

General Certificate of Education
January 2007
Advanced Subsidiary Examination



MATHEMATICS
Unit Statistics 1B

MS/SS1B

STATISTICS
Unit Statistics 1B

Tuesday 23 January 2007 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 7 (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.
- 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 times, in seconds, taken by 20 people to solve a simple numerical puzzle were

17 19 22 26 28 31 34 36 38 39
41 42 43 47 50 51 53 55 57 58

(a) Calculate the mean and the standard deviation of these times. (3 marks)

(b) In fact, 23 people solved the puzzle. However, 3 of them failed to solve it within the allotted time of 60 seconds.

Calculate the median and the interquartile range of the times taken by all 23 people.

(4 marks)

(c) For the times taken by all 23 people, explain why:

(i) the mode is **not** an appropriate numerical measure;

(ii) the range is **not** an appropriate numerical measure.

(2 marks)

2 A hotel has 50 single rooms, 16 of which are on the ground floor. The hotel offers guests a choice of a full English breakfast, a continental breakfast or no breakfast. The probabilities of these choices being made are 0.45, 0.25 and 0.30 respectively. It may be assumed that the choice of breakfast is independent from guest to guest.

(a) On a particular morning there are 16 guests, each occupying a single room on the ground floor. Calculate the probability that exactly 5 of these guests require a full English breakfast. (3 marks)

(b) On a particular morning when there are 50 guests, each occupying a single room, determine the probability that:

(i) at most 12 of these guests require a continental breakfast;

(2 marks)

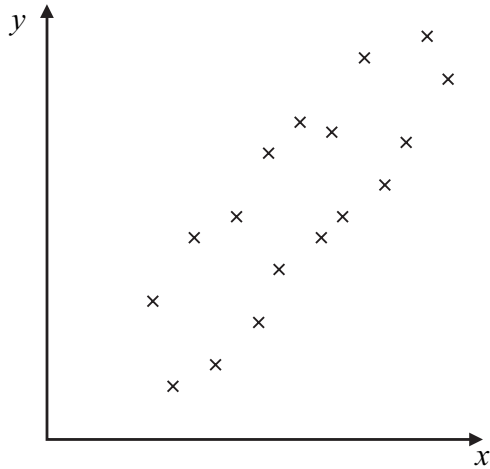
(ii) more than 10 but fewer than 20 of these guests require no breakfast.

(3 marks)

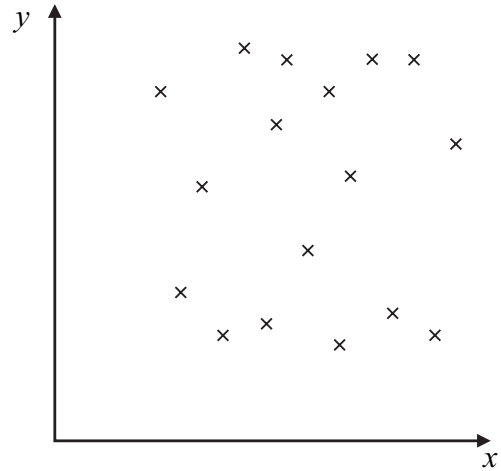
(c) When there are 40 guests, each occupying a single room, calculate the mean and the standard deviation for the number of these guests requiring breakfast. (4 marks)

- 3 Estimate, **without undertaking any calculations**, the value of the product moment correlation coefficient between the variables x and y in each of the three scatter diagrams.

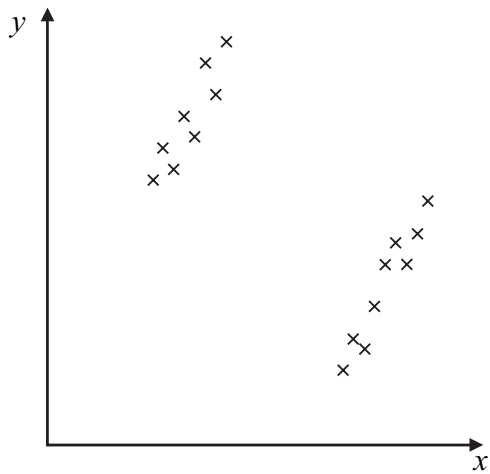
(a)



(b)



(c)



(5 marks)

Turn over for the next question

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- 4 A very popular play has been performed at a London theatre on each of 6 evenings per week for about a year. Over the past 13 weeks (78 performances), records have been kept of the proceeds from the sales of programmes at each performance. An analysis of these records has found that the mean was £184 and the standard deviation was £32.
- (a) Assuming that the 78 performances may be considered to be a random sample, construct a 90% confidence interval for the mean proceeds from the sales of programmes at an evening performance of this play. *(4 marks)*
- (b) Comment on the likely validity of the assumption in part (a) when constructing a confidence interval for the mean proceeds from the sales of programmes at an evening performance of:
- (i) this particular play;
- (ii) any play. *(3 marks)*
- 5 Dafydd, Eli and Fabio are members of an amateur cycling club that holds a time trial each Sunday during the summer. The independent probabilities that Dafydd, Eli and Fabio take part in any one of these trials are 0.6, 0.7 and 0.8 respectively.
- Find the probability that, on a particular Sunday during the summer:
- (a) none of the three cyclists takes part; *(2 marks)*
- (b) Fabio is the only one of the three cyclists to take part; *(2 marks)*
- (c) exactly one of the three cyclists takes part; *(3 marks)*
- (d) either one or two of the three cyclists take part. *(3 marks)*

6 When Monica walks to work from home, she uses either route A or route B.

- (a) Her journey time, X minutes, by route A may be assumed to be normally distributed with a mean of 37 and a standard deviation of 8.

Determine:

(i) $P(X < 45)$; *(3 marks)*

(ii) $P(30 < X < 45)$. *(3 marks)*

- (b) Her journey time, Y minutes, by route B may be assumed to be normally distributed with a mean of 40 and a standard deviation of σ .

Given that $P(Y > 45) = 0.12$, calculate the value of σ . *(4 marks)*

- (c) If Monica leaves home at 8.15 am to walk to work hoping to arrive by 9.00 am, state, with a reason, which route she should take. *(2 marks)*

- (d) When Monica travels to work from home by car, her journey time, W minutes, has a mean of 18 and a standard deviation of 12.

Estimate the probability that, for a random sample of 36 journeys to work from home by car, Monica's mean time is more than 20 minutes. *(4 marks)*

- (e) Indicate where, if anywhere, in this question you needed to make use of the Central Limit Theorem. *(1 mark)*

Turn over for the next question

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

Stan is a retired academic who supplements his pension by mowing lawns for customers who live nearby.

As part of a review of his charges for this work, he measures the areas, $x \text{ m}^2$, of a random sample of eight of his customers' lawns and notes the times, y minutes, that it takes him to mow these lawns. His results are shown in the table.

Customer	A	B	C	D	E	F	G	H
x	360	140	860	600	1180	540	260	480
y	50	25	135	70	140	90	55	70

- (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 . Draw your line on **Figure 1**. (6 marks)
- (c) Calculate the value of the residual for Customer H and indicate how your value is confirmed by your scatter diagram. (3 marks)
- (d) Given that Stan charges £12 per hour, estimate the charge for mowing a customer's lawn that has an area of 560 m^2 . (4 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 7**.

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 7)**Lawn Areas and Mowing Times**