

[Turn over

- [4]

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- 2 A shop obtains apples from a certain farm. It has been found that 5% of apples from this farm are Grade A. Following a change in growing conditions at the farm, the shop management plan to carry out a hypothesis test to find out whether the proportion of Grade A apples has increased. They select 25 apples at random. If the number of Grade A apples is more than 3 they will conclude that the proportion has increased.

- (a) State suitable null and alternative hypotheses for the test. [1]

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- (b) Find the probability of a Type I error. [3]

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In fact 2 of the 25 apples were Grade A.

- (c) Which of the errors, Type I or Type II, is possible? Justify your answer. [2]

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3 In the data-entry department of a certain firm, it is known that 0.12% of data items are entered incorrectly, and that these errors occur randomly and independently.

(a) A random sample of 3600 data items is chosen. The number of these data items that are incorrectly entered is denoted by X .

(i) State the distribution of X , including the values of any parameters. [1]

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(ii) State an appropriate approximating distribution for X , including the values of any parameters.

Justify your choice of approximating distribution. [3]

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(iii) Use your approximating distribution to find $P(X > 2)$. [2]

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- Use an approximating distribution to find the largest possible value of n . [3]

[illegible]

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|------------|-----|-----|-----|-----|-----|
| x | 0 | 1 | 2 | 3 | 4 |
| $P(X = x)$ | 0.1 | 0.2 | 0.4 | 0.2 | 0.1 |

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[illegible]

- (c) Explain whether it was necessary to use the Central Limit theorem in your answer to part (b).

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- (d) Johann has another, similar, spinner. He suspects that it is biased so that the mean score is less than 2. He spins his spinner 200 times and finds that the mean of the 200 scores is 1.86.

Given that the variance of the score on one spin of this spinner is also 1.2, test Johann's suspicion at the 5% significance level.

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- 5 (a) The random variable X has the distribution $\text{Po}(\lambda)$.

(i) State the values that X can take. [1]

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It is given that $P(X = 1) = 3 \times P(X = 0)$.

(ii) Find λ . [1]

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(iii) Find $P(4 \leq X \leq 6)$. [2]

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- Find μ .

[illegible]

- 6 A random variable X has probability density function given by

$$f(x) = \begin{cases} \frac{k}{x^2} & 1 \leq x \leq a, \\ 0 & \text{otherwise,} \end{cases}$$

where k and a are positive constants.

- (a) Show that $k = \frac{a}{a-1}$. [3]

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- (b) Find $E(X)$ in terms of a . [3]

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(c) Find the 60th percentile of X in terms of a .

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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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