Paper Reference(s)

6684

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Tuesday 25 January 2005 – Morning

Time: 1 hour 30 minutes

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

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 random variables R, S and T are distributed as follows

$$R \sim B(15, 0.3), \quad S \sim Po(7.5), \quad T \sim N(8, 2^2).$$

Find

(a) $P(R = 5)$,

(2)

(b) $P(S = 5)$,

(1)

(c) $P(T = 5)$.

(1)

---

2. (a) Explain what you understand by (i) a population and (ii) a sampling frame.

(2)

The population and the sampling frame may not be the same.

(b) Explain why this might be the case.

(1)

(c) Give an example, justifying your choices, to illustrate when you might use

(i) a census,

(ii) a sample.

(4)

---

3. A rod of length $2l$ was broken into 2 parts. The point at which the rod broke is equally likely to be anywhere along the rod. The length of the **shorter** piece of rod is represented by the random variable X.

(a) Write down the name of the probability density function of X, and specify it fully.

(3)

(b) Find $P(X < \frac{1}{3}l)$.

(2)

(c) Write down the value of $E(X)$.

(1)

Two identical rods of length $2l$ are broken.

(d) Find the probability that both of the shorter pieces are of length less than $\frac{1}{3}l$.

(2)

---

4. In an experiment, there are 250 trials and each trial results in a success or a failure.

(*a*) Write down two other conditions needed to make this into a binomial experiment.
(2)

It is claimed that 10% of students can tell the difference between two brands of baked beans. In a random sample of 250 students, 40 of them were able to distinguish the difference between the two brands.

(*b*) Using a normal approximation, test at the 1% level of significance whether or not the claim is justified. Use a one-tailed test.
(6)

(*c*) Comment on the acceptability of the assumptions you needed to carry out the test.
(2)

---

5. From company records, a manager knows that the probability that a defective article is produced by a particular production line is 0.032.

A random sample of 10 articles is selected from the production line.

(*a*) Find the probability that exactly 2 of them are defective.
(3)

On another occasion, a random sample of 100 articles is taken.

(*b*) Using a suitable approximation, find the probability that fewer than 4 of them are defective.
(4)

At a later date, a random sample of 1000 is taken.

(*c*) Using a suitable approximation, find the probability that more than 42 are defective.
(6)

---

6. Over a long period of time, accidents happened on a stretch of road at random at a rate of 3 per month.

Find the probability that

(*a*) in a randomly chosen month, more than 4 accidents occurred,

(3)

(*b*) in a three-month period, more than 4 accidents occurred.

(2)

At a later date, a speed restriction was introduced on this stretch of road. During a randomly chosen month only one accident occurred.

(*c*) Test, at the 5% level of significance, whether or not there is evidence to support the claim that this speed restriction reduced the mean number of road accidents occurring per month.

(4)

The speed restriction was kept on this road. Over a two-year period, 55 accidents occurred.

(*d*) Test, at the 5% level of significance, whether or not there is now evidence that this speed restriction reduced the mean number of road accidents occurring per month.

(7)

---

7. The random variable X has probability density function

$$f(x) = \begin{cases} k(-x^2 + 5x - 4), & 1 \le x \le 4, \\ 0, & \text{otherwise.} \end{cases}$$

(*a*) Show that $k = \frac{2}{9}$.

(3)

Find

(*b*) $E(X)$,

(3)

(*c*) the mode of X.

(2)

(*d*) the cumulative distribution function $F(x)$ for all x.

(5)

(*e*) Evaluate $P(X \le 2.5)$,

(2)

(*f*) Deduce the value of the median and comment on the shape of the distribution.

(2)

END