Cambridge International A Level

Cambridge International Examinations
Cambridge International Advanced Level

MATHEMATICS **9709/71**

Paper 7 Probability & Statistics 2 **(S2)** **October/November 2015**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

* 9 7 8 9 8 8 4 2 6 0 *

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
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.
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.
Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.

This document consists of **3** printed pages and **1** blank page.

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1 Failures of two computers occur at random and independently. On average the first computer fails 1.2 times per year and the second computer fails 2.3 times per year. Find the probability that the total number of failures by the two computers in a 6-month period is more than 1 and less than 4. [4]

2 The mean and standard deviation of the time spent by people in a certain library are 29 minutes and 6 minutes respectively.

(i) Find the probability that the mean time spent in the library by a random sample of 120 people is more than 30 minutes. [4]

(ii) Explain whether it was necessary to assume that the time spent by people in the library is normally distributed in the solution to part **(i)**. [2]

3 Jagdeesh measured the lengths, x minutes, of 60 randomly chosen lectures. His results are summarised below.

$$n = 60 \qquad \Sigma x = 3420 \qquad \Sigma x^2 = 195\,200$$

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

(ii) Calculate a 98% confidence interval for the population mean. [3]

4 A random variable X has probability density function given by

$$\mathrm{f}(x) = \begin{cases} k(3-x) & 1 \leqslant x \leqslant 2, \\ 0 & \text{otherwise,} \end{cases}$$

where k is a constant.

(i) Show that $k = \frac{2}{3}$. [3]

(ii) Find the median of X. [4]

5 On average, 1 in 2500 adults has a certain medical condition.

(i) Use a suitable approximation to find the probability that, in a random sample of 4000 people, more than 3 have this condition. [3]

(ii) In a random sample of n people, where n is large, the probability that none has the condition is less than 0.05. Find the smallest possible value of n. [4]

6 The weights, in kilograms, of men and women have the distributions $\mathrm{N}(78, 7^2)$ and $\mathrm{N}(66, 5^2)$ respectively.

(i) The maximum load that a certain cable car can carry safely is 1200 kg. If 9 randomly chosen men and 7 randomly chosen women enter the cable car, find the probability that the cable car can operate safely. [5]

(ii) Find the probability that a randomly chosen woman weighs more than a randomly chosen man. [4]

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7 At a certain hospital it was found that the probability that a patient did not arrive for an appointment was 0.2. The hospital carries out some publicity in the hope that this probability will be reduced. They wish to test whether the publicity has worked.

(i) It is suggested that the first 30 appointments on a Monday should be used for the test. Give a reason why this is not an appropriate sample. [1]

A suitable sample of 30 appointments is selected and the number of patients that do not arrive is noted. This figure is used to carry out a test at the 5% significance level.

(ii) Explain why the test is one-tail and state suitable null and alternative hypotheses. [2]

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

(iv) Use the binomial distribution to find the critical region, and find the probability of a Type I error. [5]

(v) In fact 3 patients out of the 30 do not arrive. State the conclusion of the test, explaining your answer. [2]

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