Paper Reference(s)

6684

Edexcel GCE

Statistics S2

(New Syllabus)

Advanced/Advanced Subsidiary

Tuesday 19 June 2001 – 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. Pages 6, 7 and 8 are blank.

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. The small village of *Tornep* has a preservation society which is campaigning for a new by-pass to be built. The society needs to measure

(i) the strength of opinion amongst the residents of *Tornep* for the scheme and

(ii) the flow of traffic through the village on weekdays.

The society wants to know whether to use a census or a sample survey for each of these measures.

(*a*) In each case suggest which they should use and specify a suitable sampling frame.

(4)

For the measurement of traffic flow through *Tornep*,

(*b*) suggest a suitable statistic and a possible statistical model for this statistic.

(2)

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2. On a stretch of motorway accidents occur at a rate of 0.9 per month.

(*a*) Show that the probability of no accidents in the next month is 0.407, to 3 significant figures.

(1)

Find the probability of

(*b*) exactly 2 accidents in the next 6 month period,

(3)

(*c*) no accidents in exactly 2 of the next 4 months.

(3)

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3. In a sack containing a large number of beads $\frac{1}{4}$ are coloured gold and the remainder are of different colours. A group of children use some of the beads in a craft lesson and do not replace them. Afterwards the teacher wishes to know whether or not the proportion of gold beads left in the sack has changed. He selects a random sample of 20 beads and finds that 2 of them are coloured gold.

Stating your hypotheses clearly test, at the 10% level of significance, whether or not there is evidence that the proportion of gold beads has changed.

(7)

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4. A company always sends letters by second class post unless they are marked first class. Over a long period of time it has been established that 20% of letters to be posted are marked first class.

In a random selection of 10 letters to be posted, find the probability that the number marked first class is

(*a*) at least 3,

(2)

(*b*) fewer than 2.

(2)

One Monday morning there are only 12 first class stamps. Given that there are 70 letters to be posted that day,

(*c*) use a suitable approximation to find the probability that there are enough first class stamps.

(7)

(*d*) State an assumption about these 70 letters that is required in order to make the calculation in part (*c*) valid.

(1)

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5. The maintenance department of a college receives requests for replacement light bulbs at a rate of 2 per week.

Find the probability that in a randomly chosen week the number of requests for replacement light bulbs is

(*a*) exactly 4,

(2)

(*b*) more than 5.

(2)

Three weeks before the end of term the maintenance department discovers that there are only 5 light bulbs left.

(*c*) Find the probability that the department can meet all requests for replacement light bulbs before the end of term.

(3)

The following term the principal of the college announces a package of new measures to reduce the amount of damage to college property. In the first 4 weeks following this announcement, 3 requests for replacement light bulbs are received.

(*d*) Stating your hypotheses clearly test, at the 5% level of significance, whether or not there is evidence that the rate of requests for replacement light bulbs has decreased.

(5)

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6. The continuous random variable X has cumulative distribution function F(x) given by

$$\mathrm{F}(x) = \begin{cases} 0, & x < 1 \\ \frac{1}{27}(-x^3 + 6x^2 - 5), & 1 \le x \le 4 \\ 1, & x > 4 \end{cases}$$

(a) Find the probability density function f(x).

(3)

(b) Find the mode of X.

(2)

(c) Sketch f(x) for all values of x.

(3)

(d) Find the mean μ of X.

(3)

(e) Show that F(μ) > 0.5.

(1)

(f) Show that the median of X lies between the mode and the mean.

(2)

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7. In a computer game, a star moves across the screen, with constant speed, taking 1 s to travel from one side to the other. The player can stop the star by pressing a key. The object of the game is to stop the star in the middle of the screen by pressing the key exactly 0.5 s after the star first appears. Given that the player actually presses the key T s after the star first appears, a simple model of the game assumes that T is a continuous uniform random variable defined over the interval [0, 1].

(*a*) Write down $P(T < 0.2)$.

(1)

(*b*) Write down $E(T)$.

(1)

(*c*) Use integration to find $\text{Var}(T)$.

(4)

A group of 20 children each play this game once.

(*d*) Find the probability that no more than 4 children stop the star in less than 0.2 s.

(3)

The children are allowed to practise.this game so that this continuous uniform model is no longer applicable.

(*e*) Explain how you would expect the mean and variance of T to change.

(2)

It is found that a more appropriate model of the game when played by experienced players assumes that T has a probability density function $g(t)$ given by

$$g(t) = \begin{cases} 4t, & 0 \le t \le 0.5, \\ 4 - 4t, & 0.5 \le t \le 1, \\ 0, & \textit{otherwise.} \end{cases}$$

(*f*) Using this model show that $P(T < 0.2) = 0.08$.

(2)

A group of 75 experienced players each played this game once.

(*g*) Using a suitable approximation, find the probability that more than 7 of them stop the star in less than 0.2 s.

(4)

END