Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME										
CENTRE NUMBER						CANDIDATE NUMBER				

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MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 2 **May/June 2021**

1 hour 15 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION
- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Any blank pages are indicated.

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1 In a game, a ball is thrown and lands in one of 4 slots, labelled A, B, C and D. Raju wishes to test whether the probability that the ball will land in slot A is $\frac{1}{4}$.

(a) State suitable null and alternative hypotheses for Raju's test. [1]

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The ball is thrown 100 times and it lands in slot A 15 times.

(b) Use a suitable approximating distribution to carry out the test at the 2% significance level. [5]

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2 The random variable X has the distribution $B(400, 0.01)$.

(a) Find $\mathrm{Var}(4X + 2)$. [3]

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(b) **(i)** State an appropriate approximating distribution for X, giving the values of any parameters. Justify your choice of approximating distribution. [2]

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(ii) Use your approximating distribution to find $P(2 \leqslant X \leqslant 5)$. [2]

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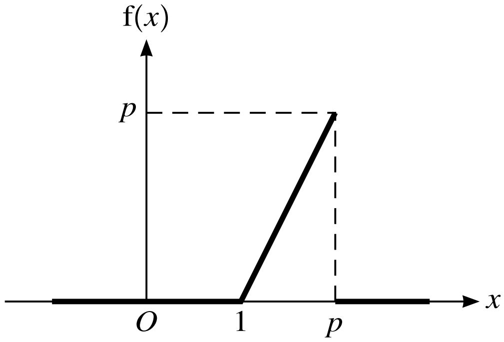

The random variable X takes values in the range $1 \leqslant x \leqslant p$, where p is a constant. The graph of the probability density function of X is shown in the diagram.

(a) Show that $p = 2$. [2]

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(b) Find $\mathrm{E}(X)$. [5]

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4 Wendy's journey to work consists of three parts: walking to the train station, riding on the train and then walking to the office. The times, in minutes, for the three parts of her journey are independent and have the distributions $N(15.0, 1.1^2)$, $N(32.0, 3.5^2)$ and $N(8.6, 1.2^2)$ respectively.

(a) Find the mean and variance of the total time for Wendy's journey. [2]

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If Wendy's journey takes more than 60 minutes, she is late for work.

(b) Find the probability that, on a randomly chosen day, Wendy will be late for work. [3]

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(c) Find the probability that the mean of Wendy's journey times over 15 randomly chosen days will be less than 54.5 minutes. [3]

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5 The time, in minutes, spent by customers at a particular gym has the distribution $N(\mu, 38.2)$. In the past the value of μ has been 42.4. Following the installation of some new equipment the management wishes to test whether the value of μ has changed.

(a) State what is meant by a Type I error in this context. [1]

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(b) The mean time for a sample of 20 customers is found to be 45.6 minutes.

Test at the 2.5% significance level whether the value of μ has changed. [5]

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6 The heights, h centimetres, of a random sample of 100 fully grown animals of a certain species were measured. The results are summarised below.

$$n = 100 \qquad \Sigma h = 7570 \qquad \Sigma h^2 = 588\,050$$

(a) Find unbiased estimates of the population mean and variance. [3]

(b) Calculate a 99% confidence interval for the mean height of animals of this species. [3]

Four random samples were taken and a 99% confidence interval for the population mean, μ, was found from each sample.

(c) Find the probability that all four of these confidence intervals contain the true value of μ. [2]

7 Customers arrive at a particular shop at random times. It has been found that the mean number of customers who arrive during a 5-minute interval is 2.1.

(a) Find the probability that exactly 4 customers arrive during a 10-minute interval. [2]

(b) Find the probability that at least 4 customers arrive during a 20-minute interval. [2]

(c) Use a suitable approximating distribution to find the probability that fewer than 40 customers arrive during a 2-hour interval. [4]

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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.