

General Certificate of Education
June 2008
Advanced Subsidiary Examination



MATHEMATICS
Unit Statistics 1B

MS/SS1B

STATISTICS
Unit Statistics 1B

Wednesday 21 May 2008 1.30 pm to 3.00 pm

For this paper you must have:

- 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 black ink or black 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.
- Show all necessary working; 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.
- The marks for questions are shown in brackets.
- Unit Statistics 1B has a **written paper only**.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.

Answer **all** questions.

- 1 The table shows the times taken, y minutes, for a wood glue to dry at different air temperatures, x °C.

| | | | | | | | | | |
|-----|------|------|------|------|------|------|------|------|------|
| x | 10 | 12 | 15 | 18 | 20 | 22 | 25 | 28 | 30 |
| y | 42.9 | 40.6 | 38.5 | 35.4 | 33.0 | 30.7 | 28.0 | 25.3 | 22.6 |

- (a) Calculate the equation of the least squares regression line $y = a + bx$. *(4 marks)*
- (b) Estimate the time taken for the glue to dry when the air temperature is 21 °C. *(2 marks)*
- 2 A basket in a stationery store contains a total of 400 marker and highlighter pens. Of the marker pens, some are permanent and the rest are non-permanent. The colours and types of pen are shown in the table.

| Type | Colour | | | |
|-----------------------------|--------|------|-----|-------|
| | Black | Blue | Red | Green |
| Permanent marker | 44 | 66 | 32 | 18 |
| Non-permanent marker | 36 | 53 | 21 | 10 |
| Highlighter | 0 | 41 | 37 | 42 |

A pen is selected at random from the basket. Calculate the probability that it is:

- (a) a blue pen; *(1 mark)*
- (b) a marker pen; *(2 marks)*
- (c) a blue pen or a marker pen; *(2 marks)*
- (d) a green pen, given that it is a highlighter pen; *(2 marks)*
- (e) a non-permanent marker pen, given that it is a red pen. *(2 marks)*

3 [Figure 1, printed on the insert, is provided for use in this question.]

The table shows, for each of a sample of 12 handmade decorative ceramic plaques, the length, x millimetres, and the width, y millimetres.

| Plaque | x | y |
|--------|-----|-----|
| A | 232 | 109 |
| B | 235 | 112 |
| C | 236 | 114 |
| D | 234 | 118 |
| E | 230 | 117 |
| F | 230 | 113 |
| G | 246 | 121 |
| H | 240 | 125 |
| I | 244 | 128 |
| J | 241 | 122 |
| K | 246 | 126 |
| L | 245 | 123 |

- (a) Calculate the value of the product moment correlation coefficient between x and y .
(3 marks)
- (b) Interpret your value in the context of this question.
(2 marks)
- (c) On **Figure 1**, complete the scatter diagram for these data.
(3 marks)
- (d) In fact, the 6 plaques A, B, ..., F are from a different source to the 6 plaques G, H, ..., L.

With reference to your scatter diagram, **but without further calculations**, estimate the value of the product moment correlation coefficient between x and y for **each** source of plaque.
(2 marks)

4 The runs scored by a cricketer in 11 innings during the 2006 season were as follows.

47 63 0 28 40 51 a 77 0 13 35

The exact value of a was unknown but it was greater than 100.

- (a) Calculate the median and the interquartile range of these 11 values. *(4 marks)*
- (b) Give a reason why, for these 11 values:
- (i) the mode is **not** an appropriate measure of average;
 - (ii) the range is **not** an appropriate measure of spread. *(2 marks)*

5 When a particular make of tennis ball is dropped from a vertical distance of 250 cm on to concrete, the height, X centimetres, to which it first bounces may be assumed to be normally distributed with a mean of 140 and a standard deviation of 2.5.

- (a) Determine:
- (i) $P(X < 145)$; *(3 marks)*
 - (ii) $P(138 < X < 142)$. *(4 marks)*
- (b) Determine, to one decimal place, the maximum height exceeded by 85% of first bounces. *(4 marks)*
- (c) Determine the probability that, for a random sample of 4 first bounces, the mean height is greater than 139 cm. *(4 marks)*

6 For the adult population of the UK, 35 per cent of men and 29 per cent of women do not wear glasses or contact lenses.

- (a) Determine the probability that, in a random sample of 40 men:
- (i) at most 15 do not wear glasses or contact lenses; *(3 marks)*
 - (ii) more than 10 but fewer than 20 do not wear glasses or contact lenses. *(3 marks)*
- (b) Calculate the probability that, in a random sample of 10 women, exactly 3 do not wear glasses or contact lenses. *(3 marks)*
- (c) (i) Calculate the mean and the variance for the number who **do** wear glasses or contact lenses in a random sample of 20 women. *(3 marks)*
- (ii) The numbers wearing glasses or contact lenses in 10 groups, each of 20 women, had a mean of 16.5 and a variance of 2.50.

Comment on the claim that these 10 groups were **not** random samples. *(3 marks)*

7 Vernon, a service engineer, is expected to carry out a boiler service in one hour.

One hour is subtracted from each of his actual times, and the resulting differences, x minutes, for a random sample of 100 boiler services are summarised in the table.

| Difference | Frequency |
|--------------------|------------|
| $-6 \leq x < -4$ | 4 |
| $-4 \leq x < -2$ | 9 |
| $-2 \leq x < 0$ | 13 |
| $0 \leq x < 2$ | 27 |
| $2 \leq x < 4$ | 21 |
| $4 \leq x < 6$ | 15 |
| $6 \leq x < 8$ | 7 |
| $8 \leq x \leq 10$ | 4 |
| Total | 100 |

- (a) (i) Calculate estimates of the mean and the standard deviation of these differences. *(4 marks)*
- (ii) Hence deduce, in minutes, estimates of the mean and the standard deviation of Vernon's actual service times for this sample. *(3 marks)*
- (b) (i) Construct an approximate 98% confidence interval for the mean time taken by Vernon to carry out a boiler service. *(4 marks)*
- (ii) Give a reason why this confidence interval is approximate rather than exact. *(1 mark)*
- (c) Vernon claims that, more often than not, a boiler service takes more than an hour and that, on average, a boiler service takes much longer than an hour.
- Comment, with a justification, on **each** of these claims. *(2 marks)*

END OF QUESTIONS

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| Surname | | | | | | Other Names | | | | | |
| Centre Number | | | | | | Candidate Number | | | | | |
| Candidate Signature | | | | | | | | | | | |

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Insert

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

Turn over ►

Figure 1 (for use in Question 3)

Decorative Plaques

