Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Statistics S2

Advanced/Advanced Subsidiary

Monday 27 June 2016 – 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.

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1. During a typical day, a school website receives visits randomly at a rate of 9 per hour.

The probability that the school website receives fewer than v visits in a randomly selected one hour period is less than 0.75

(a) Find the largest possible value of v

(1)

(b) Find the probability that in a randomly selected one hour period, the school website receives at least 4 but at most 11 visits.

(2)

(c) Find the probability that in a randomly selected 10 minute period, the school website receives more than 1 visit.

(3)

(d) Using a suitable approximation, find the probability that in a randomly selected 8 hour period the school website receives more than 80 visits.

(5)

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Question 1 continued

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2. The random variable $X \sim B(10, p)$

(a) (i) Write down an expression for $P(X = 3)$ in terms of p

(ii) Find the value of p such that $P(X = 3)$ is 16 times the value of $P(X = 7)$

(4)

The random variable $Y \sim Po(\lambda)$

(b) Find the value of λ such that $P(Y = 3)$ is 5 times the value of $P(Y = 5)$

(3)

The random variable $W \sim B(n, 0.4)$

(c) Find the value of n and the value of α such that W can be approximated by the normal distribution, $N(32, \alpha)$

(3)

Leave blank

Question 2 continued

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3. A single observation x is to be taken from $X \sim B(12, p)$

This observation is used to test $H_0: p = 0.45$ against $H_1: p > 0.45$

(a) Using a 5% level of significance, find the critical region for this test.

(2)

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

(1)

The value of the observation is found to be 9

(c) State the conclusion that can be made based on this observation.

(1)

(d) State whether or not this conclusion would change if the same test was carried out at the

(i) 10% level of significance,

(ii) 1% level of significance.

(2)

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4. The waiting times, in minutes, between flight take-offs at an airport are modelled by the continuous random variable X with probability density function

$$f(x) = \begin{cases} \frac{1}{5} & 2 \leqslant x \leqslant 7 \\ 0 & \text{otherwise} \end{cases}$$

(a) Write down the name of this distribution.

(1)

A randomly selected flight takes off at 9 am

(b) Find the probability that the next flight takes off before 9.05 am

(1)

(c) Find the probability that at least 1 of the next 5 flights has a waiting time of more than 6 minutes.

(3)

(d) Find the cumulative distribution function of X, for all x

(3)

(e) Sketch the cumulative distribution function of X for $2 \leqslant x \leqslant 7$

(2)

On foggy days, an extra 2 minutes is added to each waiting time.

(f) Find the mean and variance of the waiting times between flight take-offs on foggy days.

(3)

Leave blank

Question 4 continued

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5. A bag contains a large number of coins. It contains only 1p, 5p and 10p coins. The fraction of 1p coins in the bag is q, the fraction of 5p coins in the bag is r and the fraction of 10p coins in the bag is s.

Two coins are selected at random from the bag and the coin with the highest value is recorded. Let M represent the value of the highest coin.

The sampling distribution of M is given below

m	1	5	10
$P(M = m)$	$\frac{1}{25}$	$\frac{13}{80}$	$\frac{319}{400}$

(a) List all the possible samples of two coins which may be selected.

(2)

(b) Find the value of q, the value of r and the value of s

(7)

Leave blank

Question 5 continued

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6. A continuous random variable X has probability density function

$$f(x) = \begin{cases} ax - bx^2 & 0 \leqslant x \leqslant 2 \\ 0 & \text{otherwise} \end{cases}$$

Given that the mode is 1

(a) show that $a = 2b$

(2)

(b) Find the value of a and the value of b

(5)

(c) Calculate F(1.5)

(2)

(d) State whether the upper quartile of X is greater than 1.5, equal to 1.5, or less than 1.5
Give a reason for your answer.

(2)

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Question 6 continued

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7. Last year 4% of cars tested in a large chain of garages failed an emissions test.

A random sample of n of these cars is taken. The number of cars that fail the test is represented by X

Given that the standard deviation of X is 1.44

(a) (i) find the value of n

(ii) find E(X)

(4)

A random sample of 20 of the cars tested is taken.

(b) Find the probability that all of these cars passed the emissions test.

(1)

Given that at least 1 of these cars failed the emissions test,

(c) find the probability that exactly 3 of these cars failed the emissions test.

(4)

A car mechanic claims that more than 4% of the cars tested at the garage chain this year are failing the emissions test. A random sample of 125 of these cars is taken and 10 of these cars fail the emissions test.

(d) Using a suitable approximation, test whether or not there is evidence to support the mechanic's claim. Use a 5% level of significance and state your hypotheses clearly.

(6)

Leave blank

Question 7 continued