Pleasechecktheexaminationdetailsbelowbeforeenteringyourcandidateinformation

Candidatesurname	Othernames

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Time 1 hour 30 minutes

Paper reference **WST02/01**

Mathematics

International Advanced Subsidiary/Advanced Level
Statistics S2

You must have:
Mathematical Formulae and Statistical Tables (Yellow), calculator

TotalMarks

Candidates may use any calculator permitted 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).
- **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. If a calculator is used instead of the tables, the value should be given to an equivalent degree of accuracy.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 6 questions in this question paper. 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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ▶

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1. A research project into food purchases found that 35% of people who buy eggs do **not** buy free range eggs.

A random sample of 30 people who bought eggs is taken. The random variable F denotes the number of people who do **not** buy free range eggs.

(a) Find $P(F \geqslant 12)$

(2)

(b) Find $P(8 \leqslant F < 15)$

(2)

A farm shop gives 3 loyalty points with every purchase of free range eggs. With every purchase of eggs that are **not** free range the farm shop gives 1 loyalty point.
A random sample of 30 customers who buy eggs from the farm shop is taken.

(c) Find the probability that the total number of points given to these customers is less than 70

(3)

The manager of the farm shop believes that the proportion of customers who buy eggs but do **not** buy free range eggs is more than 35%

In a survey of 200 customers who buy eggs, 86 do **not** buy free range eggs.

Using a suitable test and a normal approximation,

(d) determine, at the 5% level of significance, whether there is evidence to support the manager's belief. State your hypotheses clearly.

(7)

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Question 1 continued

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Q1

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2. (i) The continuous random variable X is uniformly distributed over the interval $[a, b]$

Given that $P(8 < X < 14) = \frac{1}{5}$ and $E(X) = 11$

(a) write down $P(X > 14)$

(1)

(b) find $P(6X > a + b)$

(4)

(ii) Susie makes a strip of pasta 45 cm long. She then cuts the strip of pasta, at a randomly chosen point, into two pieces. The random variable S is the length of the shortest piece of pasta.

(a) Write down the distribution of S

(1)

(b) Calculate the probability that the shortest piece of pasta is less than 12 cm long.

(2)

Susie makes 20 strips of pasta, all 45 cm long, and separately cuts each strip of pasta, at a randomly chosen point, into two pieces.

(c) Calculate the probability that exactly 6 of the pieces of pasta are less than 12 cm long.

(3)

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Question 2 continued

Q2

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3. A continuous random variable X has cumulative distribution function

$$F(x) = \begin{cases} 0 & x < 0 \\ 4ax^2 & 0 \leqslant x \leqslant 1 \\ a\left(bx^3 - x^4 + 1\right) & 1 < x \leqslant 3 \\ 1 & x > 3 \end{cases}$$

where a and b are positive constants.

(a) Show that $b = 4$

(1)

(b) Find the exact value of a

(2)

(c) Find $P(X > 2.25)$

(2)

(d) Showing your working clearly,

(i) sketch the probability density function of X
(ii) calculate the mode of X

(5)

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Question 3 continued

Q3

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4. The number of cars entering a safari park per 10-minute period can be modelled by a Poisson distribution with mean 6

(a) Find the probability that in a given 10-minute period exactly 8 cars will enter the safari park.

(2)

(b) Find the smallest value of n such that the probability that at least n cars enter the safari park in 10 minutes is less than 0.05

(2)

The probability that no cars enter the safari park in m minutes, where m is an integer, is less than 0.05

(c) Find the smallest value of m

(2)

A car enters the safari park.

(d) Find the probability that there is less than 5 minutes before the next car enters the safari park.

(3)

Given that exactly 15 cars entered the safari park in a 30-minute period,

(e) find the probability that exactly 1 car entered the safari park in the first 5 minutes of the 30-minute period.

(4)

Aston claims that the mean number of cars entering the safari park per 10-minute period is more than 6
He selects a 15-minute period at random in order to test whether there is evidence to support his claim.

(f) Determine the critical region for the test at the 5% level of significance.

(2)

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Question 4 continued

Q4

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5. A bag contains a large number of counters.

40% of the counters are numbered 1
35% of the counters are numbered 2
25% of the counters are numbered 3

In a game Alif draws two counters at random from the bag. His score is 4 times the number on the first counter minus 2 times the number on the second counter.

(a) Show that Alif gets a score of 8 with probability 0.0875

(1)

(b) Find the sampling distribution of Alif's score.

(5)

(c) Calculate Alif's expected score.

(2)

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Question 5 continued

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6. The continuous random variable Y has probability density function $f(y)$ given by

$$f(y) = \begin{cases} \frac{1}{14}(y+2) & -1 < y \leqslant 1 \\ \frac{3}{14} & 1 < y \leqslant 3 \\ \frac{1}{14}(6-y) & 3 < y \leqslant 5 \\ 0 & \text{otherwise} \end{cases}$$

(a) Sketch the probability density function $f(y)$

(2)

Given that $E(Y^2) = \frac{131}{21}$

(b) find $\text{Var}(2Y - 3)$

(4)

The cumulative distribution function of Y is $F(y)$

(c) Show that $F(y) = \frac{1}{14}\left(\frac{y^2}{2} + 2y + \frac{3}{2}\right)$ for $-1 < y \leqslant 1$

(2)

(d) Find $F(y)$ for all values of y

(5)

(e) Find the exact value of the 30th percentile of Y

(2)

(f) Find $P(4Y \leqslant 5 \mid Y \leqslant 3)$

(2)

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Q6

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TOTAL FOR PAPER: 75 MARKS

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