Paper Reference(s)

6684

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Friday 23 January 2004 – 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.

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1. A large dental practice wishes to investigate the level of satisfaction of its patients.

(*a*) Suggest a suitable sampling frame for the investigation.
(1)

(*b*) Identify the sampling units.
(1)

(*c*) State one advantage and one disadvantage of using a sample survey rather than a census.
(2)

(*d*) Suggest a problem that might arise with the sampling frame when selecting patients.
(1)

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2. The random variable R has the binomial distribution B(12, 0.35).

(*a*) Find $P(R \geq 4)$.
(2)

The random variable S has the Poisson distribution with mean 2.71.

(*b*) Find $P(S \leq 1)$.
(3)

The random variable T has the normal distribution $N(25, 5^2)$.

(*c*) Find $P(T \leq 18)$.
(2)

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3. The discrete random variable X is distributed $B(n, p)$.

(*a*) Write down the value of p that will give the most accurate estimate when approximating the binomial distribution by a normal distribution.
(1)

(*b*) Give a reason to support your value.
(1)

(*c*) Given that $n = 200$ and $p = 0.48$, find $P(90 \leq X < 105)$.
(7)

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4. (*a*) Write down two conditions needed to be able to approximate the binomial distribution by the Poisson distribution.

(2)

A researcher has suggested that 1 in 150 people is likely to catch a particular virus.

Assuming that a person catching the virus is independent of any other person catching it,

(*b*) find the probability that in a random sample of 12 people, exactly 2 of them catch the virus.

(4)

(*c*) Estimate the probability that in a random sample of 1200 people fewer than 7 catch the virus.

(4)

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5. Vehicles pass a particular point on a road at a rate of 51 vehicles per hour.

(*a*) Give two reasons to support the use of the Poisson distribution as a suitable model for the number of vehicles passing this point.

(2)

Find the probability that in any randomly selected 10 minute interval

(*b*) exactly 6 cars pass this point,

(3)

(*c*) at least 9 cars pass this point.

(2)

After the introduction of a roundabout some distance away from this point it is suggested that the number of vehicles passing it has decreased. During a randomly selected 10 minute interval 4 vehicles pass the point.

(*d*) Test, at the 5% level of significance, whether or not there is evidence to support the suggestion that the number of vehicles has decreased. State your hypotheses clearly.

(6)

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6. From past records a manufacturer of ceramic plant pots knows that 20% of them will have defects. To monitor the production process, a random sample of 25 pots is checked each day and the number of pots with defects is recorded.

(*a*) Find the critical regions for a two-tailed test of the hypothesis that the probability that a plant pot has defects is 0.20. The probability of rejection in either tail should be as close as possible to 2.5%.

(5)

(*b*) Write down the significance level of the above test.

(1)

A garden centre sells these plant pots at a rate of 10 per week. In an attempt to increase sales, the price was reduced over a six-week period. During this period a total of 74 pots was sold.

(*c*) Using a 5% level of significance, test whether or not there is evidence that the rate of sales per week has increased during this six-week period.

(7)

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7. The continuous random variable X has probability density function

$$\mathrm{f}(x) = \begin{cases} kx(5-x), & 0 \le x \le 4, \\ 0, & \text{otherwise,} \end{cases}$$

where k is a constant.

(*a*) Show that $k = \dfrac{3}{56}$.

(3)

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

(4)

(*c*) Evaluate $\mathrm{E}(X)$.

(3)

(*d*) Find the modal value of X.

(3)

(*e*) Verify that the median value of X lies between 2.3 and 2.5.

(3)

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

(2)

END