General Certificate of Education
January 2009
Advanced Subsidiary Examination

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

STATISTICS
Unit Statistics 1B

Friday 9 January 2009 9.00 am to 10.30 am

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 6 (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 Ms N Parker always reads the columns of announcements in her local weekly newspaper. During each week of 2008, she notes the number of births announced. Her results are summarised in the table.

Number of births	1	2	3	4	5	6	7	8
Number of weeks	1	2	9	13	7	13	6	1

(a) Calculate the mean, median and modes of these data. *(5 marks)*

(b) State, with a reason, which of the three measures of average in part (a) you consider to be the **least** appropriate for summarising the number of births. *(2 marks)*

2 A greengrocer sells bunches of 9 carrots at his Saturday market stall. Tom and Geri are two Statistics students who work on the stall. Each selects a bunch of carrots at random.

(a) At home, Tom measures the length, x centimetres, and the maximum diameter, y centimetres, of each carrot in his selected bunch with the following results.

x	16.2	13.1	10.4	12.1	14.6	9.7	11.8	13.6	17.3
y	4.2	3.9	4.7	3.3	3.7	2.4	3.1	3.5	2.7

(i) Calculate the value of the product moment correlation coefficient. *(3 marks)*

(ii) Interpret your value in context. *(2 marks)*

(b) At her home, Geri measures the length, in centimetres, and the **weight**, in grams, of each carrot in her selected bunch and then obtains a value of -0.986 for the product moment correlation coefficient.

Comment, with a reason, on the likely validity of Geri's value. *(2 marks)*

3 UPVC facia board is supplied in lengths labelled as 5 metres. The actual length, X metres, of a board may be modelled by a normal distribution with a mean of 5.08 and a standard deviation of 0.05.

(a) Determine:

(i) $P(X < 5)$; *(3 marks)*

(ii) $P(5 < X < 5.10)$. *(2 marks)*

(b) Determine the probability that the mean length of a random sample of 4 boards:

(i) exceeds 5.05 metres; *(4 marks)*

(ii) is exactly 5 metres. *(1 mark)*

(c) Assuming that the value of the standard deviation remains unchanged, determine the mean length necessary to ensure that only 1 per cent of boards have lengths less than 5 metres. *(4 marks)*

4 Gary and his neighbour Larry work at the same place.

On any day when Gary travels to work, he uses one of three options: his car only, a bus only or both his car and a bus. The probability that he uses his car, either on its own or with a bus, is 0.6. The probability that he uses both his car and a bus is 0.25.

(a) Calculate the probability that, on any particular day when Gary travels to work, he:

(i) does not use his car; *(1 mark)*

(ii) uses his car only; *(2 marks)*

(iii) uses a bus. *(3 marks)*

(b) On any day, the probability that Larry travels to work with Gary is 0.9 when Gary uses his car only, is 0.7 when Gary uses both his car and a bus, and is 0.3 when Gary uses a bus only.

(i) Calculate the probability that, on any particular day when Gary travels to work, Larry travels with him. *(4 marks)*

(ii) Assuming that option choices are independent from day to day, calculate, to three decimal places, the probability that, during any particular week (5 days) when Gary travels to work every day, Larry never travels with him. *(2 marks)*

5 The times taken by new recruits to complete an assault course may be modelled by a normal distribution with a standard deviation of 8 minutes.

A group of 30 new recruits takes a total time of 1620 minutes to complete the course.

(a) Calculate the mean time taken by these 30 new recruits. *(1 mark)*

(b) Assuming that the 30 recruits may be considered to be a random sample, construct a 98% confidence interval for the mean time taken by new recruits to complete the course. *(4 marks)*

(c) Construct an interval within which approximately 98% of the times taken by individual new recruits to complete the course will lie. *(2 marks)*

(d) State where, if at all, in this question you made use of the Central Limit Theorem. *(1 mark)*

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

For a random sample of 10 patients who underwent hip-replacement operations, records were kept of their ages, x years, and of the number of days, y, following their operations before they were able to walk unaided safely.

Patient	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
x	55	51	62	66	72	59	78	55	62	70
y	34	33	39	49	48	43	51	41	46	51

(a) On **Figure 1**, complete the scatter diagram for these data. *(2 marks)*

(b) Calculate the equation of the least squares regression line of y on x. *(4 marks)*

(c) Draw your regression line on **Figure 1**. *(2 marks)*

(d) In fact, patients H, I and J were males and the other 7 patients were females.

(i) Calculate the mean of the residuals for the 3 male patients. *(4 marks)*

(ii) Hence estimate, for a male patient aged 65 years, the number of days following his hip-replacement operation before he is able to walk unaided safely. *(3 marks)*

7 The proportion of passengers who use senior citizen bus passes to travel into a particular town on 'Park & Ride' buses between 9.30 am and 11.30 am on weekdays is 0.45.

It is proposed that, when there are n passengers on a bus, a suitable model for the number of passengers using senior citizen bus passes is the distribution $B(n, 0.45)$.

(a) Assuming that this model applies to the 10.30 am weekday 'Park & Ride' bus into the town:

(i) calculate the probability that, when there are **16** passengers, exactly 3 of them are using senior citizen bus passes; *(3 marks)*

(ii) determine the probability that, when there are **25** passengers, fewer than 10 of them are using senior citizen bus passes; *(2 marks)*

(iii) determine the probability that, when there are **40** passengers, at least 15 but at most 20 of them are using senior citizen bus passes; *(3 marks)*

(iv) calculate the mean and the variance for the number of passengers using senior citizen bus passes when there are **50** passengers. *(2 marks)*

(b) (i) Give a reason why the proposed model may not be suitable. *(1 mark)*

(ii) Give a **different** reason why the proposed model would not be suitable for the number of passengers using senior citizen bus passes to travel into the town on the **7.15 am** weekday 'Park & Ride' bus. *(1 mark)*

END OF QUESTIONS

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