Paper Reference(s)

6684

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Wednesday 23 June 2004 – Morning

Time: 1 hour 30 minutes

Materials required for examination
Answer Book (AB16)
Graph Paper (ASG2)
Mathematical Formulae (Lilac)

Items included with question papers
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.

Instructions to Candidates

In the boxes on the answer book, write the name of the examining body (Edexcel), your centre number, candidate number, the unit title (Statistics S2), the paper reference (6684), your surname, other name and signature.
Values from the statistical tables should be quoted in full. When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
This paper has seven questions.

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.

1. Explain briefly what you understand by

(*a*) a sampling frame,

(1)

(*b*) a statistic.

(2)

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2. The continuous random variable X is uniformly distributed over the interval $[-1, 4]$.

Find

(*a*) $P(X < 2.7)$,

(1)

(*b*) $E(X)$,

(2)

(*c*) Var (X).

(2)

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3. Brad planted 25 seeds in his greenhouse. He has read in a gardening book that the probability of one of these seeds germinating is 0.25. Ten of Brad's seeds germinated. He claimed that the gardening book had underestimated this probability. Test, at the 5% level of significance, Brad's claim. State your hypotheses clearly.

(7)

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4. (*a*) State two conditions under which a random variable can be modelled by a binomial distribution.

(2)

In the production of a certain electronic component it is found that 10% are defective.

The component is produced in batches of 20.

(*b*) Write down a suitable model for the distribution of defective components in a batch.

(1)

Find the probability that a batch contains

(*c*) no defective components,

(2)

(*d*) more than 6 defective components.

(2)

(*e*) Find the mean and the variance of the defective components in a batch.

(2)

A supplier buys 100 components. The supplier will receive a refund if there are more than 15 defective components.

(*f*) Using a suitable approximation, find the probability that the supplier will receive a refund.

(4)

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5. (*a*) Explain what you understand by a critical region of a test statistic.

(2)

The number of breakdowns per day in a large fleet of hire cars has a Poisson distribution with mean $\frac{1}{7}$.

(*b*) Find the probability that on a particular day there are fewer than 2 breakdowns.

(3)

(*c*) Find the probability that during a 14-day period there are at most 4 breakdowns.

(3)

The cars are maintained at a garage. The garage introduced a weekly check to try to decrease the number of cars that break down. In a randomly selected 28-day period after the checks are introduced, only 1 hire car broke down.

(*d*) Test, at the 5% level of significance, whether or not the mean number of breakdowns has decreased. State your hypotheses clearly.

(7)

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6. Minor defects occur in a particular make of carpet at a mean rate of 0.05 per m^2.

(*a*) Suggest a suitable model for the distribution of the number of defects in this make of carpet. Give a reason for your answer.

A carpet fitter has a contract to fit this carpet in a small hotel. The hotel foyer requires 30 m^2 of this carpet. Find the probability that the foyer carpet contains

(*b*) exactly 2 defects,

(3)

(*c*) more than 5 defects.

(3)

The carpet fitter orders a total of 355 m^2 of the carpet for the whole hotel.

(*d*) Using a suitable approximation, find the probability that this total area of carpet contains 22 or more defects.

(6)

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

$$f(x) = \begin{cases} \frac{1}{3}, & 0 \le x \le 1, \\ \frac{8x^3}{45}, & 1 \le x \le 2, \\ 0, & \text{otherwise.} \end{cases}$$

(*a*) Calculate the mean of X.

(5)

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

(7)

(*c*) Find the median of X.

(3)

(*d*) Comment on the skewness of the distribution of X.

(2)

END