Candidate surname	ow before ento	Other names
Pearson Edexcel International Advanced Level	tre Number	Candidate Number
Wednesday 30	Octo	ber 2019
Afternoon (Time: 1 hour 30 minutes)		(WCT02/01
Attendon (Time, I flour 30 fillilutes)	Paper R	Reference WST02/01
Mathematics International Advanced Su Statistics S2		

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.

nstructions

Use **black** ink or ball**p**oint 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 acandidate number.

Answer all questions and ensure that your answers to parts of questions are clearly

Answer the questions in the spaces provided

 $\mathbf{A} \boxtimes$ 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 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.

nformation

⅓ A booklet Mathematical Formulae and Statistical Tables is provided.

There are 7 questions in this question paper. The total mark for this paper is 75.

The marks for **each** question are shown in brackets

 \square use this as a guide as to how much time to spend on each question.

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 ▶





P58508A ©2019 Pearson Education Ltd. 1. The proportion of people in a large population who wear glasses is p.

A random sample of 4 people is taken from the population.

The random variable X represents the number of people in the sample who wear glasses.

(a) Show that
$$P(X > 2) = p^3(4 - 3p)$$

(3)

Given that more than half of the population wear glasses and that the standard deviation of X is 0.96

(b) find
$$P(X > 2)$$

(4)

Given also that more than 2 people in the sample wear glasses,

(c) find the probability that exactly 3 people in the sample wear glasses.

(2)

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Question 1 continued	
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	Q1
(Total 9 marks)	



- 2. The continuous random variable X is uniformly distributed over the interval [-3, 12]
 - (a) Find the upper quartile of X.

(2)

(b) Find P($5 \le X < 14$)

(2)

The continuous random variable Y is uniformly distributed over the interval [a,b] where 0 < a < b

Given that E(X) = E(Y - 3) and Var(X) = 4Var(Y)

(c) find the value of a and the value of b.

(5)

4



Question 2 continued	blank
Question 2 continued	
	Q2
(Total 9 marks)	



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3.	For a particular website, hacking attempts occur randomly at a rate of 0.3 per hour.
	(a) Show that the probability of at least one hacking attempt taking place in a randomly selected one-hour period is 0.259 to 3 significant figures. (2)
	(b) Find the probability that exactly 6 hacking attempts take place in a randomly selected
	24-hour period. (3)
	Following a security update, Saira believes that the rate of hacking attempts on the website has decreased. She records 38 hacking attempts in a 7-day period following the update.
	(c) Comment on Saira's belief by using an appropriate approximation and a suitable test at the 5% level of significance. State your hypotheses clearly. (7)

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Question 3 continued		

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Question 5 continued		
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		Q3
	(Total 12 marks)	
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4. The continuous random variable X has probability density function given by

$$f(x) = \begin{cases} \frac{1}{15}x^2(3-x) & 1 \leqslant x < 3\\ \frac{3}{10}(x-3) & 3 \leqslant x \leqslant 5\\ 0 & \text{otherwise} \end{cases}$$

(a) Use algebraic integration to find $E(X^2)$

(4)

(b) Define fully the cumulative distribution function F(x)

(5)

(c) Find P(2 < X < 4)

(2)

(d) Find, to 3 significant figures, the value of k such that P(X > k) = 0.2

(3)



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Question 4 continued	



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Question 4 continued	
	Q4
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(Total 14 marks)	



5.	A bag contains a large number of 1p coins and 2p coins in the ratio 2:3 respectively.
	A jar contains a large number of 2p coins and 5p coins in the ratio 1:4 respectively.
	Type contains a large number of 2p coms and 3p coms in the ratio 1.4 respectively.
	Two coins are selected at random from the bag and one coin is selected at random from the jar. The random variable <i>T</i> represents the total of the values of the 3 coins selected.
	(a) Find the sampling distribution of <i>T</i> .
	(7)
	(b) Find the sampling distribution of the median of the values of the 3 selected coins. (4)



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Question 5 continued		

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	Question o continued	
		Q5
(Total 11 marks)		
	(Total 11 marks)	



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6.	A machine is designed to cut bolts. The length, in millimetres, of each bolt is uniformly distributed over the interval [39.5, 40.5]
	Bolts longer than 40.45 millimetres cannot be used.
	One bolt is selected at random.
	(a) Find the probability that the bolt can be used. (1)
	In a random sample of 10 bolts,
	(b) find the probability that at least 9 bolts can be used. (3)
	In a random sample of 120 bolts,
	(c) find, using a suitable approximation, the probability that more than 117 bolts can be used.
	(4)

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	b
Question 6 continued	



Question 6 continued	

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	Q6
(Total 8 marks)	



7. Jonathan believes that the time, in minutes, people spend queuing for lunch at a particular fast food restaurant can be modelled using the continuous random variable *X*, which has cumulative distribution function

$$F(x) = \begin{cases} 0 & x < 0 \\ \frac{1}{3125} (25x^4 - 4x^5) & 0 \le x \le 5 \\ 1 & x > 5 \end{cases}$$

(a) Find the mode of X.

(4)

(b) Show that the upper quartile of X is 4.0 to one decimal place.

(3)

Olivia believes that this model overestimates the proportion of queuing times that are more than 4.0 minutes. She takes a random sample of 25 queuing times and finds that 3 of them are more than 4.0 minutes.

Assuming that the model gives a probability of 0.25 that the queuing time is more than 4.0 minutes,

(c) use a suitable test, at the 5% level of significance, to assess Olivia's belief. State your hypotheses clearly.

(5)



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