

Edexcel GCE
Statistics S2
Gold Level G3
(Question Paper)

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Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Gold Level G3

Time: 1 hour 30 minutes

Materials required for examination papers

Mathematical Formulae (Green)

Items included with question

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, differentiation and integration, or have retrievable mathematical formulas stored in them.

Instructions to Candidates

Write the name of the examining body (Edexcel), your centre number, candidate number, the unit title (Statistics S2), the paper reference (6684), your surname, initials and signature.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.

Full marks may be obtained for answers to ALL questions.

There are 9 questions in this question paper. The total mark for this paper is 75.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.

You must show sufficient working to make your methods clear to the Examiner. Answers without working may gain no credit.

Suggested grade boundaries for this paper:

A*	A	B	C	D	E
63	53	42	34	26	20

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)

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)

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)

4. A random sample X_1, X_2, \dots, 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.

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

(2)

5.

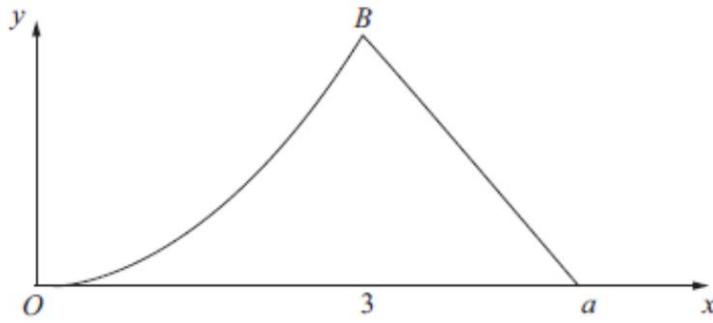


Figure 1

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

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

For $3 \leq x \leq a$, 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)**

6. 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 $P(C \geq 3)$. (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)

7. 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)

8. (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)

9. 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)

TOTAL FOR PAPER: 75 MARKS

END