Cambridge International A Level

Cambridge Assessment International Education
Cambridge International Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

5733406539

MATHEMATICS **9709/71**

Paper 7 Probability & Statistics 2 **(S2)** **May/June 2019**

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 **12** printed pages.

1 At an internet café, the charge for using a computer is 5 cents per minute. The number of minutes for which people use a computer has mean 23 and standard deviation 8.

(i) Find, in cents, the mean and standard deviation of the amount people pay when using a computer. [2]

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(ii) Each day, 15 people use computers independently. Find, in cents, the mean and standard deviation of the total amount paid by 15 people. [3]

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2 The time, in minutes, that John takes to travel to work has a normal distribution. Last year the mean and standard deviation were 26.5 and 4.8 respectively. This year John uses a different route and he finds that the mean time for his first 150 journeys is 27.5 minutes.

(i) Stating a necessary assumption, test at the 1% significance level whether the mean time for his journey to work has increased. [6]

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(ii) State, with a reason, whether it was necessary to use the Central Limit theorem in your answer to part **(i)**. [1]

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3 Sumitra has a six-sided die. She suspects that it is biased so that it shows a six less often than it would if it were fair. She decides to test the die by throwing it 30 times and noting the number of throws on which it shows a six.

(i) It shows a six on exactly 2 throws. Use a binomial distribution to carry out the test at the 5% significance level. [5]

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(ii) Later, Sumitra repeats the test at the 5% significance level by throwing the die 30 times again. Find the probability of a Type I error in this second test. [2]

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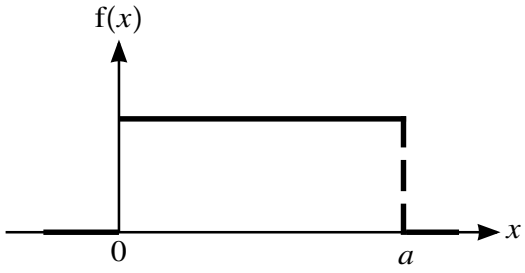
4 (a)



The diagram shows the graph of the probability density function, f, of a random variable X, where a is a constant greater than 0.5. The graph between $x = 0$ and $x = a$ is a straight line parallel to the x-axis.

(i) Find $P(X < 0.5)$ in terms of a. [2]

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(ii) Find $E(X)$ in terms of a. [1]

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(iii) Show that $\text{Var}(X) = \frac{1}{12}a^2$. [2]

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

$$g(t) = \begin{cases} \dfrac{3}{2(t-1)^2} & 2 \leqslant t \leqslant 4, \\ 0 & \text{otherwise.} \end{cases}$$

Find the value of b such that $P(T \leqslant b) = \frac{3}{4}$. [4]

5 **(a)** The random variable X has the distribution Po(2.3).

(i) Find $P(2 \leqslant X \leqslant 4)$. [2]

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(ii) Find the probability that the sum of two independent values of X is greater than 2. [3]

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(iii) The random variable S is the sum of 50 independent values of X. Use a suitable approximating distribution to find $P(S \leqslant 110)$. [4]

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(b) The random variable Y has the distribution Po(λ). Given that P($Y = 3$) = P($Y = 5$), find λ. [3]

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6 Ramesh plans to carry out a survey in order to find out what adults in his town think about local sports facilities. He chooses a random sample from the adult members of a tennis club and gives each of them a questionnaire.

(i) Give a reason why this will not result in Ramesh having a random sample of adults who live in the town. [1]

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(ii) Describe briefly a valid method that Ramesh could use to choose a random sample of adults in the town. [2]

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Ramesh now uses a valid method to choose a random sample of 350 adults from the town. He finds that 47 adults think that the local sports facilities are good.

(iii) Calculate an approximate 90% confidence interval for the proportion of all adults in the town who think that the local sports facilities are good. [4]

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(iv) Ramesh calculates a confidence interval whose width is 1.25 times the width of this 90% confidence interval. Ramesh's new interval is an x% confidence interval. Find the value of x. [3]

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Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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