Paper Reference(s)

6684

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Friday 14 June 2002 – Morning

Time: 1 hour 30 minutes

Materials required for examination	Items included with question papers
Answer Book (AB16)	Nil
Graph Paper (ASG2)	
Mathematical Formulae (Lilac)	

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. The manager of a leisure club is considering a change to the club rules. The club has a large membership and the manager wants to take the views of the members into consideration before deciding whether or not to make the change.

(*a*) Explain briefly why the manager might prefer to use a sample survey rather than a census to obtain the views.

(2)

(*b*) Suggest a suitable sampling frame.

(1)

(*c*) Identify the sampling units.

(1)

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2. A random sample $X_1, X_2, \ldots, X_n$ is taken from a finite population. A statistic Y is based on this sample.

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

(2)

(*b*) Give an example of a statistic.

(1)

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

(2)

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3. The continuous random variable R is uniformly distributed on the interval $\alpha \leq R \leq \beta$. Given that $\mathrm{E}(R) = 3$ and $\mathrm{Var}(R) = \frac{25}{3}$, find

(*a*) the value of α and the value of β,

(7)

(*b*) $\mathrm{P}(R < 6.6)$.

(2)

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4. Past records show that 20% of customers who buy crisps from a large supermarket buy them in single packets. During a particular day a random sample of 25 customers who had bought crisps was taken and 2 of them had bought them in single packets.

(*a*) Use these data to test, at the 5% level of significance, whether or not the percentage of customers who bought crisps in single packets that day was lower than usual. State your hypotheses clearly.

(6)

At the same supermarket, the manager thinks that the probability of a customer buying a bumper pack of crisps is 0.03. To test whether or not this hypothesis is true the manager decides to take a random sample of 300 customers.

(*b*) Stating your hypotheses clearly, find the critical region to enable the manager to test whether or not there is evidence that the probability is different from 0.03. The probability for each tail of the region should be as close as possible to 2.5%.

(6)

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

(1)

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5. A garden centre sells canes of nominal length 150 cm. The canes are bought from a supplier who uses a machine to cut canes of length L where $L \sim \mathrm{N}(\mu, 0.3^2)$.

(*a*) Find the value of μ, to the nearest 0.1 cm, such that there is only a 5% chance that a cane supplied to the garden centre will have length less than 150 cm.

(4)

A customer buys 10 of these canes from the garden centre.

(*b*) Find the probability that at most 2 of the canes have length less than 150 cm.

(3)

Another customer buys 500 canes.

(*c*) Using a suitable approximation, find the probability that fewer than 35 of the canes will have length less than 150 cm.

(6)

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6. From past records, a manufacturer of twine knows that faults occur in the twine at random and at a rate of 1.5 per 25 m.

(*a*) Find the probability that in a randomly chosen 25 m length of twine there will be exactly 4 faults.

(2)

The twine is usually sold in balls of length 100 m. A customer buys three balls of twine.

(*b*) Find the probability that only one of them will have fewer than 6 faults.

(6)

As a special order a ball of twine containing 500 m is produced.

(*c*) Using a suitable approximation, find the probability that it will contain between 23 and 33 faults inclusive.

(6)

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7. The continuous random variable X has probability density function

$$f(x) = \begin{cases} \dfrac{x}{15}, & 0 \le x \le 2, \\ \dfrac{2}{15}, & 2 < x < 7, \\ \dfrac{4}{9} - \dfrac{2x}{45}, & 7 \le x \le 10, \\ 0, & \text{otherwise.} \end{cases}$$

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

(3)

(*b*) (i) Find expressions for the cumulative distribution function, F(x), for $0 \le x \le 2$ and for $7 \le x \le 10$.

(ii) Show that for $2 < x < 7$, $F(x) = \dfrac{2x}{15} - \dfrac{2}{15}$.

(iii) Specify F(x) for $x < 0$ and for $x > 10$.

(8)

(*c*) Find $P(X \le 8.2)$.

(2)

(*d*) Find, to 3 significant figures, E(X).

(4)

END