the probability that the mean mass of a random sample of 50 of these rocks is less than 14.0 kg. [3]

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(ii) Explain whether it was necessary to assume that the population of the masses of these rocks is normally distributed. [1]

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(iii) A geologist suspects that rocks in another area have a mean mass which is less than 14.2 kg. A random sample of 100 rocks in this area has sample mean 13.5 kg. Assuming that the standard deviation for rocks in this area is also 3.1 kg, test at the 2% significance level whether the geologist is correct. [5]

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6 The time, in minutes, taken by people to complete a test is modelled by the continuous random variable X with probability density function given by

$$f(x) = \begin{cases} \dfrac{k}{x^2} & 5 \leqslant x \leqslant 10, \\ 0 & \text{otherwise,} \end{cases}$$

where k is a constant.

(i) Show that $k = 10$. [3]

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(ii) Show that $\mathrm{E}(X) = 10 \ln 2$. [2]

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(iii) Find $P(X > 9)$. [3]

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(iv) Given that $P(X < a) = 0.6$, find a. [3]

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7 The number of absences by girls from a certain class on any day is modelled by a random variable with distribution Po(0.2). The number of absences by boys from the same class on any day is modelled by an independent random variable with distribution Po(0.3).

(i) Find the probability that, during a randomly chosen 2-day period, the total number of absences is less than 3. [3]

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(ii) Find the probability that, during a randomly chosen 5-day period, the number of absences by boys is more than 3. [2]

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(iii) The teacher claims that, during the football season, there are more absences by boys than usual. In order to test this claim at the 5% significance level, he notes the number of absences by boys during a randomly chosen 5-day period during the football season.

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

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(b) State appropriate null and alternative hypotheses and find the probability of a Type I error. [3]

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(c) In fact there were 4 absences by boys during this period. Test the teacher's claim at the 5% significance level. [3]

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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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