Write your name here

Surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number | Candidate Number

Statistics S2

Advanced/Advanced Subsidiary

Wednesday 25 January 2017 – Afternoon
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

Pearson

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1. The continuous random variable W has the normal distribution $N(32, 4^2)$

(a) Write down the value of $P(W = 36)$

(1)

The discrete random variable X has the binomial distribution $B(20, 0.45)$

(b) Find $P(X = 8)$

(2)

(c) Find the probability that X lies within one standard deviation of its mean.

(4)

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Question 1 continued

Q1

(Total 7 marks)

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2. The continuous random variable X is uniformly distributed over the interval $[\alpha, \beta]$ where $\beta > \alpha$

Given that $\mathrm{E}(X) = 8$

(a) write down an equation involving α and β

(1)

Given also that $\mathrm{P}(X \leqslant 13) = 0.7$

(b) find the value of α and the value of β

(3)

(c) find $\mathrm{Var}(X)$

(1)

(d) find $\mathrm{P}(5 \leqslant X \leqslant 35)$

(2)

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Question 2 continued

Q2

(Total 7 marks)

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

(1)

The number of reported first aid incidents per week at an airport terminal has a Poisson distribution with mean 3.5

(b) Find the modal number of reported first aid incidents in a randomly selected week. Justify your answer.

(2)

The random variable X represents the number of reported first aid incidents at this airport terminal in the next 2 weeks.

(c) Find $P(X > 5)$

(3)

(d) Given that there were exactly 6 reported first aid incidents in a 2 week period, find the probability that exactly 4 were reported in the first week.

(4)

(e) Using a suitable approximation, find the probability that in the next 40 weeks there will be at least 120 reported first aid incidents.

(6)

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Question 3 continued

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Question 3 continued

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Question 3 continued

Q3

(Total 16 marks)

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4. The time, in thousands of hours, that a certain electrical component will last is modelled by the random variable X, with probability density function

$$\mathrm{f}(x) = \begin{cases} \dfrac{3}{64}x^2(4-x) & 0 \leqslant x \leqslant 4 \\ 0 & \text{otherwise} \end{cases}$$

Using this model, find, by algebraic integration,

(a) the mean number of hours that a component will last,

(4)

(b) the standard deviation of X.

(4)

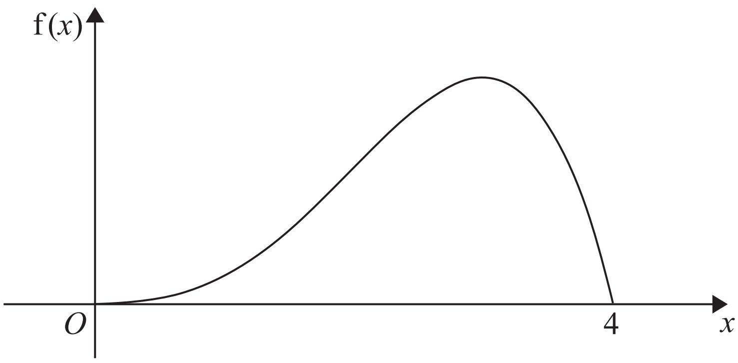

Figure 1

Figure 1 shows a sketch of the probability density function of the random variable X.

(c) Give a reason why the random variable X might be unsuitable as a model for the time, in thousands of hours, that these electrical components will last.

(1)

(d) Sketch a probability density function of a more realistic model.

(1)

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Question 4 continued

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Question 4 continued

Q4

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5. In the manufacture of cloth in a factory, defects occur randomly in the production process at a rate of 2 per 5 m^2

The quality control manager randomly selects 12 pieces of cloth each of area 15 m^2.

(a) Find the probability that exactly half of these 12 pieces of cloth will contain at most 7 defects.
(5)

The factory introduces a new procedure to manufacture the cloth. After the introduction of this new procedure, the manager takes a random sample of 25 m^2 of cloth from the next batch produced to test if there has been any change in the rate of defects.

(b) (i) Write down suitable hypotheses for this test.

(ii) Describe a suitable test statistic that the manager should use.

(iii) Explain what is meant by the critical region for this test.
(3)

(c) Using a 5% level of significance, find the critical region for this test. You should choose the largest critical region for which the probability in each tail is less than 2.5%
(4)

(d) Find the actual significance level for this test.
(2)

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Question 5 continued

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Question 5 continued

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Question 5 continued

Q5

(Total 14 marks)

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6. A seed producer claims that 96% of its bean seeds germinate.

To test the producer's claim, a random sample of 75 bean seeds was planted and 66 of these seeds germinated.

Use a suitable approximation to test, at the 1% level of significance, whether or not the producer is overstating the probability of its bean seeds germinating. State your hypotheses clearly.

(7)

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Question 6 continued

(Total 7 marks)

Q6

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7. The continuous random variable X has probability density function $\mathrm{f}(x)$ given by

$$\mathrm{f}(x) = \begin{cases} \dfrac{1}{20}x^3 & 0 \leqslant x \leqslant 2 \\ \dfrac{1}{10}(6 - x) & 2 < x \leqslant 6 \\ 0 & \text{otherwise} \end{cases}$$

(a) Sketch the graph of $\mathrm{f}(x)$ for all values of x.

(2)

(b) Write down the mode of X.

(1)

(c) Show that $\mathrm{P}(X > 2) = 0.8$

(2)

(d) Define fully the cumulative distribution function $\mathrm{F}(x)$.

(4)

Given that $\mathrm{P}(X < a \mid X > 2) = \dfrac{5}{8}$

(e) find the value of $\mathrm{F}(a)$.

(2)

(f) Hence, or otherwise, find the value of a. Give your answer to 3 significant figures.

(3)

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Question 7 continued

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Question 7 continued

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Question 7 continued

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Question 7 continued

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Q7

(Total 14 marks)

TOTAL FOR PAPER: 75 MARKS

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