GCE Examinations

Statistics
Module S1

Advanced Subsidiary / Advanced Level

Paper J

Time: 1 hour 30 minutes

Instructions and Information

Candidates may use any calculator except those with a facility for symbolic algebra and / or calculus.

Full marks may be obtained for answers to ALL questions.

Mathematical and statistical formulae and tables are available.

This paper has 6 questions.

Advice to Candidates

You must show sufficient working to make your methods clear to an examiner. Answers without working will gain no credit.



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1. A net was used to catch swallows so that they could be ringed and examined. The weights of 55 adult birds were recorded and the results are summarised in the table below.

Weight (g)	14 - 19	20 - 21	22 - 23	24 - 25	26 - 29	30 - 35
Frequency	3	6	15	20	9	2

(a) For these data calculate estimates of

(i) the median,

(ii) the 33rd percentile. **(5 marks)**

These data are represented by a histogram and the bar representing the 24 - 25 group is 1 cm wide and 20 cm high.

(b) Calculate the dimensions of the bars representing the groups

(i) 20 - 21

(ii) 26 - 29 **(6 marks)**

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2. The discrete random variable X has the probability function shown below.

$$P(X = x) = \begin{cases} \frac{k}{x}, & x = 1,\ 2,\ 3,\ 4, \\ 0, & \text{otherwise.} \end{cases}$$

(a) Show that $k = \frac{12}{25}$ **(3 marks)**

Find

(b) F(2), **(2 marks)**

(c) E(X), **(2 marks)**

(d) E($X^2 + 2$). **(4 marks)**

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3. A study was made of the heights of boys of different ages in Lancashire.

The study concluded that the heights of 13 year-old boys are normally distributed with a mean of 156 cm and a variance of 73 cm^2.

Find the probability that a 13 year-old boy chosen at random will be

(a) more than 165 cm tall, **(3 marks)**

(b) between 156 and 165 cm tall. **(2 marks)**

The study also concluded that the heights of 14 year-old boys are normally distributed with a mean of 160 cm and a variance of 79 cm^2.

One 13 year-old and one 14 year-old boy are chosen at random.

(c) Find the probability that both boys are more than 165 cm tall. **(5 marks)**

(d) State, with a reason, whether the probability that the combined height of the two boys is more than 330 cm is more or less than your answer to part *(c)*.

(2 marks)

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4. A company offering a bicycle courier service within London collected data on the delivery times for a sample of jobs completed by staff at each of its two offices.

The times, t minutes, for 20 deliveries handled by the company's Hammersmith office were summarised by

$$\Sigma t = 427, \text{ and } \Sigma t^2 = 11\,077.$$

(a) Find the mean and variance of the delivery times in this sample. **(5 marks)**

The company's Holborn office handles more business, so the delivery times for a sample of 30 jobs handled by this office was taken. The mean and standard deviation of this sample were 18.5 minutes and 8.2 minutes respectively.

(b) Find the mean and variance of the delivery times of the combined sample of 50 deliveries.

(8 marks)

Turn over

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5. A College employs 75 teachers, of whom 47 are full-time and the rest are part-time. Of the 39 male teachers at the College, 26 are full-time.

(a) Represent this information on a Venn diagram. **(3 marks)**

(b) One teacher is selected at random to be interviewed by an inspector. Find the probability that the teacher chosen

(i) works full-time and is female,

(ii) works part-time, given that he is male. **(4 marks)**

(c) Three teachers are selected at random to be observed by an inspector during one day. Find correct to 3 significant figures the probability that

(i) all three teachers chosen work full-time,

(ii) at least one of the three teachers chosen is female. **(7 marks)**

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6. A physics student recorded the length, l cm, of a spring when different masses, m grams, were suspended from it giving the following results.

m (g)	50	100	200	300	400	500	600	700
l (cm)	7.8	10.7	16.5	22.1	28.0	33.9	35.2	35.6

(a) Represent these data on a scatter diagram with l on the vertical axis. **(4 marks)**

The student decides to find the equation of a regression line of the form $l = a + bm$ using only the data for $m \leq 500$ g.

(b) Give a reason to support the fitting of such a regression line and explain why the student is excluding two of his values. **(2 marks)**

You may use

$$\Sigma m = 1550, \quad \Sigma l = 119, \quad \Sigma m^2 = 552\,500, \quad \Sigma l^2 = 2869.2, \quad \Sigma ml = 39\,540.$$

(c) Find the values of a and b. **(6 marks)**

(d) Explain the significance of the values of a and b in this situation. **(2 marks)**

END

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