General Certificate of Education
June 2008
Advanced Subsidiary Examination

MATHEMATICS **MS/SS1B**
Unit Statistics 1B

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.

	Colour			
Type	**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
$-6 \leqslant x < -4$	4
$-4 \leqslant x < -2$	9
$-2 \leqslant x < 0$	13
$0 \leqslant x < 2$	27
$2 \leqslant x < 4$	21
$4 \leqslant x < 6$	15
$6 \leqslant x < 8$	7
$8 \leqslant x \leqslant 10$	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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ASSESSMENT and QUALIFICATIONS ALLIANCE

MATHEMATICS **MS/SS1B**
Unit Statistics 1B

STATISTICS
Unit Statistics 1B

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

Figure 1 (for use in Question 3)

Decorative Plaques