Paper Reference(s)

6687/01

Edexcel GCE

Statistics S5

Advanced/Advanced Subsidiary

Wednesday 1 February 2006 – Morning

Time: 1 hour 30 minutes

Materials required for examination	Items included with question papers
Answer Book (AB16) Graph Paper (ASG2) Mathematical Formulae and Statistical Tables (Lilac or Green)	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 S5), the paper reference (6687), your surname, other names 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 in this question paper. The total mark for this paper is 75.
There are 4 pages in this paper. Any blank pages are indicated.

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. Jane shoots at a target until she hits it. The random variable J is the number of shots needed by Jane to hit the target.

(a) State a suitable distribution to model J.

(1)

(b) Given that the mean of J is 5, calculate the probability of Jane

(i) hitting the target for the first time on her 4th shot,

(3)

(ii) taking at least 3 shots to hit the target for the first time.

(3)

(c) State any assumptions you have made using this model.

(2)

(Total 9 marks)

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2. A large college buys red and blue marker pens. Three times as many blue pens are bought as red pens. The college has two suppliers for these pens. Supplier A provides 65% of the red pens and 45% of the blue pens. The remainder of the pens comes from supplier B. The college knows that 10% of the pens supplied by A and 5% of those supplied by B are defective. The pens are all stored together in a box. A member of staff selects a pen at random from the box.

(a) Find the probability that the pen will be defective.

(4)

The member of staff found that the pen was defective and complained to the college management about the quality of pens from supplier A.

(b) Find the probability that the defective pen was supplied by A.

(5)

(Total 9 marks)

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3. The continuous random variable X has probability density function

$$f(x) = \begin{cases} 0.25, & 0 \leqslant x \leqslant 4 \\ 0, & \textit{otherwise}. \end{cases}$$

(a) Write down the name of this distribution.

(1)

(b) Show that the moment generating function is given by $\frac{1}{4t}(e^{4t} - 1)$.

(4)

(c) Using this moment generating function, find the mean and the variance of X.

(4)

(Total 9 marks)

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4. The probability that John wins a coconut in a game at the fair is 0.15.

John plays a number of games.

(a) Find

(i) the probability of John winning his second coconut on his 7th game. **(2)**

(ii) the expected number of games John would need to play in order to win 3 coconuts. **(1)**

(b) State two assumptions that you made in part (a). **(2)**

Sue plays the same game, but has a different probability of winning a coconut. She plays until she has won r coconuts. The random variable G represents the total number of games Sue plays.

(c) Given that the mean and the standard deviation of G are 18 and 6 respectively, determine whether John or Sue has the greater probability of winning a coconut in a game. **(5)**

(Total 10 marks)

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5. Power cuts occur in a village independently and at random, at a rate of 3 per year.

(a) Find the probability that exactly one power cut occurs in the next month. **(2)**

(b) Given that T is the time in months between successive power cuts, show that

$$P(0 \leqslant T \leqslant t) = 1 - e^{-t/4}.$$

(3)

(c) Calculate the probability that the interval between successive power cuts is

(i) 4 months or less,

(ii) between 3 and 4 months. **(4)**

There has just been a power cut.

(d) Calculate the length of time within which there is a 75% chance that there will not be another power cut. **(3)**

(Total 12 marks)

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6. A large batch of components is delivered to a factory. A sample of 10 components is selected at random from the batch and tested for defects. If the sample contains no defective components the batch is accepted. If more than two components are defective the batch is rejected, otherwise a second random sample of 10 is taken and tested for defects. If the total number of defective components in the two samples is less than 3, the batch is accepted; otherwise it is rejected. The probability of a component being defective is 0.05.

(a) Calculate the probability that the batch is accepted after the first sample has been tested for defects.
(1)

(b) Find the probability that a second sample is taken.
(4)

(c) Calculate the probability of the batch being accepted.
(7)

(Total 12 marks)

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7. The probability generating function of the random variable X is given by

$$G_x(t) = k(1+2t+2t^2)^2.$$

(a) Show that $k = \frac{1}{25}$.
(2)

(b) Find $P(X = 2)$.
(2)

(c) Calculate $\mathrm{E}(X)$ and $\mathrm{Var}(X)$.
(8)

(d) Write down the probability generating function of $2X + 1$.
(2)

(Total 14 marks)

TOTAL FOR PAPER: 75 MARKS

END