Write your name here

Surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number | Candidate Number

Statistics S2

Advanced/Advanced Subsidiary

Monday 22 June 2015 – Morning
Time: 1 hour 30 minutes

Paper Reference
WST02/01

You must have:
Mathematical Formulae and Statistical Tables (Blue)

Total Marks

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. 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 ▶

P44847A

5/1/1/

P 4 4 8 4 7 A 0 1 2 4

PEARSON

Leave blank

1. A continuous random variable X has cumulative distribution function

$$F(x) = \begin{cases} 0 & x < 2 \\ \dfrac{1}{20}(x^2 - 4) & 2 \leqslant x \leqslant 4 \\ \dfrac{1}{5}(2x - 5) & 4 < x \leqslant 5 \\ 1 & x > 5 \end{cases}$$

(a) Calculate $P(X > 4)$

(2)

(b) Find the value of a such that $P(3 < X < a) = 0.642$

(4)

(c) Find the probability density function of X, specifying it for all values of x.

(4)

Leave blank

2. A company produces chocolate chip biscuits. The number of chocolate chips per biscuit has a Poisson distribution with mean 8

(a) Find the probability that one of these biscuits, selected at random, does not contain 8 chocolate chips.
(2)

A small packet contains 4 of these biscuits, selected at random.

(b) Find the probability that each biscuit in the packet contains at least 8 chocolate chips.
(3)

A large packet contains 9 of these biscuits, selected at random.

(c) Use a suitable approximation to find the probability that there are more than 75 chocolate chips in the packet.
(5)

A shop sells packets of biscuits, randomly, at a rate of 1.5 packets per hour. Following an advertising campaign, 11 packets are sold in 4 hours.

(d) Test, at the 5% level of significance, whether or not there is evidence that the rate of sales of packets of biscuits has increased. State your hypotheses clearly.
(5)

Leave blank

Question 2 continued

P 4 4 8 4 7 A 0 5 2 4

Turn over

Leave blank

3. A piece of spaghetti has length $2c$, where c is a positive constant. It is cut into two pieces at a random point. The continuous random variable X represents the length of the longer piece and is uniformly distributed over the interval $[c, 2c]$.

(a) Sketch the graph of the probability density function of X

(2)

(b) Use integration to prove that $\text{Var}(X) = \dfrac{c^2}{12}$

(6)

(c) Find the probability that the longer piece is more than twice the length of the shorter piece.

(3)

Leave blank

Question 3 continued

Turn over

Leave blank

4. A single observation x is to be taken from a Poisson distribution with parameter λ

This observation is to be used to test, at a 5% level of significance,

$$H_0: \lambda = k \qquad\qquad H_1: \lambda \neq k$$

where k is a positive integer.

Given that the critical region for this test is $(X = 0) \cup (X \geqslant 9)$

(a) find the value of k, justifying your answer.

(3)

(b) Find the actual significance level of this test.

(2)

Leave blank

5. A bag contains a large number of counters with 35% of the counters having a value of 6 and 65% of the counters having a value of 9

A random sample of size 2 is taken from the bag and the value of each counter is recorded as X_1 and X_2 respectively.

The statistic Y is calculated using the formula

$$Y = \frac{2X_1 + X_2}{3}$$

(a) List all the possible values of Y.

(2)

(b) Find the sampling distribution of Y.

(5)

(c) Find $\mathrm{E}(Y)$.

(2)

Leave blank

6. Past information at a computer shop shows that 40% of customers buy insurance when they purchase a product. In a random sample of 30 customers, X buy insurance.

(a) Write down a suitable model for the distribution of X.

(1)

(b) State an assumption that has been made for the model in part (a) to be suitable.

(1)

The probability that fewer than r customers buy insurance is less than 0.05

(c) Find the largest possible value of r.

(2)

A second random sample, of 100 customers, is taken.

The probability that at least t of these customers buy insurance is 0.938, correct to 3 decimal places.

(d) Using a suitable approximation, find the value of t.

(6)

The shop now offers an extended warranty on all products. Following this, a random sample of 25 customers is taken and 6 of them buy insurance.

(e) Test, at the 10% level of significance, whether or not there is evidence that the proportion of customers who buy insurance has decreased. State your hypotheses clearly.

(5)

Leave blank

Question 6 continued

P 4 4 8 4 7 A 0 1 7 2 4

Turn over

Leave blank

7. A random variable X has probability density function

$$f(x) = \begin{cases} \dfrac{2x}{15} & 0 \leqslant x \leqslant k \\ \dfrac{1}{5}(5 - x) & k < x \leqslant 5 \\ 0 & \text{otherwise} \end{cases}$$

(a) Showing your working clearly, find the value of k.

(5)

(b) Write down the mode of X.

(1)

(c) Find $P\left(X \leqslant \dfrac{k}{2} \,\middle|\, X \leqslant k \right)$

(4)

Leave blank

Question 7 continued