CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Advanced Subsidiary Level
General Certificate of Education Advanced Level

HIGHER MATHEMATICS **8719/7**

MATHEMATICS **9709/7**

PAPER 7 Probability & Statistics 2 **(S2)**

MAY/JUNE SESSION 2002

1 hour 15 minutes

Additional materials:
Answer paper
Graph paper
List of Formulae (MF9)

TIME 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

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.

INFORMATION FOR CANDIDATES

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.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

This question paper consists of 3 printed pages and 1 blank page.

UNIVERSITY *of* CAMBRIDGE
Local Examinations Syndicate

[Turn over

1 The result of a fitness trial is a random variable X which is normally distributed with mean μ and standard deviation 2.4. A researcher uses the results from a random sample of 90 trials to calculate a 98% confidence interval for μ. What is the width of this interval? [4]

2 The manager of a video hire shop wishes to estimate the proportion of videos damaged by customers. He takes a random sample of 120 videos and finds that 33 of them are damaged. Find a 95% confidence interval for the true proportion of videos that are being damaged when hired from this shop. [4]

3 Mary buys 3 packets of sugar and 5 packets of coffee and puts them in her shopping basket, together with her purse which weighs 350 g. Weights of packets of sugar are normally distributed with mean 500 g and standard deviation 20 g. Weights of packets of coffee are normally distributed with mean 200 g and standard deviation 12 g. Find the probability that the total weight in the shopping basket is less than 2900 g. [6]

4 The mean time to mark a certain set of examination papers is estimated by the examination board to be 12 minutes per paper. A random sample of 150 examination papers gave $\Sigma x = 2130$ and $\Sigma x^2 = 37\,746$, where x is the time in minutes to mark an examination paper.

(i) Calculate unbiased estimates of the population mean and variance. [2]

(ii) Stating the null and alternative hypotheses, use a 10% significance level to test whether the examination board's estimated time is consistent with the data. [5]

5 To test whether a coin is biased or not, it is tossed 10 times. The coin will be considered biased if there are 9 or 10 heads, or 9 or 10 tails.

(i) Show that the probability of making a Type I error in this test is approximately 0.0215. [4]

(ii) Find the probability of making a Type II error in this test when the probability of a head is actually 0.7. [4]

6 Between 7 p.m. and 11 p.m., arrivals of patients at the casualty department of a hospital occur at random at an average rate of 6 per hour.

(i) Find the probability that, during any period of one hour between 7 p.m. and 11 p.m., exactly 5 people will arrive. [2]

(ii) A patient arrives at exactly 10.15 p.m. Find the probability that at least one more patient arrives before 10.35 p.m. [3]

(iii) Use a suitable approximation to estimate the probability that fewer than 20 patients arrive at the casualty department between 7 p.m. and 11 p.m. on any particular night. [5]

7 A factory is supplied with grain at the beginning of each week. The weekly demand, X thousand tonnes, for grain from this factory is a continuous random variable having the probability density function given by

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

Find

(i) the mean value of X, [3]

(ii) the variance of X, [3]

(iii) the quantity of grain in tonnes that the factory should have in stock at the beginning of a week, in order to be 98% certain that the demand in that week will be met. [5]

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