Paper Reference(s)

6683

Edexcel GCE

Statistics S1

Advanced/Advanced Subsidiary

Wednesday 15 January 2003 − 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 S1), the paper reference (6683), 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.

1. The total amount of time a secretary spent on the telephone in a working day was recorded to the nearest minute. The data collected over 40 days are summarised in the table below.

Time (mins)	90–139	140–149	150–159	160–169	170–179	180–229
No. of days	8	10	10	4	4	4

Draw a histogram to illustrate these data

(4)

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2. A car dealer offers purchasers a three year warranty on a new car. He sells two models, the Zippy and the Nifty. For the first 50 cars sold of each model the number of claims under the warranty is shown in the table below.

	Claim	No claim
Zippy	35	15
Nifty	40	10

One of the purchasers is chosen at random. Let A be the event that no claim is made by the purchaser under the warranty and B the event that the car purchased is a Nifty.

(a) Find $P(A \cap B)$.

(2)

(b) Find $P(A')$.

(2)

Given that the purchaser chosen does not make a claim under the warranty,

(c) find the probability that the car purchased is a Zippy.

(2)

(d) Show that making a claim is not independent of the make of the car purchased.

Comment on this result.

(3)

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3. A drinks machine dispenses coffee into cups. A sign on the machine indicates that each cup contains 50 ml of coffee. The machine actually dispenses a mean amount of 55 ml per cup and 10% of the cups contain less than the amount stated on the sign. Assuming that the amount of coffee dispensed into each cup is normally distributed find

(*a*) the standard deviation of the amount of coffee dispensed per cup in ml,

(4)

(*b*) the percentage of cups that contain more than 61 ml.

(3)

Following complaints, the owners of the machine make adjustments. Only 2.5% of cups now contain less than 50 ml. The standard deviation of the amount dispensed is reduced to 3 ml.

Assuming that the amount of coffee dispensed is still normally distributed,

(c) find the new mean amount of coffee per cup.

(4)

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4. A restaurant owner is concerned about the amount of time customers have to wait before being served. He collects data on the waiting times, to the nearest minute, of 20 customers. These data are listed below.

15, 14, 16, 15, 17, 16, 15, 14, 15, 16,

17, 16, 15, 14, 16, 17, 15, 25, 18, 16

(*a*) Find the median and inter-quartile range of the waiting times.

(5)

An outlier is an observation that falls either 1.5 × (inter-quartile range) above the upper quartile or 1.5 × (inter-quartile range) below the lower quartile.

(*b*) Draw a boxplot to represent these data, clearly indicating any outliers.

(7)

(*c*) Find the mean of these data.

(2)

(*d*) Comment on the skewness of these data. Justify your answer.

(2)

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5. The discrete random variable X has probability function

$$P(X = x) = \begin{cases} k(2 - x), & x = 0, 1, 2, \\ k(x - 2), & x = 3, \\ 0, & \text{otherwise,} \end{cases}$$

where k is a positive constant.

(a) Show that $k = 0.25$.

(2)

(b) Find $E(X)$ and show that $E(X^2) = 2.5$.

(4)

(c) Find $Var(3X - 2)$.

(3)

Two independent observations X_1 and X_2 are made of X.

(d) Show that $P(X_1 + X_2 = 5) = 0$.

(1)

(e) Find the complete probability function for $X_1 + X_2$.

(3)

(f) Find $P(1.3 \leq X_1 + X_2 \leq 3.2)$.

(3)

6. The chief executive of Rex cars wants to investigate the relationship between the number of new car sales and the amount of money spent on advertising. She collects data from company records on the number of new car sales, c, and the cost of advertising each year, p (£000). The data are shown in the table below.

Year	Number of new car sale, c	Cost of advertising (£000), p
1990	4240	120
1991	4380	126
1992	4420	132
1993	4440	134
1994	4430	137
1995	4520	144
1996	4590	148
1997	4660	150
1998	4700	153
1999	4790	158

(*a*) Using the coding $x = (p - 100)$ and $y = \frac{1}{10}(c - 4000)$, draw a scatter diagram to represent these data. Explain why x is the explanatory variable.

(5)

(*b*) Find the equation of the least squares regression line of y on x.

[Use $\Sigma x = 402$, $\Sigma y = 517$, $\Sigma x^2 = 17\,538$ and $\Sigma xy = 22\,611$.]

(7)

(*c*) Deduce the equation of the least squares regression line of c on p in the form $c = a + bp$.

(3)

(*d*) Interpret the value of a.

(2)

(*e*) Predict the number of extra new cars sales for an increase of £2000 in advertising budget. Comment on the validity of your answer.

(2)

END