Cambridge International A Level

Cambridge International Examinations
Cambridge International Advanced Level

MATHEMATICS **9709/72**

Paper 7 Probability & Statistics 2 **(S2)** **February/March 2016**

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 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 A fair six-sided die is thrown 20 times and the number of sixes, X, is recorded. Another fair six-sided die is thrown 20 times and the number of odd-numbered scores, Y, is recorded. Find the mean and standard deviation of $X + Y$. [5]

2 Jill shoots arrows at a target. Last week, 65% of her shots hit the target. This week Jill claims that she has improved. Out of her first 20 shots this week, she hits the target with 18 shots. Assuming shots are independent, test Jill's claim at the 1% significance level. [5]

3 In the past, Arvinder has found that the mean time for his journey to work is 35.2 minutes. He tries a different route to work, hoping that this will reduce his journey time. Arvinder decides to take a random sample of 25 journeys using the new route. If the sample mean is less than 34.7 minutes he will conclude that the new route is quicker. Assume that, for the new route, the journey time has a normal distribution with standard deviation 5.6 minutes.

(i) Find the probability that a Type I error occurs. [4]

(ii) Arvinder finds that the sample mean is 34.5 minutes. Explain briefly why it is impossible for him to make a Type II error. [1]

4 The masses, in grams, of large bags of sugar and small bags of sugar are denoted by X and Y respectively, where $X \sim \mathrm{N}(5.1, 0.2^2)$ and $Y \sim \mathrm{N}(2.5, 0.1^2)$. Find the probability that the mass of a randomly chosen large bag is less than twice the mass of a randomly chosen small bag. [5]

5 The 150 oranges in a random sample from a certain supplier were weighed and the masses, X grams, were recorded. The results are summarised below.

$$n = 150 \qquad \Sigma x = 14\,910 \qquad \Sigma x^2 = 1\,525\,000$$

(i) Calculate a 99% confidence interval for the population mean of X. [6]

(ii) The supplier claims that the mean mass of his oranges is 100 grams. Use your answer to part **(i)** to explain whether this claim should be accepted. [1]

(iii) State briefly why the sample should be random. [1]

6 The battery in Sue's phone runs out at random moments. Over a long period, she has found that the battery runs out, on average, 3.3 times in a 30-day period.

(i) Find the probability that the battery runs out fewer than 3 times in a 25-day period. [3]

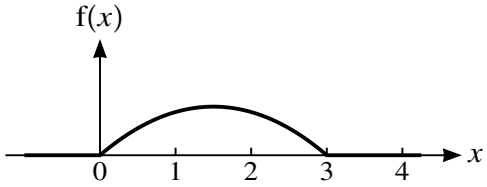
(ii) (a) Use an approximating distribution to find the probability that the battery runs out more than 50 times in a year (365 days). [4]

(b) Justify the approximating distribution used in part **(ii)(a)**. [1]

(iii) Independently of her phone battery, Sue's computer battery also runs out at random moments. On average, it runs out twice in a 15-day period. Find the probability that the total number of times that her phone battery and her computer battery run out in a 10-day period is at least 4. [3]

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7 (a)



The diagram shows the graph of the probability density function, f, of a random variable X, where

$$f(x) = \begin{cases} \frac{2}{9}(3x - x^2) & 0 \leqslant x \leqslant 3, \\ 0 & \text{otherwise.} \end{cases}$$

(i) State the value of $E(X)$ and find $Var(X)$. [4]

(ii) State the value of $P(1.5 \leqslant X \leqslant 4)$. [1]

(iii) Given that $P(1 \leqslant X \leqslant 2) = \frac{13}{27}$, find $P(X > 2)$. [2]

(b) A random variable, W, has probability density function given by

$$g(w) = \begin{cases} aw & 0 \leqslant w \leqslant b, \\ 0 & \text{otherwise,} \end{cases}$$

where a and b are constants. Given that the median of W is 2, find a and b. [4]

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