Statistics S2

Advanced/Advanced Subsidiary

Monday 16 January 2006 − Morning

Time: 1 hour 30 minutes

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Lilac)	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.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 7 questions on this paper. The total mark for this paper is 75.

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. A fair coin is tossed 4 times.

   Find the probability that

   (*a*) an equal number of head and tails occur

   (2)

   (*b*) all the outcomes are the same,

   (3)

   (*c*) the first tail occurs on the third throw.

   (2)

2. Accidents on a particular stretch of motorway occur at an average rate of 1.5 per week.

   (*a*) Write down a suitable model to represent the number of accidents per week on this stretch of motorway.

   (1)

   Find the probability that

   (*b*) there will be 2 accidents in the same week,

   (2)

   (*c*) there is at least one accident per week for 3 consecutive weeks,

   (3)

   (*d*) there are more than 4 accidents in a 2 week period.

   (2)

3. The random variable X is uniformly distributed over the interval $[-1, 5]$.

   (*a*) Sketch the probability density function f(x) of X.

   (3)

   Find

   (*b*) E(X),

   (1)

   (*c*) Var(X),

   (2)

   (*d*) P($-0.3 < X < 3.3$).

   (2)

4. The random variable $X \sim B(150, 0.02)$.

Use a suitable approximation to estimate $P(X > 7)$.

(4)

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

$$f(x) = \begin{cases} kx(x-2), & 2 \le x \le 3, \\ 0, & \text{otherwise,} \end{cases}$$

where k is a positive constant.

(*a*) Show that $k = \dfrac{3}{4}$.

(4)

Find

(*b*) E(X),

(3)

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

(6)

(d) Show that the median value of X lies between 2.70 and 2.75.

(2)

6. A bag contains a large number of coins. Half of them are 1p coins, one third are 2p coins and the remainder are 5p coins.

(*a*) Find the mean and variance of the value of the coins.

(4)

A random sample of 2 coins is chosen from the bag.

(*b*) List all the possible samples that can be drawn.

(3)

(*c*) Find the sampling distribution of the mean value of these samples.

(6)

7. A teacher thinks that 20% of the pupils in a school read the Deano comic regularly.

He chooses 20 pupils at random and finds 9 of them read the Deano.

(*a*) (i) Test, at the 5% level of significance, whether or not there is evidence that the percentage of pupils that read the Deano is different from 20%. State your hypotheses clearly.

    (ii) State all the possible numbers of pupils that read the Deano from a sample of size 20 that will make the test in part (*a*)(i) significant at the 5% level.

(9)

The teacher takes another 4 random samples of size 20 and they contain 1, 3, 1 and 4 pupils that read the Deano.

(*b*) By combining all 5 samples and using a suitable approximation test, at the 5% level of significance, whether or not this provides evidence that the percentage of pupils in the school that read the Deano is different from 20%.

(8)

(*c*) Comment on your results for the tests in part (*a*) and part (*b*).

(2)

TOTAL FOR PAPER: 75 MARKS
END