6687/01

Edexcel GCE

Statistics

Unit S5 Mock paper

Advanced Subsidiary / Advanced

Time: 1 hour 30 minutes

Materials required for the examination	Items included with these question papers
Answer Book (AB04) Graph Paper (GP02) Mathematical Formulae	Nil

Candidates may use any calculator EXCEPT **those with a facility for symbolic algebra, differentiation and/or integration. Thus candidates may** NOT **use calculators such as Texas TI 89, TI 92, Casio CFX 9970G, Hewlett Packard HP 48G.**

Instructions to Candidates

In the boxes on the Answer Book provided, 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 including Statistical Formulae and Tables' is provided.

Full marks may be obtained for answers to ALL questions.

This paper has 6 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 will gain no credit.

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1. Sixty percent of the students in a statistics class are men. During breaks between lectures the students take refreshments. Coffee is drunk by 75% of the men and 50% of the women whilst 20% of the men and 40% of the women drink tea. The remainder take some other form of refreshment.

(*a*) Find the percentage of the students who drink

(i) coffee,

(ii) tea. **(2 marks)**

After a break one of the students, who did not drink either coffee or tea, left some books behind.

(*b*) Find the probability that this student was a woman. **(3 marks)**

A lecturer selects two students at random from amongst those who did not drink coffee or tea in the break.

(*c*) Find the probability that the two students are a man and a woman. **(3 marks)**

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2. A biscuit manufacturer has placed a small token inside 3% of the packets of special chocolate biscuits. Jasmine bought 10 packets of these special chocolate biscuits.

(*a*) Find the probability that Jasmine obtains at least 1 token. **(2 marks)**

Graham decides to buy packets of these special chocolate biscuits one at a time and check them for tokens.

(*b*) Find the probability that he obtains his first token with the fourth packet. **(2 marks)**

When 5 tokens are collected a prize can be claimed.

(*c*) Find the probability that Graham collects enough tokens to claim a prize, with the 50th packet. **(3 marks)**

(*d*) Write down the expected number of packets that Graham will have to buy in order to be able to claim a prize. **(1 mark)**

Given that Graham obtained his fourth token in his 135th packet,

(*e*) find the probability that he will be able to claim a prize before buying his 150th packet. **(3 marks)**

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3. The random variable X has moment generating function $M_X(t) = e^{8t(1+t)}$.

The random variable $Y = \frac{1}{2}X - 2$.

(a) Find the moment generating function of Y. **(3 marks)**

(b) Find $P(Y < 3)$. **(4 marks)**

The random variable $W = a - bX$, where a and b are positive constants.

Given that the distribution of W is the same as the distribution of Y,

(c) find the values of a and b. **(4 marks)**

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4. The random variable Y has probability generating function $G_Y(t)$ given by

$$G_Y(t) = \frac{1}{3^{10}}(2 + t)^5(2t + 1)^5.$$

(a) Find $E(Y)$. **(3 marks)**

The random variable X has a binomial distribution with $n = 5$ and $p = \frac{1}{3}$.

(b) Show that the probability generating function of the random variable $W = 5 - X$ is

$$G_W(t) = \frac{(2t+1)^5}{3^5}$$ **(5 marks)**

A fair six-sided die is rolled 5 times and the number of times it lands on either a 1 or a 6 is recorded. The experiment is repeated and the random variables S_1 and S_2 represent the two outcomes.

(c) Show that $5 + S_1 - S_2 = Y$. **(5 marks)**

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5. In large batches of items from a production process, 5% of the items are thought to be defective. Two acceptance sampling schemes A and B are proposed for deciding whether or not to accept any particular batch.

Scheme A: Take a random sample of size 30 and accept the batch if no more than 3 items are defective; otherwise reject it.

Scheme B: Take a random sample of size 25 and accept the batch if no more than 2 items are defective and reject the batch if 4 or more defective items are present. If exactly 3 defective items are found, take a further random sample of size 10 and accept the batch if there are no defectives in this second sample; otherwise reject the batch.

(a) Find the probability of acceptance for each of these two schemes. **(4 marks)**

(b) Find the expected number of items sampled from each batch for each of the two schemes. **(3 marks)**

(c) Find, for each of the two schemes, the probability that the number of batches that need to be examined before a batch is accepted is greater than 2. **(3 marks)**

Over the next year, 100 batches of these items will be required.

(d) Find the expected number of batches that will need to be examined under each of these two schemes. **(3 marks)**

(e) Suggest, giving your reason, which scheme you would recommend be adopted for the next year. **(2 marks)**

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6. The random variable T has an exponential distribution with mean 2.

(a) Find

(i) $P(T < 0.5)$,

(ii) $P(1.5 < T < 2.0)$. **(4 marks)**

A random sample of 65 light bulbs produced by *Britelite* was tested and the lifetime, x hours, of each bulb was recorded. The results are summarised in Table 1 below.

Hours	$x < 50$	$50 \le x < 100$	$100 \le x < 150$	$150 \le x < 200$
O_i	9	13	10	10

Hours	$200 \le x < 300$	$300 \le x < 500$	$x \ge 500$
O_i	8	11	4

Table 1

A member of the research department believed that these data could be modelled by an exponential distribution with mean 200 and she calculated expected frequencies. Some of the values, to 1 decimal place, are given in Table 2.

Hours	$x < 50$	$50 \le x < 100$	$100 \le x < 150$	$150 \le x < 200$
E_i	s	11.2	8.7	t

Hours	$200 \le x < 300$	$300 \le x < 500$	$x \ge 500$
E_i	9.4	9.2	5.3

Table 2

(b) Find the value of s and the value of t. **(2 marks)**

The researcher obtained a value of 4.916 for the statistic $\sum \frac{(O_i - E_i)^2}{E_i}$ without pooling any classes.

(c) Stating your hypotheses clearly test, at the 5% level of significance, the researcher's belief. **(4 marks)**

A test rig has just been fitted with *Britelite* bulbs.

(d) Find the probability that no more than 1 bulb will fail in the next 100 hours. **(3 marks)**

Given that the rig was fitted with 5 new bulbs,

(e) find the probability that at least 4 of the bulbs last longer than 100 hours. **(4 marks)**

END