Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Statistics S1

Advanced/Advanced Subsidiary

Wednesday 19 October 2016 – Morning
Time: 1 hour 30 minutes

Paper Reference
WST01/01

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.

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PEARSON

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1. The random variable $X \sim \text{N}(\mu, \sigma^2)$

Given that $\text{P}(X > \mu + a) = 0.35$ where a is a constant, find

(a) $\text{P}(X > \mu - a)$

(1)

(b) $\text{P}(\mu - a < X < \mu + a)$

(2)

(c) $\text{P}(X < \mu + a \mid X > \mu - a)$

(2)

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Question 1 continued

(Total 5 marks)

Q1

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2. The discrete random variable X has probability distribution

x	–2	–1	1	2	3
$P(X = x)$	b	a	a	b	$\frac{1}{5}$

where a and b are constants.

(a) Write down an equation for a and b.

(1)

(b) Calculate $E(X)$.

(2)

Given that $E(X^2) = 3.5$

(c) (i) find a second equation in a and b,

(ii) hence find the value of a and the value of b.

(4)

(d) Find $Var(X)$.

(2)

The random variable $Y = 5 - 3X$

(e) Find $P(Y > 0)$.

(3)

(f) Find

(i) $E(Y)$,

(ii) $Var(Y)$.

(3)

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Question 2 continued

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Question 2 continued

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Question 2 continued

(Total 15 marks)

Q2

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3. Hugo recorded the purchases of 80 customers in the ladies fashion department of a large store. His results were as follows

20 customers bought a coat
12 customers bought a coat and a scarf
23 customers bought a pair of gloves
13 customers bought a pair of gloves and a scarf
no customer bought a coat and a pair of gloves
14 customers did not buy a coat nor a scarf nor a pair of gloves.

(a) Draw a Venn diagram to represent all of this information.

(4)

(b) One of the 80 customers is selected at random.

(i) Find the probability that the customer bought a scarf.

(1)

(ii) Given that the customer bought a coat, find the probability that the customer also bought a scarf.

(2)

(iii) State, giving a reason, whether or not the event 'the customer bought a coat' and the event 'the customer bought a scarf ' are statistically independent.

(2)

Hugo had asked the member of staff selling coats and the member of staff selling gloves to encourage customers also to buy a scarf.

(c) By considering suitable conditional probabilities, determine whether the member of staff selling coats or the member of staff selling gloves has the better performance at selling scarves to their customers. Give a reason for your answer.

(3)

Leave blank

Question 3 continued

Leave blank

Question 3 continued

Question 3 continued

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(Total 12 marks)

Q3

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4. A doctor is studying the scans of 30-week old foetuses. She takes a random sample of 8 scans and measures the length, f mm, of the leg bone called the femur. She obtains the following results.

52 53 56 57 57 59 60 62

(a) Show that $S_{ff} = 80$

(3)

The doctor also measures the head circumference, h mm, of each foetus and her results are summarised as

$$\sum h = 2209 \qquad \sum h^2 = 610\,463 \qquad S_{fh} = 182$$

(b) Find S_{hh}

(2)

(c) Calculate the product moment correlation coefficient between the length of the femur and the head circumference for these data.

(2)

The doctor believes that there is a linear relationship between the length of the femur and the head circumference of 30-week old foetuses.

(d) State, giving a reason, whether or not your calculation in part (c) supports the doctor's belief.

(1)

(e) Find an equation of the regression line of h on f.

(4)

The doctor plans in future to measure the femur length, f, and then use the regression line to estimate the corresponding head circumference, h.

A statistician points out that there will always be the chance of an error between the true head circumference and the estimated value of the head circumference.

Given that the error, E mm, has the normal distribution $N(0, 4^2)$

(f) find the probability that the estimate is within 3 mm of the true value.

(3)

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Question 4 continued

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Question 4 continued

Leave blank

Question 4 continued

(Total 15 marks)

Q4

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5. The label on a jar of Amy's jam states that the jar contains about 400 grams of jam. For each jar that contains less than 388 grams of jam, Amy will be fined £100. If a jar contains more than 410 grams of jam then Amy makes a loss of £0.30 on that jar.

The weight of jam, A grams, in a jar of Amy's jam has a normal distribution with mean μ grams and standard deviation σ grams. Amy chooses μ and σ so that $P(A < 388) = 0.001$ and $P(A > 410) = 0.0197$

(a) Find the value of μ and the value of σ.

(7)

Amy can sell jars of jam containing between 388 grams and 410 grams for a profit of £0.25

(b) Calculate the expected amount, in £s, that Amy receives for each jar of jam.

(4)

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Question 5 continued

Leave blank

Question 5 continued

Leave blank

Question 5 continued

(Total 11 marks)

Q5

Leave blank

6. The stem and leaf diagram gives the blood pressure, x mmHg, for a random sample of 19 female patients.

10	1	2								(2)
11	2	7	7	8	8					(5)
12	0	2	2	3	4	4	5	5	7	(9)
13	1	2	9							(3)

Key: 10 | 1 means blood pressure of 101mmHg

(a) Find the median and the quartiles for these data.

(3)

(b) Find the interquartile range $(Q_3 - Q_1)$

(1)

An outlier is a value that is greater than $Q_3 + 1.5 \times (Q_3 - Q_1)$ or less than $Q_1 - 1.5 \times (Q_3 - Q_1)$

(c) Showing your working clearly, identify any outliers for these data.

(3)

(d) On the grid on page 21 draw a box and whisker plot to represent these data. Show any outliers clearly.

(4)

The above data can be summarised by

$$\sum x = 2299 \quad \text{and} \quad \sum x^2 = 279709$$

(e) Calculate the mean and the standard deviation for these data.

(3)

For a random sample taken from a normal distribution, a rule for determining outliers is:

an outlier is more than 2.7 × standard deviation above or below the mean.

(f) Find the limits to determine outliers using this rule.

(2)

(g) State, giving a reason based on some of the above calculations, whether or not a normal distribution is a suitable model for these data.

(1)

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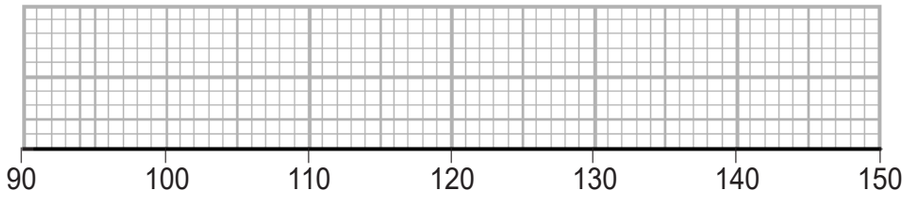
Question 6 continued



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Question 6 continued

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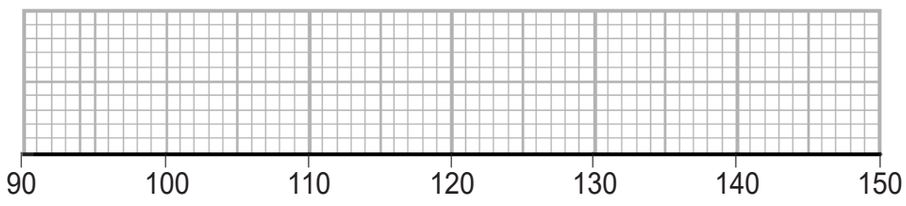
Question 6 continued

Only use this diagram if you need to redraw your plot.



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Question 6 continued

Q6

(Total 17 marks)

TOTAL FOR PAPER: 75 MARKS

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