

General Certificate of Education  
January 2005  
Advanced Subsidiary Examination

**MATHEMATICS**  
**Unit Statistics 1B**

**MS/SS1B**



**STATISTICS**  
**Unit Statistics 1B**

Thursday 27 January 2005 Afternoon Session

**In addition to this paper you will require:**

- an 8-page answer book;
- the **blue** AQA booklet of formulae and statistical tables;
- an insert for use in Question 3 (enclosed).

You may use a graphics calculator.

Time allowed: 1 hour 30 minutes

**Instructions**

- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Write the information required on the front of your answer book. The *Examining Body* for this paper is AQA. The *Paper Reference* is MS/SS1B.
- Answer **all** questions.
- All necessary working should be shown; otherwise marks for method may be lost.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.
- Fill in the boxes at the top of the insert.

**Information**

- The maximum mark for this paper is 75.
- Mark allocations are shown in brackets.
- Unit Statistics 1B has a **written paper only**.

**Advice**

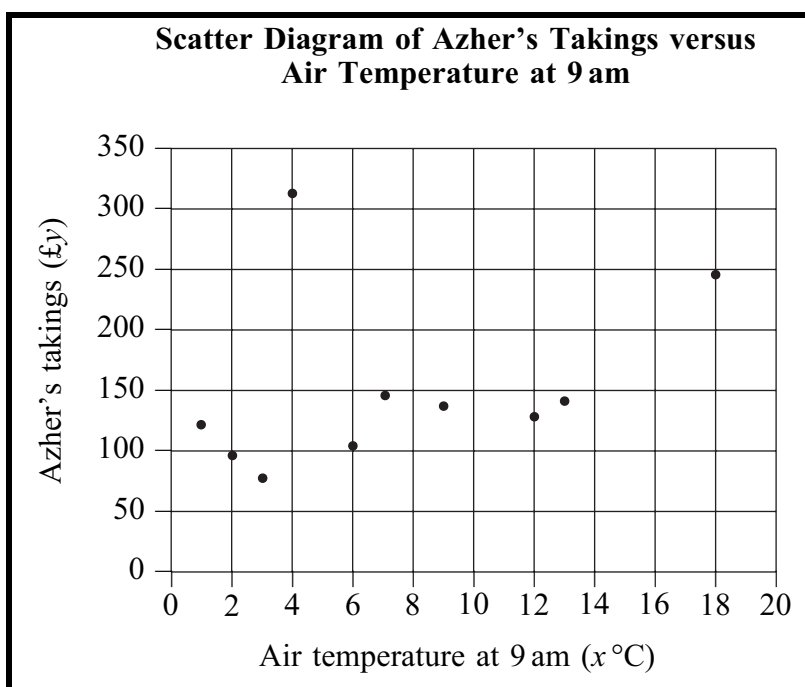
- Unless stated otherwise, formulae may be quoted, without proof, from the booklet.

Answer **all** questions.

- 1 Each Monday, Azher has a stall at a town's outdoor market. The table below shows, for each of a random sample of 10 Mondays during 2003, the air temperature,  $x$  °C, at 9 am and Azher's takings, £ $y$ .

Monday	1	2	3	4	5	6	7	8	9	10
$x$	2	6	9	18	1	3	7	12	13	4
$y$	97	103	136	245	121	78	145	128	141	312

- (a) A scatter diagram of these data is shown below.



- Give **two** distinct comments, in context, on what this diagram reveals. (2 marks)
- (b) One of the Mondays is found to be Easter Monday, the busiest Monday market of the year. Identify which Monday this is most likely to be. (1 mark)
- (c) **Removing the data for the Monday you identified in part (b)**, calculate the value of the product moment correlation coefficient for the remaining 9 pairs of values of  $x$  and  $y$ . (3 marks)
- (d) Name one other variable that would have been likely to affect Azher's takings at this town's outdoor market. (1 mark)

- 2 The volume, in millilitres, of lemonade in mini-cans may be assumed to be normally distributed with a standard deviation of 3.5.

The volumes, in millilitres, of lemonade in a random sample of 12 mini-cans were as follows.

155	148	156	149	147	156
157	156	150	154	148	154

- (a) Construct a 98% confidence interval for the mean volume of lemonade in a mini-can, giving the limits to one decimal place. *(5 marks)*
- (b) On each mini-can is printed “150 ml”. Comment on this, using the given sample and your confidence interval in part (a). *(3 marks)*
- (c) State why, in part (a), use of the Central Limit Theorem was **not** necessary. *(1 mark)*
- 3 [Figure 1, printed on the insert, is provided for use in this question.]

A parcel delivery company has a depot on the outskirts of a town.

Each weekday, a van leaves the depot to deliver parcels across a nearby area. The table below shows, for a random sample of 10 weekdays, the number,  $x$ , of parcels to be delivered and the total time,  $y$  minutes, that the van is out of the depot.

$x$	9	16	22	11	19	26	14	10	11	17
$y$	79	127	172	109	152	214	131	80	94	148

- (a) On **Figure 1**, plot a scatter diagram of these data. *(2 marks)*
- (b) Calculate the equation of the least squares regression line of  $y$  on  $x$  and draw your line on **Figure 1**. *(6 marks)*
- (c) Use your regression equation to estimate the total time that the van is out of the depot when delivering:
- (i) 15 parcels;
- (ii) 35 parcels. *(2 marks)*
- Comment on the likely reliability of **each** of your estimates. *(2 marks)*
- (d) The time that the van is out of the depot delivering parcels may be thought of as the time needed to travel to and from the area plus an amount of time proportional to the number of parcels to be delivered.

Given that the regression line of  $y$  on  $x$  is of the form  $y = a + bx$ , give an interpretation, in context, for each of your values of  $a$  and  $b$ . *(2 marks)*

**Turn over** ►

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4 Chopped lettuce is sold in bags nominally containing 100 grams.

The weight,  $X$  grams, of chopped lettuce, delivered by the machine filling the bags, may be assumed to be normally distributed with mean  $\mu$  and standard deviation 4.

- (a) Assuming that  $\mu = 106$ , determine the probability that a randomly selected bag of chopped lettuce:
- (i) weighs less than 110 grams; *(3 marks)*
  - (ii) is underweight. *(3 marks)*
- (b) Determine the minimum value of  $\mu$  so that at most 2 per cent of bags of chopped lettuce are underweight. Give your answer to one decimal place. *(4 marks)*
- (c) Boxes each contain 10 bags of chopped lettuce. The mean weight of a bag of chopped lettuce in a box is denoted by  $\bar{X}$ .

Given that  $\mu = 108.5$ :

- (i) write down values for the mean and variance of  $\bar{X}$ ; *(2 marks)*
- (ii) determine the probability that  $\bar{X}$  exceeds 110. *(3 marks)*

- 5 Each evening Aaron sets his alarm for 7 am. He believes that the probability that he wakes before his alarm rings each morning is 0.4, and is independent from morning to morning.
- (a) Assuming that Aaron's belief is correct, determine the probability that, during a week (7 mornings), he wakes before his alarm rings:
- (i) on 2 or fewer mornings;
- (ii) on more than 1 but fewer than 5 mornings. *(5 marks)*
- (b) Assuming that Aaron's belief is correct, calculate the probability that, during a 4-week period, he wakes before his alarm rings on exactly 7 mornings. *(3 marks)*
- (c) Assuming that Aaron's belief is correct, calculate values for the mean and standard deviation of the number of mornings in a week when Aaron wakes before his alarm rings. *(2 marks)*
- (d) During a 50-week period, Aaron records, each week, the number of mornings on which he wakes before his alarm rings. The results are as follows.

<b>Number of mornings</b>	0	1	2	3	4	5	6	7
<b>Frequency</b>	10	8	7	7	5	5	4	4

- (i) Calculate the mean and standard deviation of these data. *(3 marks)*
- (ii) State, giving reasons, whether your answers to part (d)(i) support Aaron's belief that the probability that he wakes before his alarm rings each morning is 0.4, and is independent from morning to morning. *(3 marks)*

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

- 6 The table below shows the numbers of males and females in each of three employment categories at a university on 31 July 2003.

	Employment category		
	Managerial	Academic	Support
Male	38	369	303
Female	26	275	643

- (a) An employee is selected at random. Determine the probability that the employee is:
- (i) female; *(1 mark)*
  - (ii) a female academic; *(1 mark)*
  - (iii) either female or academic or both; *(2 marks)*
  - (iv) female, given that the employee is academic. *(2 marks)*
- (b) Three employees are selected at random, without replacement. Determine the probability that:
- (i) all three employees are male; *(2 marks)*
  - (ii) exactly one employee is male. *(3 marks)*
- (c) The event “employee selected is academic” is denoted by  $A$ . The event “employee selected is female” is denoted by  $F$ .

Describe in context, as simply as possible, the events denoted by:

- (i)  $F \cap A$ ; *(1 mark)*
- (ii)  $F' \cup A$ . *(2 marks)*

**END OF QUESTIONS**

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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Insert for use in Question 3.

Fill in the boxes at the top of this page.

Fasten this insert securely to your answer book.

**TURN OVER FOR FIGURE 1**

**Scatter diagram for parcel deliveries by a van**