Surname	Other n	ames
Pearson Edexcel International Advanced Level	Centre Number	Candidate Number
Statistics	<u>S3</u>	
Advanced/Advance		
	a siinsiarv	
Advanced/Advance	a Subsidiary	
Wednesday 20 May 2015 –		Paper Reference WST03/01
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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 names of the 720 members of a swimming club are listed alphabetically in the club's membership book. The chairman of the swimming club wishes to select a systematic sample of 40 names. The names are numbered from 001 to 720 and a number between 001 and w is selected at random. The corresponding name and every xth name thereafter are included in the sample.					
	(a) Find the value of w.					
	(b) Find the value of x.	(1)				
	(c) Write down the probability that the sample includes both the first name and second name in the club's membership book.					
	(d) State one advantage and one disadvantage of systematic sampling in this case.	(1)				

2. Nine dancers, Adilzhan (A), Bianca (B), Chantelle (C), Lee (L), Nikki (N), Ranjit (R), Sergei (S), Thuy (T) and Yana (Y), perform in a dancing competition.

Two judges rank each dancer according to how well they perform. The table below shows the rankings of each judge starting from the dancer with the strongest performance.

Rank	1	2	3	4	5	6	7	8	9
Judge 1	S	N	В	С	T	A	Y	R	L
Judge 2	S	T	N	В	C	Y	L	A	R

(a))	Calculate	Spearman's	rank	correlation	coefficient	for	these	data
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(5)

(b)	Stating your hypotheses	clearly, test at the	1% level	of significance,	whether	or n	01
	the two judges are gener	ally in agreement.					

(4)



3. The number of accidents on a particular stretch of motorway was recorded each day for 200 consecutive days. The results are summarised in the following table.

Number of accidents	0	1	2	3	4	5
Frequency	47	57	46	35	9	6

(a) Show that the mean number of accidents per day for these data is 1.6

(1)

A motorway supervisor believes that the number of accidents per day on this stretch of motorway can be modelled by a Poisson distribution.

She uses the mean found in part (a) to calculate the expected frequencies for this model. Her results are given in the following table.

Number of accidents	0	1	2	3	4	5 or more
Frequency	40.38	64.61	r	27.57	11.03	S

(b) Find the value of r and the value of s, giving your answers to 2 decimal places.

(3)

(c) Stating your hypotheses clearly, use a 10% level of significance to test the motorway supervisor's belief. Show your working clearly.

(7)

estion 3 continued		



4.	A farm produces potatoes. The potatoes are packed into sacks. The weight of a sack of potatoes is modelled by a normal distribution with mean 25.6 kg and standard deviation 0.24 kg	bla
	(a) Find the probability that two randomly chosen sacks of potatoes differ in weight by more than 0.5 kg	
	(6)	
	Sacks of potatoes are randomly selected and packed onto pallets.	
	The weight of an empty pallet is modelled by a normal distribution with mean $20.0~\mathrm{kg}$ and standard deviation $0.32~\mathrm{kg}$	
	Each full pallet of potatoes holds 30 sacks of potatoes.	
	(b) Find the probability that the total weight of a randomly chosen full pallet of potatoes is greater than 785 kg	
	(5)	



5.	A Head of Department at a large university believes that gender is independent of the
	grade obtained by students on a Business Foundation course. A random sample was taken
	of 200 male students and 160 female students who had studied the course.

The results are summarised below.

		Male	Female
	Distinction	18.5%	27.5%
Grade	Merit	63.5%	60.0%
	Unsatisfactory	18.0%	12.5%

	Ulisatisfactor	1 y 1 0.070	12.370	
Stating your h	ypotheses clearly, test the Show your working clear	e Head of Departr	ment's belief using a 5%	6 leve
significance.	Show your working clear	.1у.		

Question 5 continued	



6. As part of an investigation, a random sample was taken of 50 footballers who had completed an obstacle course in the early morning. The time taken by each of these footballers to complete the obstacle course, x minutes, was recorded and the results are summarised by

$$\sum x = 1570$$
 and $\sum x^2 = 49467.58$

(a) Find unbiased estimates for the mean and variance of the time taken by footballers to complete the obstacle course in the early morning.

(4)

An independent random sample was taken of 50 footballers who had completed the same obstacle course in the late afternoon. The time taken by each of these footballers to complete the obstacle course, y minutes, was recorded and the results are summarised as

$$\overline{y} = 30.9$$
 and $s_v^2 = 3.03$

(b) Test, at the 5% level of significance, whether or not the mean time taken by footballers to complete the obstacle course in the early morning, is greater than the mean time taken by footballers to complete the obstacle course in the late afternoon. State your hypotheses clearly.

(7)

(c) Explain the relevance of the Central Limit Theorem to the test in part (b).

(1)

(d) State an assumption you have made in carrying out the test in part (b).

(1)





(b) Find an approximation for the probability that the mean of the 40 scores is less than 3 (3)	(a)	Find the mean and the variance of <i>S</i> .
		(2)
	(b)	

8.	A factory produces steel sheets whose weights X kg, are such that $X \sim N(\mu, \sigma^2)$	ora
	A random sample of these sheets is taken and a 95% confidence interval for μ is found to be (29.74, 31.86)	
	(a) Find, to 2 decimal places, the standard error of the mean. (3)	
	(b) Hence, or otherwise, find a 90% confidence interval for μ based on the same sample of sheets.	
	(3)	
	Using four different random samples, four 90% confidence intervals for μ are to be found.	
	(c) Calculate the probability that at least 3 of these intervals will contain μ . (3)	

