UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

MATHEMATICS **9709/71**

Paper 7 Probability & Statistics 2 **(S2)** **May/June 2012**

1 hour 15 minutes

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

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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 a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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 The weights, in grams, of packets of sugar are distributed with mean μ and standard deviation 23. A random sample of 150 packets is taken. The mean weight of this sample is found to be 494 g. Calculate a 98% confidence interval for μ. [3]

2 An examination consists of a written paper and a practical test. The written paper marks (M) have mean 54.8 and standard deviation 16.0. The practical test marks (P) are independent of the written paper marks and have mean 82.4 and standard deviation 4.8. The final mark is found by adding 75% of M to 25% of P. Find the mean and standard deviation of the final marks for the examination. [3]

3 When the council published a plan for a new road, only 15% of local residents approved the plan. The council then published a revised plan and, out of a random sample of 300 local residents, 60 approved the revised plan. Is there evidence, at the 2.5% significance level, that the proportion of local residents who approve the revised plan is greater than for the original plan? [5]

4 The random variable X has probability density function given by

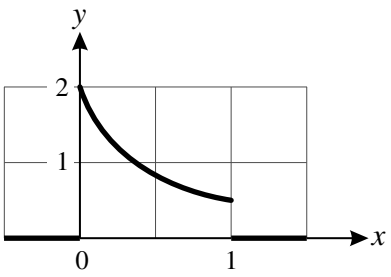
$$\mathrm{f}(x) = \begin{cases} \dfrac{k}{(x+1)^2} & 0 \leqslant x \leqslant 1, \\ 0 & \text{otherwise,} \end{cases}$$

where k is a constant.

(i) Show that $k = 2$. [2]

(ii) Find a such that $\mathrm{P}(X < a) = \frac{1}{5}$. [3]

(iii)



The diagram shows the graph of $y = \mathrm{f}(x)$. The median of X is denoted by m. Use the diagram to explain whether $m < 0.5$, $m = 0.5$ or $m > 0.5$. [2]

5 A random variable X has the distribution Po(3.2).

(i) A random value of X is found.

(a) Find $\mathrm{P}(X \geqslant 3)$. [2]

(b) Find the probability that $X = 3$ given that $X \geqslant 3$. [3]

(ii) Random samples of 120 values of X are taken.

(a) Describe fully the distribution of the sample mean. [2]

(b) Find the probability that the mean of a random sample of size 120 is less than 3.3. [3]

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6 A survey taken last year showed that the mean number of computers per household in Branley was 1.66. This year a random sample of 50 households in Branley answered a questionnaire with the following results.

Number of computers	0	1	2	3	4	> 4
Number of households	5	12	18	10	5	0

(i) Calculate unbiased estimates for the population mean and variance of the number of computers per household in Branley this year. [3]

(ii) Test at the 5% significance level whether the mean number of computers per household has changed since last year. [5]

(iii) Explain whether it is possible that a Type I error may have been made in the test in part **(ii)**. [1]

(iv) State what is meant by a Type II error in the context of the test in part **(ii)**, and give the set of values of the test statistic that could lead to a Type II error being made. [2]

7 At work Jerry receives emails randomly at a constant average rate of 15 emails per hour.

(i) Find the probability that Jerry receives more than 2 emails during a 20-minute period at work. [3]

(ii) Jerry's working day is 8 hours long. Find the probability that Jerry receives fewer than 110 emails per day on each of 2 working days. [4]

(iii) At work Jerry also receives texts randomly and independently at a constant average rate of 1 text every 10 minutes. Find the probability that the total number of emails and texts that Jerry receives during a 5-minute period at work is more than 2 and less than 6. [4]

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