Cambridge International A Level

Cambridge International Examinations
Cambridge International Advanced Level

CANDIDATE NAME	
CENTRE NUMBER	CANDIDATE NUMBER

9789690418181

MATHEMATICS **9709/72**

Paper 7 Probability & Statistics 2 **(S2)** **February/March 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 **13** printed pages and **3** blank pages.

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1 X is a random variable with mean 4.9 and standard deviation 2.21. A random sample of 75 values of X is taken. Find the probability that the sample mean is greater than 5.0. [3]

2 The number of phone calls arriving in a 10-minute period at a switchboard is modelled by the random variable X which has the distribution Po(4.1). Use an approximating distribution to find the probability that more than 90 calls arrive in a 4-hour period. [5]

3 The heights of plants of type A have mean 1.2 m and standard deviation 0.03 m. A random sample of 5 plants of type A is selected. The sum of the heights of these 5 plants is denoted by H_A m.

(i) Find the mean and variance of H_A. [3]

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The heights of plants of type B have mean 0.6 m and standard deviation 0.02 m. A random sample of 5 plants of type B is selected. The sum of the heights of these 5 plants is denoted by H_B m.

(ii) Find the mean and variance of $H_A - 2H_B$. [4]

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4 A store sells two types of computer, laptops and tablets. The number of laptops sold per hour is modelled by a random variable with distribution Po(0.9). The number of tablets sold per hour is modelled by an independent random variable with distribution Po(1.5).

(i) Find the probability that, during a randomly chosen hour, the total number of laptops and tablets sold in the store is less than 4. [3]

(ii) The manager claims that on sunny Saturdays fewer laptops than usual are sold. In order to test this claim, an employee notes the number of laptops sold during a 4-hour period on a randomly chosen sunny Saturday. In fact only 1 laptop is sold during this period. Test the manager's claim at the 10% significance level. [5]

5 Packets of Frugums contain 30 sweets. The manufacturer claims that, on average, 17% of the sweets are orange flavoured. Angela suspects that the average is actually less than 17%. In order to test the manufacturer's claim, she buys a packet of Frugums. If there are fewer than 3 orange flavoured sweets in the packet, she will conclude that the claim is false.

(i) State appropriate null and alternative hypotheses. [1]

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(ii) Explain what is meant by a Type I error in this situation. [1]

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(iii) Calculate the probability of a Type I error. [3]

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(iv) Given that the true percentage of orange flavoured sweets is 5%, calculate the probability of a Type II error. [3]

6 A random variable X has probability density function given by

$$f(x) = \begin{cases} 6x(1-x) & 0 \leqslant x \leqslant 1, \\ 0 & \text{otherwise.} \end{cases}$$

(i) Find the probability that X does not lie between 0.3 and 0.7. [4]

(ii) Sketch the graph of the probability density function and hence state the value of $\mathrm{E}(X)$. [2]

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(iii) Find $\mathrm{Var}(X)$. [3]

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7 A nutritionist wishes to investigate the mean sugar content in some cereal bars. He takes a random sample of 10 of the bars and measures the mass, in grams, of sugar in each bar. His results are shown below.

11.9 11.7 11.8 11.9 11.6 12.1 11.7 11.9 11.8 11.9

Assume that the mass, in grams, of sugar in bars of this type has the distribution $N(\mu, 0.01)$.

(i) Calculate a 99% confidence interval for μ. [4]

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(ii) Explain whether it was necessary to use the Central Limit theorem in the calculation in part **(i)**. [1]

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(iii) The manufacturer claims that the mean mass of sugar in bars of this type is 11.7 g. Explain why your answer to part **(i)** does not support this claim. [1]

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(iv) The manufacturer suggests that a 95% confidence interval would be more likely to support his claim than a 99% confidence interval. **Without doing a calculation**, explain whether this suggestion is correct. [1]

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(v) It is thought that the value of 0.01 for the population variance may not be correct. Use the values in the sample to calculate an unbiased estimate of the population variance. [3]

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Additional Page

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