

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Pearson
Edexcel GCE

Centre Number

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Candidate Number

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Monday 24 June 2019

Morning (Time: 1 hour 30 minutes)

Paper Reference **6684/01**

Statistics S2

Advanced/Advanced Subsidiary

You must have:

Mathematical Formulae and Statistical Tables (Pink)

Total Marks

Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B). Coloured pencils and highlighter pens must not be used.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Values from the statistical tables should be quoted in full. When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information

- The total mark for this paper is 75.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Pearson

1. Customers arrive at a bank at a rate of 10 customers per 5 minutes.

John suggests that a Poisson distribution would be a suitable model to describe the number of customers arriving at the bank in a 1-minute interval.

(a) Write down two assumptions that John has made. (2)

Given that the Poisson distribution is a suitable model,

(b) find the probability that in any given 1-minute interval
(i) exactly 2 customers arrive,
(ii) more than 4 customers arrive. (5)

When there is sufficient evidence that the rate of customers arriving at the bank is higher than 10 customers per 5 minutes, the manager must open another service till to avoid long queues.

In a 4-minute interval, the manager observes 9 customers arriving.

(c) Test, at the 5% significance level, whether or not the manager has sufficient evidence to open another service till. State your hypotheses clearly. (5)

(d) Using a 1% significance level, determine the smallest number of customers the manager must observe in a 1-minute interval in order to have sufficient evidence to open another service till. (3)

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Question 1 continued

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2. A random variable X has probability density function

$$f(x) = \begin{cases} \frac{1}{18}(x^2 - 2x + 1) & 1 \leq x < 4 \\ \frac{3}{2} - \frac{x}{4} & 4 \leq x \leq 6 \\ 0 & \text{otherwise} \end{cases}$$

(a) Use algebraic integration to show that $E(X^2) = \frac{329}{20}$ (4)

(b) Given that $E(X) = \frac{95}{24}$

(i) find, to 3 decimal places, the standard deviation of X (2)

(ii) describe, giving a reason, the skewness of the distribution. (2)

(c) Find the cumulative distribution function $F(x)$ for all values of x (5)

(d) Find $P(2 < X < 5)$ (2)

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Question 2 continued

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3. A company sells a variety of bars of chocolate including *Pearchoc* bars. In an attempt to increase the sales of *Pearchoc* bars, the company runs a promotion where any *Pearchoc* wrapper that has the word WINNER printed on the inside wins a prize. The company prints the word WINNER on 5% of *Pearchoc* bar wrappers.

Pearchoc bars are sold in packets of 12

(a) Find the probability that in a randomly selected packet of *Pearchoc* bars, the number of wrappers with the word WINNER printed on them will be

- (i) exactly one,
- (ii) more than two.

(5)

A customer bought 4 packets of *Pearchoc* bars.

(b) Find the probability that only 1 of the packets contained exactly 1 wrapper with the word WINNER printed on it.

(3)

Before the promotion, 4% of all bars of chocolate sold in a supermarket were *Pearchoc* bars. After the promotion, the company selects a random sample of 150 sales of bars of chocolate from the supermarket database and finds that 10 of these sales were *Pearchoc* bars.

(c) Using a suitable approximation and stating your hypotheses clearly, test whether or not the company's promotion has been successful. Use a 5% level of significance.

(6)



Question 3 continued

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Q3

(Total 14 marks)



4. (a) State the condition under which the normal distribution may be used as an approximation to the Poisson distribution. (1)

(b) Explain why a continuity correction must be incorporated when using the normal distribution as an approximation to the Poisson distribution. (1)

Each weekend during the ski season, requests to hire pairs of skis from *Skisea* occur randomly. The mean number of requests to hire pairs of skis for a weekend is 205. During the ski season *Skisea* only has 220 pairs of skis that can be hired for a weekend.

(c) Using a suitable approximation, find the probability that the requests to hire pairs of skis cannot all be met on a particular weekend during the ski season. (6)

During the ski season there are 20 weekends on which a pair of skis can be hired.

(d) Estimate the number of weekends that the company will not be able to meet all the requests to hire pairs of skis. (2)



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Question 4 continued

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Q4

(Total 10 marks)



5. The continuous random variable X is uniformly distributed over the interval $\alpha \leq x \leq \beta$ where α and β are constants.

The mean of X is μ and the standard deviation is σ

Given that $\mu = 20.4$ and $P(X < 23) = \frac{3}{4}$

(a) find the value of α and the value of β (4)

(b) calculate the exact value of $P(\mu - \sigma < X < \mu + \sigma)$ (3)

Susie has 30 m of fencing. She wishes to form a rectangular enclosure of perimeter 30 m. The length, Y metres, of one side of the enclosure is uniformly distributed between 4 m and 12 m.

(c) Find the probability that the length of the longer side of the enclosure is more than 8 m. (5)

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Question 5 continued

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Question 5 continued

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(Total 12 marks)

Q5	
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