Paper Reference(s)

6684

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Tuesday 17 June 2003 – Afternoon

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 statistic,

(2)

(*b*) a sampling distribution.

(2)

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2. (*a*) Write down the condition needed to approximate a Poisson distribution by a Normal distribution.

(1)

The random variable $Y \sim \text{Po}(30)$.

(*b*) Estimate $\text{P}(Y > 28)$.

(6)

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3. In a town, 30% of residents listen to the local radio station. Four residents are chosen at random.

(*a*) State the distribution of the random variable X, the number of these four residents that listen to local radio.

(2)

(*b*) On graph paper, draw the probability distribution of X.

(3)

(*c*) Write down the most likely number of these four residents that listen to the local radio station.

(1)

(*d*) Find $\text{E}(X)$ and $\text{Var}(X)$.

(3)

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4. (*a*) Write down the conditions under which the binomial distribution may be a suitable model to use in statistical work.

(4)

A six-sided die is biased. When the die is thrown the number 5 is twice as likely to appear as any other number. All the other faces are equally likely to appear. The die is thrown repeatedly.

Find the probability that

(*b*) (i) the first 5 will occur on the sixth throw,

(ii) in the first eight throws there will be exactly three 5s.

(8)

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5. A drinks machine dispenses lemonade into cups. It is electronically controlled to cut off the flow of lemonade randomly between 180 ml and 200 ml. The random variable X is the volume of lemonade dispensed into a cup.

(*a*) Specify the probability density function of X and sketch its graph.

(4)

(*b*) Find the probability that the machine dispenses

(i) less than 183 ml,

(ii) exactly 183 ml.

(3)

(*c*) Calculate the inter-quartile range of X.

(1)

(*d*) Determine the value of x such that $P(X \geq x) = 2P(X \leq x)$.

(3)

(*e*) Interpret in words your value of x.

(2)

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6. A doctor expects to see, on average, 1 patient per week with a particular disease.

(*a*) Suggest a suitable model for the distribution of the number of times per week that the doctor sees a patient with the disease. Give a reason for your answer.

(3)

(*b*) Using your model, find the probability that the doctor sees more than 3 patients with the disease in a 4 week period.

(4)

The doctor decides to send information to his patients to try to reduce the number of patients he sees with the disease. In the first 6 weeks after the information is sent out, the doctor sees 2 patients with the disease.

(*c*) Test, at the 5% level of significance, whether or not there is reason to believe that sending the information has reduced the number of times the doctor sees patients with the disease. State your hypotheses clearly.

(6)

Medical research into the nature of the disease discovers that it can be passed from one patient to another.

(*d*) Explain whether or not this research supports your choice of model. Give a reason for your answer.

(2)

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

$$\text{f}(x) = \begin{cases} k(x^2 + 2x + 1) & -1 \leq x \leq 0, \\ 0, & \text{otherwise} \end{cases}$$

where k is a positive integer.

(a) Show that $k = 3$.

(4)

Find

(b) E(X),

(4)

(c) the cumulative distribution function F(x),

(4)

(d) P($-0.3 < X < 0.3$).

(3)

END