Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number | Candidate Number

Statistics S2

Advanced/Advanced Subsidiary

Monday 27 June 2016 – Morning
Time: 1 hour 30 minutes

Paper Reference
6684/01

You must have:
Mathematical Formulae and Statistical Tables (Pink)

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

P46674A

©2016 Pearson Education Ltd.

1/1/1/

P 4 6 6 7 4 A 0 1 2 8

PEARSON

Leave blank

1. A student is investigating the numbers of cherries in a *Rays* fruit cake. A random sample of *Rays* fruit cakes is taken and the results are shown in the table below.

Number of cherries	0	1	2	3	4	5	$\geqslant 6$
Frequency	24	37	21	12	4	2	0

(a) Calculate the mean and the variance of these data.

(3)

(b) Explain why the results in part (a) suggest that a Poisson distribution may be a suitable model for the number of cherries in a *Rays* fruit cake.

(1)

The number of cherries in a *Rays* fruit cake follows a Poisson distribution with mean 1.5

A *Rays* fruit cake is to be selected at random.

Find the probability that it contains

(c) (i) exactly 2 cherries,

(ii) at least 1 cherry.

(4)

Rays fruit cakes are sold in packets of 5

(d) Show that the probability that there are more than 10 cherries, in total, in a randomly selected packet of *Rays* fruit cakes, is 0.1378 correct to 4 decimal places.

(3)

Twelve packets of *Rays* fruit cakes are selected at random.

(e) Find the probability that exactly 3 packets contain more than 10 cherries.

(3)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 1 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 1 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 1 continued

(Total 14 marks)

Q1

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

2. In a region of the UK, 5% of people have red hair. In a random sample of size n, taken from this region, the expected number of people with red hair is 3

(a) Calculate the value of n.

(2)

A random sample of 20 people is taken from this region.
Find the probability that

(b) (i) exactly 4 of these people have red hair,

(ii) at least 4 of these people have red hair.

(5)

Patrick claims that *Reddman* people have a probability greater than 5% of having red hair.
In a random sample of 50 *Reddman* people, 4 of them have red hair.

(c) Stating your hypotheses clearly, test Patrick's claim. Use a 1% level of significance.

(5)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 2 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 2 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 2 continued

Q2

(Total 12 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

3. The random variable R has a continuous uniform distribution over the interval [5, 9]

(a) Specify fully the probability density function of R.

(1)

(b) Find $P(7 < R < 10)$

(1)

The random variable A is the area of a circle radius R cm.

(c) Find $E(A)$

(4)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 3 continued

Q3

(Total 6 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

4. A continuous random variable X has cumulative distribution function $\mathrm{F}(x)$ given by

$$\mathrm{F}(x) = \begin{cases} 0 & x < 2 \\ k(ax + bx^2 - x^3) & 2 \leqslant x \leqslant 3 \\ 1 & x > 3 \end{cases}$$

Given that the mode of X is $\frac{8}{3}$

(a) show that $b = 8$

(6)

(b) find the value of k.

(4)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 4 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 4 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Leave blank

Question 4 continued

Q4

(Total 10 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

5. In a large school, 20% of students own a touch screen laptop. A random sample of n students is chosen from the school. Using a normal approximation, the probability that more than 55 of these n students own a touch screen laptop is 0.0401 correct to 3 significant figures.

Find the value of n.

(8)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 5 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 5 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 5 continued

Q5

(Total 8 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

6. A bag contains a large number of counters with one of the numbers 4, 6 or 8 written on each of them in the ratio 5 : 3 : 2 respectively.

A random sample of 2 counters is taken from the bag.

(a) List all the possible samples of size 2 that can be taken.

(2)

The random variable M represents the mean value of the 2 counters.
Given that $P(M = 4) = \frac{1}{4}$ and $P(M = 8) = \frac{1}{25}$

(b) find the sampling distribution for M.

(5)

A sample of n sets of 2 counters is taken. The random variable Y represents the number of these n sets that have a mean of 8

(c) Calculate the minimum value of n such that $P(Y \geqslant 1) > 0.9$

(3)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 6 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 6 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 6 continued

Q6

(Total 10 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

7. The weight, X kg, of staples in a bin full of paper has probability density function

$$f(x) = \begin{cases} \dfrac{9x - 3x^2}{10} & 0 \leqslant x < 2 \\ 0 & \text{otherwise} \end{cases}$$

Use integration to find

(a) E(X)

(4)

(b) Var (X)

(4)

(c) P($X > 1.5$)

(3)

Peter raises money by collecting paper and selling it for recycling. A bin full of paper is sold for £50 but if the weight of the staples exceeds 1.5 kg it sells for £25

(d) Find the expected amount of money Peter raises per bin full of paper.

(2)

Peter could remove all the staples before the paper is sold but the time taken to remove the staples means that Peter will have 20% fewer bins full of paper to sell.

(e) Decide whether or not Peter should remove all the staples before selling the bins full of paper. Give a reason for your answer.

(2)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 7 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 7 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 7 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Leave blank

Question 7 continued

Q7

(Total 15 marks)

TOTAL FOR PAPER: 75 MARKS

END

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

P 4 6 6 7 4 A 0 2 8 2 8