Edexcel Maths S2

Past Paper Pack

2005-2013

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	8	4	/	0	1	Signature	

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Wednesday 22 June 2005 – Afternoon

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
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Total	

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Lilac or Green)	Nil

Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration. Thus candidates may NOT use calculators such as the Texas Instruments TI 89, TI 92, Casio CFX 9970G, Hewlett Packard HP 48G.

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Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
Marks for individual questions and parts of questions are shown in round brackets: e.g. **(2)**.
There are 7 questions in this question paper. The total for this question paper is 75.
There are 20 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
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1. It is estimated that 4% of people have green eyes. In a random sample of size n, the expected number of people with green eyes is 5.

(a) Calculate the value of n.

(3)

The expected number of people with green eyes in a second random sample is 3.

(b) Find the standard deviation of the number of people with green eyes in this second sample.

(4)

Leave blank

2. The continuous random variable X is uniformly distributed over the interval [2, 6].

(a) Write down the probability density function f(x).
(2)

Find

(b) E(X),
(1)

(c) Var(X),
(2)

(d) the cumulative distribution function of X, for all x,
(4)

(e) $P(2.3 < X < 3.4)$.
(2)

Leave blank

3. The random variable X is the number of misprints per page in the first draft of a novel.

(a) State two conditions under which a Poisson distribution is a suitable model for X.
(2)

The number of misprints per page has a Poisson distribution with mean 2.5. Find the probability that

(b) a randomly chosen page has no misprints,
(2)

(c) the total number of misprints on 2 randomly chosen pages is more than 7.
(3)

The first chapter contains 20 pages.

(d) Using a suitable approximation find, to 2 decimal places, the probability that the chapter will contain less than 40 misprints.
(7)

Leave blank

Question 3 continued

Leave blank

4. Explain what you understand by

(a) a sampling unit,

(1)

(b) a sampling frame,

(1)

(c) a sampling distribution.

(2)

Q4

(Total 4 marks)

Leave blank

5. In a manufacturing process, 2% of the articles produced are defective. A batch of 200 articles is selected.

(a) Giving a justification for your choice, use a suitable approximation to estimate the probability that there are exactly 5 defective articles.

(5)

(b) Estimate the probability there are less than 5 defective articles.

(2)

Leave blank

6. A continuous random variable X has probability density function f(x) where

$$f(x)=\begin{cases} k(4x-x^3), & 0\leqslant x\leqslant 2,\\ 0, & \text{otherwise,}\end{cases}$$

where k is a positive integer.

(a) Show that $k=\frac{1}{4}$.

(4)

Find

(b) E(X),

(3)

(c) the mode of X,

(3)

(d) the median of X.

(4)

(e) Comment on the skewness of the distribution.

(2)

(f) Sketch f(x).

(2)

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Question 6 continued

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7. A drugs company claims that 75% of patients suffering from depression recover when treated with a new drug.

A random sample of 10 patients with depression is taken from a doctor's records.

(a) Write down a suitable distribution to model the number of patients in this sample who recover when treated with the new drug.
(2)

Given that the claim is correct,

(b) find the probability that the treatment will be successful for exactly 6 patients.
(2)

The doctor believes that the claim is incorrect and the percentage who will recover is lower. From her records she took a random sample of 20 patients who had been treated with the new drug. She found that 13 had recovered.

(c) Stating your hypotheses clearly, test, at the 5% level of significance, the doctor's belief.
(6)

(d) From a sample of size 20, find the greatest number of patients who need to recover for the test in part (c) to be significant at the 1% level.
(4)

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Question 7 continued

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Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Thursday 8 June 2006 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

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1. Before introducing a new rule the secretary of a golf club decided to find out how members might react to this rule.

(a) Explain why the secretary decided to take a random sample of club members rather than ask all the members.

(1)

(b) Suggest a suitable sampling frame.

(1)

(c) Identify the sampling units.

(1)

Q1

(Total 3 marks)

Leave blank

2. The continuous random variable L represents the error, in mm, made when a machine cuts rods to a target length. The distribution of L is continuous uniform over the interval $[-4.0, 4.0]$.

Find

(a) $P(L < -2.6)$,

(1)

(b) $P(L < -3.0 \text{ or } L > 3.0)$.

(2)

A random sample of 20 rods cut by the machine was checked.

(c) Find the probability that more than half of them were within 3.0 mm of the target length.

(4)

Leave blank

3. An estate agent sells properties at a mean rate of 7 per week.

(a) Suggest a suitable model to represent the number of properties sold in a randomly chosen week. Give two reasons to support your model.

(3)

(b) Find the probability that in any randomly chosen week the estate agent sells exactly 5 properties.

(2)

(c) Using a suitable approximation find the probability that during a 24 week period the estate agent sells more than 181 properties.

(6)

Leave blank

Question 3 continued

Leave blank

4. Breakdowns occur on a particular machine at random at a mean rate of 1.25 per week.

(a) Find the probability that fewer than 3 breakdowns occurred in a randomly chosen week.

(4)

Over a 4 week period the machine was monitored. During this time there were 11 breakdowns.

(b) Test, at the 5% level of significance, whether or not there is evidence that the rate of breakdowns has changed over this period. State your hypotheses clearly.

(7)

Leave blank

Question 4 continued

Leave blank

5. A manufacturer produces large quantities of coloured mugs. It is known from previous records that 6% of the production will be green.

A random sample of 10 mugs was taken from the production line.

(a) Define a suitable distribution to model the number of green mugs in this sample.
(1)

(b) Find the probability that there were exactly 3 green mugs in the sample.
(3)

A random sample of 125 mugs was taken.

(c) Find the probability that there were between 10 and 13 (inclusive) green mugs in this sample, using

(i) a Poisson approximation,
(3)

(ii) a Normal approximation.
(6)

Leave blank

Question 5 continued

Leave blank

6. The continuous random variable X has probability density function

$$f(x) = \begin{cases} \dfrac{1+x}{k}, & 1 \leqslant x \leqslant 4, \\ 0, & \text{otherwise.} \end{cases}$$

(a) Show that $k = \dfrac{21}{2}$.

(3)

(b) Specify fully the cumulative distribution function of X.

(5)

(c) Calculate E(X).

(3)

(d) Find the value of the median.

(3)

(e) Write down the mode.

(1)

(f) Explain why the distribution is negatively skewed.

(1)

Leave blank

Question 6 continued

Leave blank

7. It is known from past records that 1 in 5 bowls produced in a pottery have minor defects. To monitor production a random sample of 25 bowls was taken and the number of such bowls with defects was recorded.

(a) Using a 5% level of significance, find critical regions for a two-tailed test of the hypothesis that 1 in 5 bowls have defects. The probability of rejecting, in either tail, should be as close to 2.5% as possible.

(6)

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

(1)

At a later date, a random sample of 20 bowls was taken and 2 of them were found to have defects.

(c) Test, at the 10% level of significance, whether or not there is evidence that the proportion of bowls with defects has decreased. State your hypotheses clearly.

(7)

Leave blank

Question 7 continued

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Candidate No.						6	6	8	4	/	0	1	Signature	

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Tuesday 16 January 2007 – Morning

Time: 1 hour 30 minutes

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Green)	Nil

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Examiner's use only

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1. (a) Define a statistic.

(2)

A random sample $X_1, X_2, \ldots, X_n$ is taken from a population with unknown mean μ.

(b) For each of the following state whether or not it is a statistic.

(i) $\frac{X_1 + X_4}{2}$,

(1)

(ii) $\frac{\sum X^2}{n} - \mu^2$.

(1)

Q1

(Total 4 marks)

Leave blank

2. The random variable J has a Poisson distribution with mean 4.

(a) Find $P(J \geqslant 10)$.

(2)

The random variable K has a binomial distribution with parameters $n = 25$, $p = 0.27$.

(b) Find $P(K \leqslant 1)$.

(3)

Q2

(Total 5 marks)

Leave blank

3. For a particular type of plant 45% have white flowers and the remainder have coloured flowers. Gardenmania sells plants in batches of 12. A batch is selected at random.

Calculate the probability that this batch contains

(a) exactly 5 plants with white flowers,

(3)

(b) more plants with white flowers than coloured ones.

(2)

Gardenmania takes a random sample of 10 batches of plants.

(c) Find the probability that exactly 3 of these batches contain more plants with white flowers than coloured ones.

(3)

Due to an increasing demand for these plants by large companies, Gardenmania decides to sell them in batches of 50.

(d) Use a suitable approximation to calculate the probability that a batch of 50 plants contains more than 25 plants with white flowers.

(7)

Leave blank

Question 3 continued

Leave blank

4. (a) State the condition under which the normal distribution may be used as an approximation to the Poisson distribution.
(1)

(b) Explain why a continuity correction must be incorporated when using the normal distribution as an approximation to the Poisson distribution.
(1)

A company has yachts that can only be hired for a week at a time. All hiring starts on a Saturday.
During the winter the mean number of yachts hired per week is 5.

(c) Calculate the probability that fewer than 3 yachts are hired on a particular Saturday in winter.
(2)

During the summer the mean number of yachts hired per week increases to 25.
The company has only 30 yachts for hire.

(d) Using a suitable approximation find the probability that the demand for yachts cannot be met on a particular Saturday in the summer.
(6)

In the summer there are 16 Saturdays on which a yacht can be hired.

(e) Estimate the number of Saturdays in the summer that the company will not be able to meet the demand for yachts.
(2)

Leave blank

Question 4 continued

Q4

(Total 12 marks)

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5. The continuous random variable X is uniformly distributed over the interval $\alpha < x < \beta$.

(a) Write down the probability density function of X, for all x.

(2)

(b) Given that $E(X) = 2$ and $P(X < 3) = \frac{5}{8}$ find the value of α and the value of β.

(4)

A gardener has wire cutters and a piece of wire 150 cm long which has a ring attached at one end. The gardener cuts the wire, at a randomly chosen point, into 2 pieces. The length, in cm, of the piece of wire with the ring on it is represented by the random variable X. Find

(c) $E(X)$,

(1)

(d) the standard deviation of X,

(2)

(e) the probability that the shorter piece of wire is at most 30 cm long.

(3)

Leave blank

Question 5 continued

Leave blank

6. Past records from a large supermarket show that 20% of people who buy chocolate bars buy the family size bar. On one particular day a random sample of 30 people was taken from those that had bought chocolate bars and 2 of them were found to have bought a family size bar.

(a) Test at the 5% significance level, whether or not the proportion p, of people who bought a family size bar of chocolate that day had decreased. State your hypotheses clearly.

(6)

The manager of the supermarket thinks that the probability of a person buying a gigantic chocolate bar is only 0.02. To test whether this hypothesis is true the manager decides to take a random sample of 200 people who bought chocolate bars.

(b) Find the critical region that would enable the manager to test whether or not there is evidence that the probability is different from 0.02. The probability of each tail should be as close to 2.5% as possible.

(6)

(c) Write down the significance level of this test.

(1)

Leave blank

Question 6 continued

Leave blank

7. The continuous random variable X has cumulative distribution function

$$F(x) = \begin{cases} 0, & x < 0, \\ 2x^2 - x^3, & 0 \leqslant x \leqslant 1, \\ 1, & x > 1. \end{cases}$$

(a) Find $P(X > 0.3)$. **(2)**

(b) Verify that the median value of X lies between $x = 0.59$ and $x = 0.60$. **(3)**

(c) Find the probability density function $f(x)$. **(2)**

(d) Evaluate $E(X)$. **(3)**

(e) Find the mode of X. **(2)**

(f) Comment on the skewness of X. Justify your answer. **(2)**

Leave blank

Question 7 continued

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Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Monday 11 June 2007 – Afternoon

Time: 1 hour 30 minutes

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Team Leader's use only

Question Number	Leave Blank
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Mathematical Formulae (Green)	Nil

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1. A string AB of length 5 cm is cut, in a random place C, into two pieces. The random variable X is the length of AC.

(a) Write down the name of the probability distribution of X and sketch the graph of its probability density function.

(3)

(b) Find the values of $\mathrm{E}(X)$ and $\mathrm{Var}(X)$.

(3)

(c) Find $\mathrm{P}(X > 3)$.

(1)

(d) Write down the probability that AC is 3 cm long.

(1)

Leave blank

2. Bacteria are randomly distributed in a river at a rate of 5 per litre of water. A new factory opens and a scientist claims it is polluting the river with bacteria. He takes a sample of 0.5 litres of water from the river near the factory and finds that it contains 7 bacteria. Stating your hypotheses clearly test, at the 5% level of significance, the claim of the scientist.
(7)

Leave blank

3. An engineering company manufactures an electronic component. At the end of the manufacturing process, each component is checked to see if it is faulty.
Faulty components are detected at a rate of 1.5 per hour.

(a) Suggest a suitable model for the number of faulty components detected per hour.
(1)

(b) Describe, in the context of this question, two assumptions you have made in part (a) for this model to be suitable.
(2)

(c) Find the probability of 2 faulty components being detected in a 1 hour period.
(2)

(d) Find the probability of at least one faulty component being detected in a 3 hour period.
(3)

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4. A bag contains a large number of coins:

75% are 10p coins,

25% are 5p coins.

A random sample of 3 coins is drawn from the bag.
Find the sampling distribution for the median of the values of the 3 selected coins.
(7)

Leave blank

5. (a) Write down the conditions under which the Poisson distribution may be used as an approximation to the Binomial distribution.

(2)

A call centre routes incoming telephone calls to agents who have specialist knowledge to deal with the call. The probability of the caller being connected to the wrong agent is 0.01

(b) Find the probability that 2 consecutive calls will be connected to the wrong agent.

(2)

(c) Find the probability that more than 1 call in 5 consecutive calls are connected to the wrong agent.

(3)

The call centre receives 1000 calls each day.

(d) Find the mean and variance of the number of wrongly connected calls.

(3)

(e) Use a Poisson approximation to find, to 3 decimal places, the probability that more than 6 calls each day are connected to the wrong agent.

(2)

Leave blank

Question 5 continued

Leave blank

6. Linda regularly takes a taxi to work five times a week. Over a long period of time she finds the taxi is late once a week. The taxi firm changes her driver and Linda thinks the taxi is late more often. In the first week, with the new driver, the taxi is late 3 times.

You may assume that the number of times a taxi is late in a week has a Binomial distribution.

Test, at the 5% level of significance, whether or not there is evidence of an increase in the proportion of times the taxi is late. State your hypotheses clearly.

(7)

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7. (a) (i) Write down two conditions for $X \sim \text{Bin}(n, p)$ to be approximated by a normal distribution $Y \sim \text{N}(\mu, \sigma^2)$.

(2)

(ii) Write down the mean and variance of this normal approximation in terms of n and p.

(2)

A factory manufactures 2000 DVDs every day. It is known that 3% of DVDs are faulty.

(b) Using a normal approximation, estimate the probability that at least 40 faulty DVDs are produced in one day.

(5)

The quality control system in the factory identifies and destroys every faulty DVD at the end of the manufacturing process. It costs £0.70 to manufacture a DVD and the factory sells non-faulty DVDs for £11.

(c) Find the expected profit made by the factory per day.

(3)

Leave blank

Question 7 continued

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8. The continuous random variable X has probability density function given by

$$f(x) = \begin{cases} \frac{1}{6}x & 0 < x \leqslant 3 \\ 2 - \frac{1}{2}x & 3 < x < 4 \\ 0 & \text{otherwise} \end{cases}$$

(a) Sketch the probability density function of X.

(3)

(b) Find the mode of X.

(1)

(c) Specify fully the cumulative distribution function of X.

(7)

(d) Using your answer to part (c), find the median of X.

(3)

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Question 8 continued

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6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Tuesday 15 January 2008 – Morning

Time: 1 hour 30 minutes

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1. (a) Explain what you understand by a census.

(1)

Each cooker produced at GT Engineering is stamped with a unique serial number. GT Engineering produces cookers in batches of 2000. Before selling them, they test a random sample of 5 to see what electric current overload they will take before breaking down.

(b) Give one reason, other than to save time and cost, why a sample is taken rather than a census.

(1)

(c) Suggest a suitable sampling frame from which to obtain this sample.

(1)

(d) Identify the sampling units.

(1)

Q1

(Total 4 marks)

Leave blank

2. The probability of a bolt being faulty is 0.3. Find the probability that in a random sample of 20 bolts there are

(a) exactly 2 faulty bolts,

(2)

(b) more than 3 faulty bolts.

(2)

These bolts are sold in bags of 20. John buys 10 bags.

(c) Find the probability that exactly 6 of these bags contain more than 3 faulty bolts.

(3)

Leave blank

3. (a) State two conditions under which a Poisson distribution is a suitable model to use in statistical work.

(2)

The number of cars passing an observation point in a 10 minute interval is modelled by a Poisson distribution with mean 1.

(b) Find the probability that in a randomly chosen 60 minute period there will be

(i) exactly 4 cars passing the observation point,

(ii) at least 5 cars passing the observation point.

(5)

The number of other vehicles, other than cars, passing the observation point in a 60 minute interval is modelled by a Poisson distribution with mean 12.

(c) Find the probability that exactly 1 vehicle, of any type, passes the observation point in a 10 minute period.

(4)

Leave blank

Question 3 continued

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4. The continuous random variable Y has cumulative distribution function F(y) given by

$$\mathrm{F}(y) = \begin{cases} 0 & y < 1 \\ k(y^4 + y^2 - 2) & 1 \leqslant y \leqslant 2 \\ 1 & y > 2 \end{cases}$$

(a) Show that $k = \dfrac{1}{18}$.
(2)

(b) Find P($Y > 1.5$).
(2)

(c) Specify fully the probability density function f(y).
(3)

Leave blank

Question 4 continued

Leave blank

5. Dhriti grows tomatoes. Over a period of time, she has found that there is a probability 0.3 of a ripe tomato having a diameter greater than 4 cm. She decides to try a new fertiliser. In a random sample of 40 ripe tomatoes, 18 have a diameter greater than 4 cm. Dhriti claims that the new fertiliser has increased the probability of a ripe tomato being greater than 4 cm in diameter.

Test Dhriti's claim at the 5% level of significance. State your hypotheses clearly.

(7)

Leave blank

6. The probability that a sunflower plant grows over 1.5 metres high is 0.25. A random sample of 40 sunflower plants is taken and each sunflower plant is measured and its height recorded.

(a) Find the probability that the number of sunflower plants over 1.5 m high is between 8 and 13 (inclusive) using

(i) a Poisson approximation,

(ii) a Normal approximation.

(10)

(b) Write down which of the approximations used in part (a) is the most accurate estimate of the probability. You must give a reason for your answer.

(2)

Leave blank

Question 6 continued

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7. (a) Explain what you understand by

(i) a hypothesis test,

(ii) a critical region.

(3)

During term time, incoming calls to a school are thought to occur at a rate of 0.45 per minute. To test this, the number of calls during a random 20 minute interval, is recorded.

(b) Find the critical region for a two-tailed test of the hypothesis that the number of incoming calls occurs at a rate of 0.45 per 1 minute interval. The probability in each tail should be as close to 2.5% as possible.

(5)

(c) Write down the actual significance level of the above test.

(1)

In the school holidays, 1 call occurs in a 10 minute interval.

(d) Test, at the 5% level of significance, whether or not there is evidence that the rate of incoming calls is less during the school holidays than in term time.

(5)

Leave blank

Question 7 continued

Leave blank

8. The continuous random variable X has probability density function f(x) given by

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

(a) Sketch f(x) for all values of x.

(3)

(b) Write down the mode of X.

(1)

Find

(c) E(X),

(3)

(d) the median of X.

(4)

(e) Comment on the skewness of this distribution. Give a reason for your answer.

(2)

Leave blank

Question 8 continued

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	8	4	/	0	1	Signature	

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Friday 23 May 2008 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
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Total	

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Green)	Nil

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1. Jean regularly takes a break from work to go to the post office. The amount of time Jean waits in the queue to be served at the post office has a continuous uniform distribution between 0 and 10 minutes.

(a) Find the mean and variance of the time Jean spends in the post office queue. **(3)**

(b) Find the probability that Jean does not have to wait more than 2 minutes. **(2)**

Jean visits the post office 5 times.

(c) Find the probability that she never has to wait more than 2 minutes. **(2)**

Jean is in the queue when she receives a message that she must return to work for an urgent meeting. She can only wait in the queue for a further 3 minutes.

Given that Jean has already been queuing for 5 minutes,

(d) find the probability that she must leave the post office queue without being served. **(3)**

Leave blank

Question 1 continued

Leave blank

2. In a large college 58% of students are female and 42% are male. A random sample of 100 students is chosen from the college. Using a suitable approximation find the probability that more than half the sample are female.

(7)

Leave blank

3. A test statistic has a Poisson distribution with parameter λ.

Given that

$$H_0 : \lambda = 9, \; H_1 : \lambda \neq 9$$

(a) find the critical region for the test statistic such that the probability in each tail is as close as possible to 2.5%.

(3)

(b) State the probability of incorrectly rejecting H_0 using this critical region.

(2)

Leave blank

4. Each cell of a certain animal contains 11000 genes. It is known that each gene has a probability 0.0005 of being damaged.

A cell is chosen at random.

(a) Suggest a suitable model for the distribution of the number of damaged genes in the cell.
(2)

(b) Find the mean and variance of the number of damaged genes in the cell.
(2)

(c) Using a suitable approximation, find the probability that there are at most 2 damaged genes in the cell.
(4)

Leave blank

Question 4 continued

5. Sue throws a fair coin 15 times and records the number of times it shows a head.

(a) State the distribution to model the number of times the coin shows a head.
(2)

Find the probability that Sue records

(b) exactly 8 heads,
(2)

(c) at least 4 heads.
(2)

Sue has a different coin which she believes is biased in favour of heads. She throws the coin 15 times and obtains 13 heads.

(d) Test Sue's belief at the 1% level of significance. State your hypotheses clearly.
(6)

Leave blank

Question 5 continued

Leave blank

6. A call centre agent handles telephone calls at a rate of 18 per hour.

(a) Give two reasons to support the use of a Poisson distribution as a suitable model for the number of calls per hour handled by the agent.
(2)

(b) Find the probability that in any randomly selected 15 minute interval the agent handles

(i) exactly 5 calls,

(ii) more than 8 calls.
(5)

The agent received some training to increase the number of calls handled per hour. During a randomly selected 30 minute interval after the training the agent handles 14 calls.

(c) Test, at the 5% level of significance, whether or not there is evidence to support the suggestion that the rate at which the agent handles calls has increased. State your hypotheses clearly.
(6)

Leave blank

Question 6 continued

Leave blank

7. A random variable X has probability density function given by

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

where k is a constant.

(a) Show that $k = \frac{1}{5}$ **(4)**

(b) Calculate the mean of X. **(4)**

(c) Specify fully the cumulative distribution function F(x). **(7)**

(d) Find the median of X. **(3)**

(e) Comment on the skewness of the distribution of X. **(2)**

Leave blank

Question 7 continued

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	8	4	/	0	1	Signature	

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Wednesday 21 January 2009 – Afternoon

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
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Materials required for examination
Mathematical Formulae (Green)

Items included with question papers
Nil

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1. A botanist is studying the distribution of daisies in a field. The field is divided into a number of equal sized squares. The mean number of daisies per square is assumed to be 3. The daisies are distributed randomly throughout the field.

Find the probability that, in a randomly chosen square there will be

(a) more than 2 daisies,

(3)

(b) either 5 or 6 daisies.

(2)

The botanist decides to count the number of daisies, x, in each of 80 randomly selected squares within the field. The results are summarised below

$$\sum x = 295 \qquad \sum x^2 = 1386$$

(c) Calculate the mean and the variance of the number of daisies per square for the 80 squares. Give your answers to 2 decimal places.

(3)

(d) Explain how the answers from part (c) support the choice of a Poisson distribution as a model.

(1)

(e) Using your mean from part (c), estimate the probability that exactly 4 daisies will be found in a randomly selected square.

(2)

Leave blank

Question 1 continued

Leave blank

2. The continuous random variable X is uniformly distributed over the interval [–2, 7].

(a) Write down fully the probability density function f(x) of X.

(2)

(b) Sketch the probability density function f(x) of X.

(2)

Find

(c) $E(X^2)$,

(3)

(d) $P(-0.2 < X < 0.6)$.

(2)

Leave blank

3. A single observation x is to be taken from a Binomial distribution $B(20, p)$.

This observation is used to test $H_0 : p = 0.3$ against $H_1 : p \neq 0.3$

(a) Using a 5% level of significance, find the critical region for this test.
The probability of rejecting either tail should be as close as possible to 2.5%.
(3)

(b) State the actual significance level of this test.
(2)

The actual value of x obtained is 3.

(c) State a conclusion that can be drawn based on this value giving a reason for your answer.
(2)

Leave blank

4. The length of a telephone call made to a company is denoted by the continuous random variable T. It is modelled by the probability density function

$$f(t) = \begin{cases} kt & 0 \leqslant t \leqslant 10 \\ 0 & \text{otherwise} \end{cases}$$

(a) Show that the value of k is $\frac{1}{50}$.
(3)

(b) Find $P(T > 6)$.
(2)

(c) Calculate an exact value for $E(T)$ and for $Var(T)$.
(5)

(d) Write down the mode of the distribution of T.
(1)

It is suggested that the probability density function, $f(t)$, is not a good model for T.

(e) Sketch the graph of a more suitable probability density function for T.
(1)

Leave blank

Question 4 continued

Leave blank

5. A factory produces components of which 1% are defective. The components are packed in boxes of 10. A box is selected at random.

(a) Find the probability that the box contains exactly one defective component.

(2)

(b) Find the probability that there are at least 2 defective components in the box.

(3)

(c) Using a suitable approximation, find the probability that a batch of 250 components contains between 1 and 4 (inclusive) defective components.

(4)

Leave blank

6. A web server is visited on weekdays, at a rate of 7 visits per minute. In a random one minute on a Saturday the web server is visited 10 times.

(a) (i) Test, at the 10% level of significance, whether or not there is evidence that the rate of visits is greater on a Saturday than on weekdays. State your hypotheses clearly.

(ii) State the minimum number of visits required to obtain a significant result.

(7)

(b) State an assumption that has been made about the visits to the server.

(1)

In a random two minute period on a Saturday the web server is visited 20 times.

(c) Using a suitable approximation, test at the 10% level of significance, whether or not the rate of visits is greater on a Saturday.

(6)

Leave blank

Question 6 continued

Leave blank

7. A random variable X has probability density function given by

$$f(x) = \begin{cases} -\frac{2}{9}x + \frac{8}{9} & 1 \leqslant x \leqslant 4 \\ 0 & \text{otherwise} \end{cases}$$

(a) Show that the cumulative distribution function $F(x)$ can be written in the form $ax^2 + bx + c$, for $1 \leqslant x \leqslant 4$ where a, b and c are constants.

(3)

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

(2)

(c) Show that the upper quartile of X is 2.5 and find the lower quartile.

(6)

Given that the median of X is 1.88

(d) describe the skewness of the distribution. Give a reason for your answer.

(2)

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Question 7 continued

Centre No.					
Candidate No.					

Paper Reference

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Surname | Initial(s)

Signature

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Monday 1 June 2009 – Morning

Time: 1 hour 30 minutes

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Team Leader's use only

Question Number	Leave Blank
1	
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Materials required for examination
Mathematical Formulae (Orange or Green)

Items included with question papers
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1. A bag contains a large number of counters of which 15% are coloured red. A random sample of 30 counters is selected and the number of red counters is recorded.

(a) Find the probability of no more than 6 red counters in this sample.

(2)

A second random sample of 30 counters is selected and the number of red counters is recorded.

(b) Using a Poisson approximation, estimate the probability that the total number of red counters in the combined sample of size 60 is less than 13.

(3)

Leave blank

2. An effect of a certain disease is that a small number of the red blood cells are deformed. Emily has this disease and the deformed blood cells occur randomly at a rate of 2.5 per ml of her blood. Following a course of treatment, a random sample of 2 ml of Emily's blood is found to contain only 1 deformed red blood cell.

Stating your hypotheses clearly and using a 5% level of significance, test whether or not there has been a decrease in the number of deformed red blood cells in Emily's blood.

(6)

Leave blank

3. A random sample $X_1, X_2, \ldots X_n$ is taken from a population with unknown mean μ and unknown variance σ^2. A statistic Y is based on this sample.

(a) Explain what you understand by the statistic Y.

(2)

(b) Explain what you understand by the sampling distribution of Y.

(1)

(c) State, giving a reason which of the following is **not** a statistic based on this sample.

(i) $\sum_{i=1}^{n} \frac{(X_i - \bar{X})^2}{n}$ (ii) $\sum_{i=1}^{n} \left(\frac{X_i - \mu}{\sigma}\right)^2$ (iii) $\sum_{i=1}^{n} X_i^2$

(2)

Leave blank

4. Past records suggest that 30% of customers who buy baked beans from a large supermarket buy them in single tins. A new manager questions whether or not there has been a change in the proportion of customers who buy baked beans in single tins. A random sample of 20 customers who had bought baked beans was taken.

(a) Using a 10% level of significance, find the critical region for a two-tailed test to answer the manager's question. You should state the probability of rejection in each tail which should be less than 0.05.

(5)

(b) Write down the actual significance level of a test based on your critical region from part (a).

(1)

The manager found that 11 customers from the sample of 20 had bought baked beans in single tins.

(c) Comment on this finding in the light of your critical region found in part (a).

(2)

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Question 4 continued

Q4

(Total 8 marks)

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5. An administrator makes errors in her typing randomly at a rate of 3 errors every 1000 words.

(a) In a document of 2000 words find the probability that the administrator makes 4 or more errors.

(3)

The administrator is given an 8000 word report to type and she is told that the report will only be accepted if there are 20 or fewer errors.

(b) Use a suitable approximation to calculate the probability that the report is accepted.

(7)

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Question 5 continued

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6. The three independent random variables A, B and C each has a continuous uniform distribution over the interval [0, 5].

(a) Find $\mathrm{P}(A > 3)$.
(1)

(b) Find the probability that A, B and C are all greater than 3.
(2)

The random variable Y represents the maximum value of A, B and C.

The cumulative distribution function of Y is

$$\mathrm{F}(y) = \begin{cases} 0 & y < 0 \\ \dfrac{y^3}{125} & 0 \leqslant y \leqslant 5 \\ 1 & y > 5 \end{cases}$$

(c) Find the probability density function of Y.
(2)

(d) Sketch the probability density function of Y.
(2)

(e) Write down the mode of Y.
(1)

(f) Find $\mathrm{E}(Y)$.
(3)

(g) Find $\mathrm{P}(Y > 3)$.
(2)

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Question 6 continued

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7.

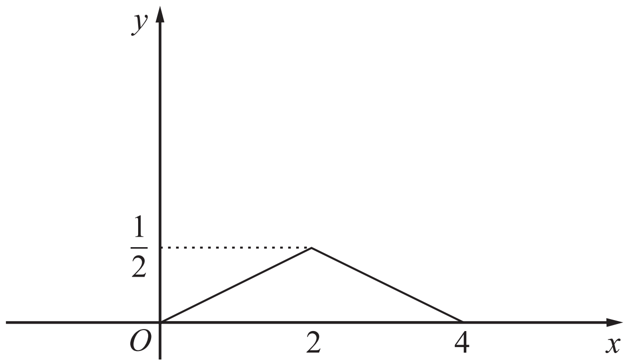

Figure 1

Figure 1 shows a sketch of the probability density function f(x) of the random variable X. The part of the sketch from $x = 0$ to $x = 4$ consists of an isosceles triangle with maximum at (2, 0.5).

(a) Write down E(X).

(1)

The probability density function f(x) can be written in the following form.

$$f(x) = \begin{cases} ax & 0 \leqslant x < 2 \\ b - ax & 2 \leqslant x \leqslant 4 \\ 0 & \text{otherwise} \end{cases}$$

(b) Find the values of the constants a and b.

(2)

(c) Show that σ, the standard deviation of X, is 0.816 to 3 decimal places.

(7)

(d) Find the lower quartile of X.

(3)

(e) State, giving a reason, whether $P(2 - \sigma < X < 2 + \sigma)$ is more or less than 0.5

(2)

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Question 7 continued

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8. A cloth manufacturer knows that faults occur randomly in the production process at a rate of 2 every 15 metres.

(a) Find the probability of exactly 4 faults in a 15 metre length of cloth.
(2)

(b) Find the probability of more than 10 faults in 60 metres of cloth.
(3)

A retailer buys a large amount of this cloth and sells it in pieces of length x metres. He chooses x so that the probability of no faults in a piece is 0.80

(c) Write down an equation for x and show that $x = 1.7$ to 2 significant figures.
(4)

The retailer sells 1200 of these pieces of cloth. He makes a profit of 60p on each piece of cloth that does not contain a fault but a loss of £1.50 on any pieces that do contain faults.

(d) Find the retailer's expected profit.
(4)

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Question 8 continued

Centre No.						Paper Reference	Surname	Initial(s)
Candidate No.						6 6 8 4 / 0 1	Signature	

Paper Reference(s)

6684/01
Edexcel GCE
Statistics S2
Advanced/Advanced Subsidiary
Tuesday 19 January 2010 – Morning

Time: 1 hour 30 minutes

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Team Leader's use only

Question Number	Leave Blank
1	
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Total	

Materials required for examination
Mathematical Formulae (Pink or Green)

Items included with question papers
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1. A manufacturer supplies DVD players to retailers in batches of 20. It has 5% of the players returned because they are faulty.

(a) Write down a suitable model for the distribution of the number of faulty DVD players in a batch.
(2)

Find the probability that a batch contains

(b) no faulty DVD players,
(2)

(c) more than 4 faulty DVD players.
(2)

(d) Find the mean and variance of the number of faulty DVD players in a batch.
(2)

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2. A continuous random variable X has cumulative distribution function

$$\mathrm{F}(x) = \begin{cases} 0, & x < -2 \\ \dfrac{x+2}{6}, & -2 \leqslant x \leqslant 4 \\ 1, & x > 4 \end{cases}$$

(a) Find $\mathrm{P}(X < 0)$.

(2)

(b) Find the probability density function $\mathrm{f}(x)$ of X.

(3)

(c) Write down the name of the distribution of X.

(1)

(d) Find the mean and the variance of X.

(3)

(e) Write down the value of $\mathrm{P}(X = 1)$.

(1)

Leave blank

Question 2 continued

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3. A robot is programmed to build cars on a production line. The robot breaks down at random at a rate of once every 20 hours.

(a) Find the probability that it will work continuously for 5 hours without a breakdown.
(3)

Find the probability that, in an 8 hour period,

(b) the robot will break down at least once,
(3)

(c) there are exactly 2 breakdowns.
(2)

In a particular 8 hour period, the robot broke down twice.

(d) Write down the probability that the robot will break down in the following 8 hour period. Give a reason for your answer.
(2)

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Question 3 continued

Leave blank

4. The continuous random variable X has probability density function f(x) given by

$$f(x) = \begin{cases} k(x^2 - 2x + 2) & 0 < x \leqslant 3 \\ 3k & 3 < x \leqslant 4 \\ 0 & \text{otherwise} \end{cases}$$

where k is a constant.

(a) Show that $k = \frac{1}{9}$ **(4)**

(b) Find the cumulative distribution function F(x). **(6)**

(c) Find the mean of X. **(3)**

(d) Show that the median of X lies between $x = 2.6$ and $x = 2.7$ **(4)**

Leave blank

Question 4 continued

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5. A café serves breakfast every morning. Customers arrive for breakfast at random at a rate of 1 every 6 minutes.

Find the probability that

(a) fewer than 9 customers arrive for breakfast on a Monday morning between 10 am and 11 am.

(3)

The café serves breakfast every day between 8 am and 12 noon.

(b) Using a suitable approximation, estimate the probability that more than 50 customers arrive for breakfast next Tuesday.

(6)

Leave blank

6. (a) Define the critical region of a test statistic.

(2)

A discrete random variable X has a Binomial distribution B(30, p). A single observation is used to test $H_0 : p = 0.3$ against $H_1 : p \neq 0.3$

(b) Using a 1% level of significance find the critical region of this test. You should state the probability of rejection in each tail which should be as close as possible to 0.005

(5)

(c) Write down the actual significance level of the test.

(1)

The value of the observation was found to be 15.

(d) Comment on this finding in light of your critical region.

(2)

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Question 6 continued

Q6

(Total 10 marks)

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7. A bag contains a large number of coins. It contains only 1p and 2p coins in the ratio 1:3

(a) Find the mean μ and the variance σ^2 of the values of this population of coins.
(3)

A random sample of size 3 is taken from the bag.

(b) List all the possible samples.
(2)

(c) Find the sampling distribution of the mean value of the samples.
(6)

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Question 7 continued

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	8	4	/	0	1	Signature	

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Wednesday 9 June 2010 – Afternoon

Time: 1 hour 30 minutes

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Team Leader's use only

Question Number	Leave Blank
1	
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Materials required for examination	Items included with question papers
Mathematical Formulae (Pink)	Nil

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1. Explain what you understand by

(a) a population,

(1)

(b) a statistic.

(1)

A researcher took a sample of 100 voters from a certain town and asked them who they would vote for in an election. The proportion who said they would vote for Dr Smith was 35%.

(c) State the population and the statistic in this case.

(2)

(d) Explain what you understand by the sampling distribution of this statistic.

(1)

Leave blank

2. Bhim and Joe play each other at badminton and for each game, independently of all others, the probability that Bhim loses is 0.2

Find the probability that, in 9 games, Bhim loses

(a) exactly 3 of the games,
(3)

(b) fewer than half of the games.
(2)

Bhim attends coaching sessions for 2 months. After completing the coaching, the probability that he loses each game, independently of all others, is 0.05

Bhim and Joe agree to play a further 60 games.

(c) Calculate the mean and variance for the number of these 60 games that Bhim loses.
(2)

(d) Using a suitable approximation calculate the probability that Bhim loses more than 4 games.
(3)

Leave blank

3. A rectangle has a perimeter of 20 cm. The length, X cm, of one side of this rectangle is uniformly distributed between 1 cm and 7 cm.

Find the probability that the length of the longer side of the rectangle is more than 6 cm long.

(5)

H 3 5 3 9 6 A 0 6 2 4

Leave blank

4. The lifetime, X, in tens of hours, of a battery has a cumulative distribution function F(x) given by

$$F(x) = \begin{cases} 0 & x < 1 \\ \frac{4}{9}(x^2 + 2x - 3) & 1 \leqslant x \leqslant 1.5 \\ 1 & x > 1.5 \end{cases}$$

(a) Find the median of X, giving your answer to 3 significant figures.
(3)

(b) Find, in full, the probability density function of the random variable X.
(3)

(c) Find $P(X \geqslant 1.2)$
(2)

A camping lantern runs on 4 batteries, all of which must be working. Four new batteries are put into the lantern.

(d) Find the probability that the lantern will still be working after 12 hours.
(2)

Leave blank

Question 4 continued

Leave blank

5. A company has a large number of regular users logging onto its website. On average 4 users every hour fail to connect to the company's website at their first attempt.

(a) Explain why the Poisson distribution may be a suitable model in this case.
(1)

Find the probability that, in a randomly chosen **2 hour** period,

(b) (i) all users connect at their first attempt,

(ii) at least 4 users fail to connect at their first attempt.
(5)

The company suffered from a virus infecting its computer system. During this infection it was found that the number of users failing to connect at their first attempt, over a 12 hour period, was 60.

(c) Using a suitable approximation, test whether or not the mean number of users per hour who failed to connect at their first attempt had increased. Use a 5% level of significance and state your hypotheses clearly.
(9)

Leave blank

Question 5 continued

Leave blank

6. A company claims that a quarter of the bolts sent to them are faulty. To test this claim the number of faulty bolts in a random sample of 50 is recorded.

(a) Give two reasons why a binomial distribution may be a suitable model for the number of faulty bolts in the sample.

(2)

(b) Using a 5% significance level, find the critical region for a two-tailed test of the hypothesis that the probability of a bolt being faulty is $\frac{1}{4}$. The probability of rejection in either tail should be as close as possible to 0.025

(3)

(c) Find the actual significance level of this test.

(2)

In the sample of 50 the actual number of faulty bolts was 8.

(d) Comment on the company's claim in the light of this value. Justify your answer.

(2)

The machine making the bolts was reset and another sample of 50 bolts was taken. Only 5 were found to be faulty.

(e) Test at the 1% level of significance whether or not the probability of a faulty bolt has decreased. State your hypotheses clearly.

(6)

Leave blank

Question 6 continued

Leave blank

7. The random variable Y has probability density function f(y) given by

$$f(y) = \begin{cases} ky(a-y) & 0 \leqslant y \leqslant 3 \\ 0 & \text{otherwise} \end{cases}$$

where k and a are positive constants.

(a) (i) Explain why $a \geqslant 3$

(ii) Show that $k = \dfrac{2}{9(a-2)}$

(6)

Given that E(Y) = 1.75

(b) show that $a = 4$ and write down the value of k.

(6)

For these values of a and k,

(c) sketch the probability density function,

(2)

(d) write down the mode of Y.

(1)

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Question 7 continued

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	8	4	/	0	1	Signature	

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Friday 14 January 2011 – Afternoon

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
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Total	

Materials required for examination	Items included with question papers
Mathematical Formulae (Pink)	Nil

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There are 7 questions in this question paper. The total mark for this paper is 75.
There are 24 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

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Answers without working may not gain full credit.

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1. A disease occurs in 3% of a population.

(a) State any assumptions that are required to model the number of people with the disease in a random sample of size n as a binomial distribution.
(2)

(b) Using this model, find the probability of exactly 2 people having the disease in a random sample of 10 people.
(3)

(c) Find the mean and variance of the number of people with the disease in a random sample of 100 people.
(2)

A doctor tests a random sample of 100 patients for the disease. He decides to offer all patients a vaccination to protect them from the disease if more than 5 of the sample have the disease.

(d) Using a suitable approximation, find the probability that the doctor will offer all patients a vaccination.
(3)

H 3 5 4 1 1 A 0 2 2 4

Leave blank

2. A student takes a multiple choice test. The test is made up of 10 questions each with 5 possible answers. The student gets 4 questions correct. Her teacher claims she was guessing the answers. Using a one tailed test, at the 5% level of significance, test whether or not there is evidence to reject the teacher's claim.
State your hypotheses clearly.

(6)

Leave blank

3. The continuous random variable X is uniformly distributed over the interval [–1,3]. Find

(a) $E(X)$ **(1)**

(b) $Var(X)$ **(2)**

(c) $E(X^2)$ **(2)**

(d) $P(X < 1.4)$ **(1)**

A total of 40 observations of X are made.

(e) Find the probability that at least 10 of these observations are negative. **(5)**

Leave blank

Question 3 continued

Leave blank

4. Richard regularly travels to work on a ferry. Over a long period of time, Richard has found that the ferry is late on average 2 times every week. The company buys a new ferry to improve the service. In the 4-week period after the new ferry is launched, Richard finds the ferry is late 3 times and claims the service has improved. Assuming that the number of times the ferry is late has a Poisson distribution, test Richard's claim at the 5% level of significance. State your hypotheses clearly.

(6)

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5. A continuous random variable X has the probability density function $f(x)$ shown in Figure 1.

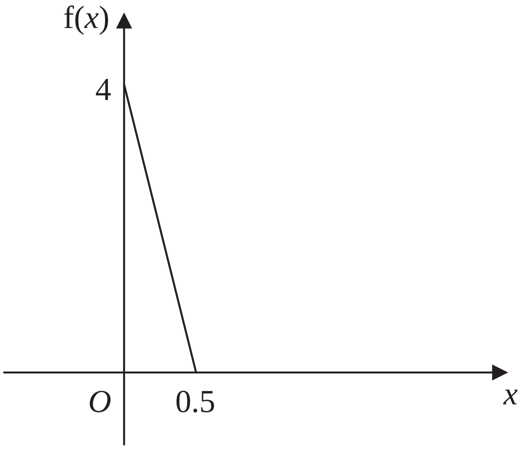

Figure 1

(a) Show that $f(x) = 4 - 8x$ for $0 \leqslant x \leqslant 0.5$ and specify $f(x)$ for all real values of x. **(4)**

(b) Find the cumulative distribution function $F(x)$. **(4)**

(c) Find the median of X. **(3)**

(d) Write down the mode of X. **(1)**

(e) State, with a reason, the skewness of X. **(1)**

Leave blank

Question 5 continued

Leave blank

6. Cars arrive at a motorway toll booth at an average rate of 150 per hour.

(a) Suggest a suitable distribution to model the number of cars arriving at the toll booth, X, per minute.
(2)

(b) State clearly any assumptions you have made by suggesting this model.
(2)

Using your model,

(c) find the probability that in any given minute

(i) no cars arrive,

(ii) more than 3 cars arrive.
(3)

(d) In any given 4 minute period, find m such that $P(X > m) = 0.0487$
(3)

(e) Using a suitable approximation find the probability that fewer than 15 cars arrive in any given 10 minute period.
(6)

H 3 5 4 1 1 A 0 1 6 2 4

Leave blank

Question 6 continued

Leave blank

7. The queuing time in minutes, X, of a customer at a post office is modelled by the probability density function

$$\mathrm{f}(x) = \begin{cases} kx(81 - x^2) & 0 \leqslant x \leqslant 9 \\ 0 & \text{otherwise} \end{cases}$$

(a) Show that $k = \dfrac{4}{6561}$.

(3)

Using integration, find

(b) the mean queuing time of a customer,

(4)

(c) the probability that a customer will queue for more than 5 minutes.

(3)

Three independent customers shop at the post office.

(d) Find the probability that at least 2 of the customers queue for more than 5 minutes.

(3)

Leave blank

Question 7 continued

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	8	4	/	0	1	Signature	

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Thursday 26 May 2011 – Morning

Time: 1 hour 30 minutes

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Team Leader's use only

Question Number	Leave Blank
1	
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Total	

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Pink)	Nil

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There are 28 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

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1. A factory produces components. Each component has a unique identity number and it is assumed that 2% of the components are faulty. On a particular day, a quality control manager wishes to take a random sample of 50 components.

(a) Identify a sampling frame.

(1)

The statistic F represents the number of faulty components in the random sample of size 50.

(b) Specify the sampling distribution of F.

(2)

Leave blank

2. A traffic officer monitors the rate at which vehicles pass a fixed point on a motorway. When the rate exceeds 36 vehicles per minute he must switch on some speed restrictions to improve traffic flow.

(a) Suggest a suitable model to describe the number of vehicles passing the fixed point in a 15 s interval.

(1)

The traffic officer records 12 vehicles passing the fixed point in a 15 s interval.

(b) Stating your hypotheses clearly, and using a 5% level of significance, test whether or not the traffic officer has sufficient evidence to switch on the speed restrictions.

(6)

(c) Using a 5% level of significance, determine the smallest number of vehicles the traffic officer must observe in a 10 s interval in order to have sufficient evidence to switch on the speed restrictions.

(3)

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Question 2 continued

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3.

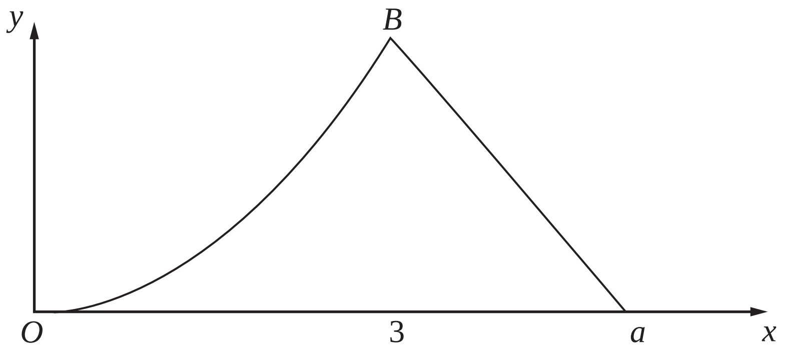

Figure 1

Figure 1 shows a sketch of the probability density function $f(x)$ of the random variable X.

For $0 \leqslant x \leqslant 3$, $f(x)$ is represented by a curve OB with equation $f(x) = kx^2$, where k is a constant.

For $3 \leqslant x \leqslant a$, where a is a constant, $f(x)$ is represented by a straight line passing through B and the point $(a, 0)$.

For all other values of x, $f(x) = 0$.

Given that the mode of X = the median of X, find

(a) the mode,

(1)

(b) the value of k,

(4)

(c) the value of a.

(3)

Without calculating $E(X)$ and with reference to the skewness of the distribution

(d) state, giving your reason, whether $E(X) < 3$, $E(X) = 3$ or $E(X) > 3$.

(2)

P 3 8 1 6 5 A 0 8 2 8

Leave blank

Question 3 continued

Leave blank

4. In a game, players select sticks at random from a box containing a large number of sticks of different lengths. The length, in cm, of a randomly chosen stick has a continuous uniform distribution over the interval [7, 10].

A stick is selected at random from the box.

(a) Find the probability that the stick is shorter than 9.5 cm.

(2)

To win a bag of sweets, a player must select 3 sticks and wins if the length of the longest stick is more than 9.5 cm.

(b) Find the probability of winning a bag of sweets.

(2)

To win a soft toy, a player must select 6 sticks and wins the toy if more than four of the sticks are shorter than 7.6 cm.

(c) Find the probability of winning a soft toy.

(4)

5. Defects occur at random in planks of wood with a constant rate of 0.5 per 10 cm length. Jim buys a plank of length 100 cm.

(a) Find the probability that Jim's plank contains at most 3 defects.

(2)

Shivani buys 6 planks each of length 100 cm.

(b) Find the probability that fewer than 2 of Shivani's planks contain at most 3 defects.

(5)

(c) Using a suitable approximation, estimate the probability that the total number of defects on Shivani's 6 planks is less than 18.

(6)

Leave blank

Question 5 continued

Leave blank

6. A shopkeeper knows, from past records, that 15% of customers buy an item from the display next to the till. After a refurbishment of the shop, he takes a random sample of 30 customers and finds that only 1 customer has bought an item from the display next to the till.

(a) Stating your hypotheses clearly, and using a 5% level of significance, test whether or not there has been a change in the proportion of customers buying an item from the display next to the till.

(6)

During the refurbishment a new sandwich display was installed. Before the refurbishment 20% of customers bought sandwiches. The shopkeeper claims that the proportion of customers buying sandwiches has now increased. He selects a random sample of 120 customers and finds that 31 of them have bought sandwiches.

(b) Using a suitable approximation and stating your hypotheses clearly, test the shopkeeper's claim. Use a 10% level of significance.

(8)

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Question 6 continued

Leave blank

7. The continuous random variable X has probability density function given by

$$\mathrm{f}(x)=\begin{cases}\dfrac{3}{32}(x-1)(5-x) & 1\leqslant x\leqslant 5\\ 0 & \text{otherwise}\end{cases}$$

(a) Sketch $\mathrm{f}(x)$ showing clearly the points where it meets the x-axis.
(2)

(b) Write down the value of the mean, μ, of X.
(1)

(c) Show that $\mathrm{E}(X^2)=9.8$
(4)

(d) Find the standard deviation, σ, of X.
(2)

The cumulative distribution function of X is given by

$$\mathrm{F}(x)=\begin{cases}0 & x<1\\ \dfrac{1}{32}\left(a-15x+9x^2-x^3\right) & 1\leqslant x\leqslant 5\\ 1 & x>5\end{cases}$$

where a is a constant.

(e) Find the value of a.
(2)

(f) Show that the lower quartile of X, q_1, lies between 2.29 and 2.31
(3)

(g) Hence find the upper quartile of X, giving your answer to 1 decimal place.
(1)

(h) Find, to 2 decimal places, the value of k so that

$$\mathrm{P}(\mu-k\sigma<X<\mu+k\sigma)=0.5$$

(2)

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Question 7 continued

Centre No.						Paper Reference	Surname	Initial(s)
Candidate No.						6 6 8 4 / 0 1	Signature	

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Tuesday 17 January 2012 – Morning

Time: 1 hour 30 minutes

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Team Leader's use only

Question Number	Leave Blank
1	
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Materials required for examination	Items included with question papers
Mathematical Formulae (Pink)	Nil

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There are 20 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

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Turn over

PEARSON

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1. The time in minutes that Elaine takes to checkout at her local supermarket follows a continuous uniform distribution defined over the interval [3, 9].

Find

(a) Elaine's expected checkout time,
(1)

(b) the variance of the time taken to checkout at the supermarket,
(2)

(c) the probability that Elaine will take more than 7 minutes to checkout.
(2)

Given that Elaine has already spent 4 minutes at the checkout,

(d) find the probability that she will take a total of less than 6 minutes to checkout.
(3)

Leave blank

2. David claims that the weather forecasts produced by local radio are no better than those achieved by tossing a fair coin and predicting rain if a head is obtained or no rain if a tail is obtained. He records the weather for 30 randomly selected days. The local radio forecast is correct on 21 of these days.

Test David's claim at the 5% level of significance.

State your hypotheses clearly.

(7)

Leave blank

3. The probability of a telesales representative making a sale on a customer call is 0.15

Find the probability that

(a) no sales are made in 10 calls,

(2)

(b) more than 3 sales are made in 20 calls.

(2)

Representatives are required to achieve a mean of at least 5 sales each day.

(c) Find the least number of calls each day a representative should make to achieve this requirement.

(2)

(d) Calculate the least number of calls that need to be made by a representative for the probability of at least 1 sale to exceed 0.95

(3)

Leave blank

4. A website receives hits at a rate of 300 per hour.

(a) State a distribution that is suitable to model the number of hits obtained during a 1 minute interval.

(1)

(b) State two reasons for your answer to part (a).

(2)

Find the probability of

(c) 10 hits in a given minute,

(3)

(d) at least 15 hits in 2 minutes.

(3)

The website will go down if there are more than 70 hits in 10 minutes.

(e) Using a suitable approximation, find the probability that the website will go down in a particular 10 minute interval.

(7)

Leave blank

Question 4 continued

Leave blank

5. The probability of an electrical component being defective is 0.075
The component is supplied in boxes of 120

(a) Using a suitable approximation, estimate the probability that there are more than 3 defective components in a box.

(5)

A retailer buys 2 boxes of components.

(b) Estimate the probability that there are at least 4 defective components in each box.

(2)

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Question 5 continued

Q5

(Total 7 marks)

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6. A random variable X has probability density function given by

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

where k is a positive constant.

(a) Sketch the graph of $f(x)$.
(2)

(b) Show that $k = \frac{1}{2}(1+\sqrt{5})$.
(4)

(c) Define fully the cumulative distribution function $F(x)$.
(6)

(d) Find $P(0.5 < X < 1.5)$.
(2)

(e) Write down the median of X and the mode of X.
(2)

(f) Describe the skewness of the distribution of X. Give a reason for your answer.
(2)

Leave blank

Question 6 continued

Leave blank

7. (a) Explain briefly what you understand by

(i) a critical region of a test statistic,

(ii) the level of significance of a hypothesis test.

(2)

(b) An estate agent has been selling houses at a rate of 8 per month. She believes that the rate of sales will decrease in the next month.

(i) Using a 5% level of significance, find the critical region for a one tailed test of the hypothesis that the rate of sales will decrease from 8 per month.

(ii) Write down the actual significance level of the test in part (b)(i).

(3)

The estate agent is surprised to find that she actually sold 13 houses in the next month. She now claims that this is evidence of an increase in the rate of sales per month.

(c) Test the estate agent's claim at the 5% level of significance. State your hypotheses clearly.

(5)

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Question 7 continued

Centre No.						Paper Reference	Surname	Initial(s)
Candidate No.						6 6 8 4 / 0 1	Signature	

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Thursday 24 May 2012 – Morning

Time: 1 hour 30 minutes

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Team Leader's use only

Question Number	Leave Blank
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Materials required for examination
Mathematical Formulae (Pink)

Items included with question papers
Nil

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PEARSON

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1. A manufacturer produces sweets of length L mm where L has a continuous uniform distribution with range [15, 30].

(a) Find the probability that a randomly selected sweet has a length greater than 24 mm.
(2)

These sweets are randomly packed in bags of 20 sweets.

(b) Find the probability that a randomly selected bag will contain at least 8 sweets with length greater than 24 mm.
(3)

(c) Find the probability that 2 randomly selected bags will both contain at least 8 sweets with length greater than 24 mm.
(2)

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2. A test statistic has a distribution B(25, p).

Given that

$$H_0 : p = 0.5 \qquad H_1 : p \neq 0.5$$

(a) find the critical region for the test statistic such that the probability in each tail is as close as possible to 2.5%.

(3)

(b) State the probability of incorrectly rejecting H_0 using this critical region.

(2)

Leave blank

3. (a) Write down two conditions needed to approximate the binomial distribution by the Poisson distribution.

(2)

A machine which manufactures bolts is known to produce 3% defective bolts. The machine breaks down and a new machine is installed. A random sample of 200 bolts is taken from those produced by the new machine and 12 bolts were defective.

(b) Using a suitable approximation, test at the 5% level of significance whether or not the proportion of defective bolts is higher with the new machine than with the old machine. State your hypotheses clearly.

(7)

Leave blank

4. The number of houses sold by an estate agent follows a Poisson distribution, with a mean of 2 per week.

(a) Find the probability that in the next 4 weeks the estate agent sells,

(i) exactly 3 houses,

(ii) more than 5 houses.

(5)

The estate agent monitors sales in periods of 4 weeks.

(b) Find the probability that in the next twelve of these 4 week periods there are exactly nine periods in which more than 5 houses are sold.

(3)

The estate agent will receive a bonus if he sells more than 25 houses in the next 10 weeks.

(c) Use a suitable approximation to estimate the probability that the estate agent receives a bonus.

(6)

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Question 4 continued

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5. The queueing time, X minutes, of a customer at a till of a supermarket has probability density function

$$f(x) = \begin{cases} \frac{3}{32}x(k-x) & 0 \leqslant x \leqslant k \\ 0 & \text{otherwise} \end{cases}$$

(a) Show that the value of k is 4

(4)

(b) Write down the value of E(X).

(1)

(c) Calculate Var(X).

(4)

(d) Find the probability that a randomly chosen customer's queueing time will differ from the mean by at least half a minute.

(3)

Leave blank

Question 5 continued

Leave blank

6. A bag contains a large number of balls.

65% are numbered 1

35% are numbered 2

A random sample of 3 balls is taken from the bag.

Find the sampling distribution for the range of the numbers on the 3 selected balls.

(6)

Leave blank

7. The continuous random variable X has probability density function $\mathrm{f}(x)$ given by

$$\mathrm{f}(x) = \begin{cases} \dfrac{x^2}{45} & 0 \leqslant x \leqslant 3 \\[2ex] \dfrac{1}{5} & 3 < x < 4 \\[2ex] \dfrac{1}{3} - \dfrac{x}{30} & 4 \leqslant x \leqslant 10 \\[2ex] 0 & \text{otherwise} \end{cases}.$$

(a) Sketch $\mathrm{f}(x)$ for $0 \leqslant x \leqslant 10$

(4)

(b) Find the cumulative distribution function $\mathrm{F}(x)$ for all values of x.

(8)

(c) Find $\mathrm{P}(X \leqslant 8)$.

(2)

Leave blank

Question 7 continued

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8. In a large restaurant an average of 3 out of every 5 customers ask for water with their meal.

A random sample of 10 customers is selected.

(a) Find the probability that

(i) exactly 6 ask for water with their meal,

(ii) less than 9 ask for water with their meal.

(5)

A second random sample of 50 customers is selected.

(b) Find the smallest value of n such that

$$\mathrm{P}(X < n) \geqslant 0.9$$

where the random variable X represents the number of these customers who ask for water.

(3)

Leave blank

Question 8 continued

January 2013

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	8	4	/	0	1	Signature	

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Friday 18 January 2013 – Afternoon

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
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Materials required for examination	Items included with question papers
Mathematical Formulae (Pink)	Nil

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 or symbolic differentiation/integration, or have retrievable mathematical formulae stored in them.

Instructions to Candidates

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Check that you have the correct question paper.
Answer ALL the questions.
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Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 7 questions in this question paper. The total mark for this paper is 75.
There are 28 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You should show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.

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Turn over

PEARSON

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1. (a) Write down the conditions under which the Poisson distribution can be used as an approximation to the binomial distribution.

(2)

The probability of any one letter being delivered to the wrong house is 0.01
On a randomly selected day Peter delivers 1000 letters.

(b) Using a Poisson approximation, find the probability that Peter delivers at least 4 letters to the wrong house.

Give your answer to 4 decimal places.

(3)

Leave blank

2. In a village, power cuts occur randomly at a rate of 3 per year.

(a) Find the probability that in any given year there will be

(i) exactly 7 power cuts,

(ii) at least 4 power cuts.

(5)

(b) Use a suitable approximation to find the probability that in the next 10 years the number of power cuts will be less than 20

(6)

Leave blank

Question 2 continued

Leave blank

3. A random variable X has the distribution B(12, p).

(a) Given that $p = 0.25$ find

(i) $P(X < 5)$

(ii) $P(X \geqslant 7)$

(3)

(b) Given that $P(X = 0) = 0.05$, find the value of p to 3 decimal places.

(3)

(c) Given that the variance of X is 1.92, find the possible values of p.

(4)

Leave blank

Question 3 continued

Leave blank

4. The continuous random variable X is uniformly distributed over the interval $[-4, 6]$.

(a) Write down the mean of X.

(1)

(b) Find $\mathrm{P}(X \leqslant 2.4)$

(2)

(c) Find $\mathrm{P}(-3 < X - 5 < 3)$

(2)

The continuous random variable Y is uniformly distributed over the interval $[a, 4a]$.

(d) Use integration to show that $\mathrm{E}(Y^2) = 7a^2$

(4)

(e) Find $\mathrm{Var}(Y)$.

(2)

(f) Given that $\mathrm{P}(X < \frac{8}{3}) = \mathrm{P}(Y < \frac{8}{3})$, find the value of a.

(3)

Leave blank

Question 4 continued

Leave blank

5. The continuous random variable T is used to model the number of days, t, a mosquito survives after hatching.

The probability that the mosquito survives for more than t days is

$$\frac{225}{(t+15)^2}, \quad t \geqslant 0$$

(a) Show that the cumulative distribution function of T is given by

$$\mathrm{F}(t) = \begin{cases} 1 - \dfrac{225}{(t+15)^2} & t \geqslant 0 \\ 0 & \text{otherwise} \end{cases}$$

(1)

(b) Find the probability that a randomly selected mosquito will die within 3 days of hatching.

(2)

(c) Given that a mosquito survives for 3 days, find the probability that it will survive for at least 5 more days.

(3)

A large number of mosquitoes hatch on the same day.

(d) Find the number of days after which only 10% of these mosquitoes are expected to survive.

(4)

Leave blank

Question 5 continued

Leave blank

6. (a) Explain what you understand by a hypothesis.

(1)

(b) Explain what you understand by a critical region.

(2)

Mrs George claims that 45% of voters would vote for her.

In an opinion poll of 20 randomly selected voters it was found that 5 would vote for her.

(c) Test at the 5% level of significance whether or not the opinion poll provides evidence to support Mrs George's claim.

(4)

In a second opinion poll of *n* randomly selected people it was found that no one would vote for Mrs George.

(d) Using a 1% level of significance, find the smallest value of *n* for which the hypothesis $H_0 : p = 0.45$ will be rejected in favour of $H_1 : p < 0.45$

(3)

Leave blank

Question 6 continued

Leave blank

7. The continuous random variable X has the following probability density function

$$f(x) = \begin{cases} a + bx & 0 \leqslant x \leqslant 5 \\ 0 & \text{otherwise} \end{cases}$$

where a and b are constants.

(a) Show that $10a + 25b = 2$

(4)

Given that $\mathrm{E}(X) = \frac{35}{12}$

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

(3)

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

(3)

(d) Find, to 3 significant figures, the median of X.

(3)

(e) Comment on the skewness. Give a reason for your answer.

(2)

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Question 7 continued

Centre No.						Paper Reference								Surname	Initial(s)
Candidate No.						6	6	8	4	/	0	1	R	Signature	

Paper Reference(s)

6684/01R

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Friday 24 May 2013 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
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Materials required for examination	**Items included with question papers**
Mathematical Formulae (Pink)	Nil

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There are 24 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

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Turn over

PEARSON

Leave blank

1. A bag contains a large number of counters. A third of the counters have a number 5 on them and the remainder have a number 1.

A random sample of 3 counters is selected.

(a) List all possible samples.

(2)

(b) Find the sampling distribution for the range.

(3)

Leave blank

2. The continuous random variable Y has cumulative distribution function

$$F(y) = \begin{cases} 0 & y < 0 \\ \frac{1}{4}(y^3 - 4y^2 + ky) & 0 \leqslant y \leqslant 2 \\ 1 & y > 2 \end{cases}$$

where k is a constant.

(a) Find the value of k.

(2)

(b) Find the probability density function of Y, specifying it for all values of y.

(3)

(c) Find $P(Y > 1)$.

(2)

Leave blank

3. The random variable X has a continuous uniform distribution on $[a, b]$ where a and b are positive numbers.

Given that $E(X) = 23$ and $Var(X) = 75$

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

(6)

Given that $P(X > c) = 0.32$

(b) find $P(23 < X < c)$.

(2)

Leave blank

4. The random variable X has probability density function $f(x)$ given by

$$f(x) = \begin{cases} k(3 + 2x - x^2) & 0 \leqslant x \leqslant 3 \\ 0 & \text{otherwise} \end{cases}$$

where k is a constant.

(a) Show that $k = \frac{1}{9}$

(3)

(b) Find the mode of X.

(2)

(c) Use algebraic integration to find $E(X)$.

(4)

By comparing your answers to parts (b) and (c),

(d) describe the skewness of X, giving a reason for your answer.

(2)

Leave blank

Question 4 continued

P 4 2 8 3 2 A 0 9 2 4

Turn over

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5. In a village shop the customers must join a queue to pay. The number of customers joining the queue in a 10 minute interval is modelled by a Poisson distribution with mean 3

Find the probability that

(a) exactly 4 customers join the queue in the next 10 minutes,

(2)

(b) more than 10 customers join the queue in the next 20 minutes.

(3)

When a customer reaches the front of the queue the customer pays the assistant. The time each customer takes paying the assistant, T minutes, has a continuous uniform distribution over the interval [0, 5]. The random variable T is independent of the number of people joining the queue.

(c) Find $P(T > 3.5)$

(1)

In a random sample of 5 customers, the random variable C represents the number of customers who took more than 3.5 minutes paying the assistant.

(d) Find $P(C \geqslant 3)$

(3)

Bethan has just reached the front of the queue and starts paying the assistant.

(e) Find the probability that in the next 4 minutes Bethan finishes paying the assistant and no other customers join the queue.

(4)

Leave blank

Question 5 continued

Leave blank

6. Frugal bakery claims that their packs of 10 muffins contain on average 80 raisins per pack. A Poisson distribution is used to describe the number of raisins per muffin.

A muffin is selected at random to test whether or not the mean number of raisins per muffin has changed.

(a) Find the critical region for a two-tailed test using a 10% level of significance. The probability of rejection in each tail should be less than 0.05

(4)

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

(2)

The bakery has a special promotion claiming that their muffins now contain even more raisins.

A random sample of 10 muffins is selected and is found to contain a total of 95 raisins.

(c) Use a suitable approximation to test the bakery's claim. You should state your hypotheses clearly and use a 5% level of significance.

(8)

Leave blank

Question 6 continued

Leave blank

7. As part of a selection procedure for a company, applicants have to answer all 20 questions of a multiple choice test. If an applicant chooses answers at random the probability of choosing a correct answer is 0.2 and the number of correct answers is represented by the random variable X.

(a) Suggest a suitable distribution for X.

(2)

Each applicant gains 4 points for each correct answer but loses 1 point for each incorrect answer. The random variable S represents the final score, in points, for an applicant who chooses answers to this test at random.

(b) Show that $S = 5X - 20$

(2)

(c) Find $\mathrm{E}(S)$ and $\mathrm{Var}(S)$.

(4)

An applicant who achieves a score of at least 20 points is invited to take part in the final stage of the selection process.

(d) Find $\mathrm{P}(S \geqslant 20)$

(4)

Cameron is taking the final stage of the selection process which is a multiple choice test consisting of 100 questions. He has been preparing for this test and believes that his chance of answering each question correctly is 0.4

(e) Using a suitable approximation, estimate the probability that Cameron answers more than half of the questions correctly.

(5)

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Question 7 continued

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	8	4	/	0	1	Signature	

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Friday 24 May 2013 – Morning

Time: 1 hour 30 minutes

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Team Leader's use only

Question Number	Leave Blank
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Total	

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Turn over

PEARSON

Leave blank

1. A bag contains a large number of 1p, 2p and 5p coins.

50% are 1p coins
20% are 2p coins
30% are 5p coins

A random sample of 3 coins is chosen from the bag.

(a) List all the possible samples of size 3 with median 5p.
(2)

(b) Find the probability that the median value of the sample is 5p.
(4)

(c) Find the sampling distribution of the median of samples of size 3
(5)

Leave blank

Question 1 continued

Leave blank

2. The number of defects per metre in a roll of cloth has a Poisson distribution with mean 0.25

Find the probability that

(a) a randomly chosen metre of cloth has 1 defect,

(2)

(b) the total number of defects in a randomly chosen 6 metre length of cloth is more than 2

(3)

A tailor buys 300 metres of cloth.

(c) Using a suitable approximation find the probability that the tailor's cloth will contain less than 90 defects.

(5)

Leave blank

Question 2 continued

Q2

(Total 10 marks)

Leave blank

3. An online shop sells a computer game at an average rate of 1 per day.

(a) Find the probability that the shop sells more than 10 games in a 7 day period.
(3)

Once every 7 days the shop has games delivered before it opens.

(b) Find the least number of games the shop should have in stock immediately after a delivery so that the probability of running out of the game before the next delivery is less than 0.05
(3)

In an attempt to increase sales of the computer game, the price is reduced for six months. A random sample of 28 days is taken from these six months. In the sample of 28 days, 36 computer games are sold.

(c) Using a suitable approximation and a 5% level of significance, test whether or not the average rate of sales per day has increased during these six months. State your hypotheses clearly.
(7)

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Question 3 continued

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4. A continuous random variable X is uniformly distributed over the interval $[b, 4b]$ where b is a constant.

(a) Write down $\mathrm{E}(X)$.
(1)

(b) Use integration to show that $\mathrm{Var}(X) = \dfrac{3b^2}{4}$.
(3)

(c) Find $\mathrm{Var}(3 - 2X)$.
(2)

Given that $b = 1$ find

(d) the cumulative distribution function of X, $\mathrm{F}(x)$, for all values of x,
(2)

(e) the median of X.
(1)

Leave blank

Question 4 continued

Leave blank

5. The continuous random variable X has a cumulative distribution function

$$F(x) = \begin{cases} 0 & x < 1 \\ \dfrac{x^3}{10} + \dfrac{3x^2}{10} + ax + b & 1 \leqslant x \leqslant 2 \\ 1 & x > 2 \end{cases}$$

where a and b are constants.

(a) Find the value of a and the value of b.
(4)

(b) Show that $f(x) = \dfrac{3}{10}(x^2 + 2x - 2), \quad 1 \leqslant x \leqslant 2$
(1)

(c) Use integration to find E(X).
(4)

(d) Show that the lower quartile of X lies between 1.425 and 1.435
(3)

Leave blank

Question 5 continued

Leave blank

6. In a manufacturing process 25% of articles are thought to be defective. Articles are produced in batches of 20

(a) A batch is selected at random. Using a 5% significance level, find the critical region for a two tailed test that the probability of an article chosen at random being defective is 0.25
You should state the probability in each tail which should be as close as possible to 0.025

(5)

The manufacturer changes the production process to try to reduce the number of defective articles. She then chooses a batch at random and discovers there are 3 defective articles.

(b) Test at the 5% level of significance whether or not there is evidence that the changes to the process have reduced the percentage of defective articles. State your hypotheses clearly.

(5)

Leave blank

Question 6 continued

Q6

(Total 10 marks)

Leave blank

7. A telesales operator is selling a magazine. Each day he chooses a number of people to telephone. The probability that each person he telephones buys the magazine is 0.1

(a) Suggest a suitable distribution to model the number of people who buy the magazine from the telesales operator each day.

(1)

(b) On Monday, the telesales operator telephones 10 people. Find the probability that he sells at least 4 magazines.

(3)

(c) Calculate the least number of people he needs to telephone on Tuesday, so that the probability of selling at least 1 magazine, on that day, is greater than 0.95

(3)

A call centre also sells the magazine. The probability that a telephone call made by the call centre sells a magazine is 0.05
The call centre telephones 100 people every hour.

(d) Using a suitable approximation, find the probability that more than 10 people telephoned by the call centre buy a magazine in a randomly chosen hour.

(3)

Leave blank

Question 7 continued

Q7

(Total 10 marks)

TOTAL FOR PAPER: 75 MARKS

END