

General Certificate of Education
January 2008
Advanced Subsidiary Examination



MATHEMATICS
Unit Statistics 1A

MS/SS1A/W

STATISTICS
Unit Statistics 1A

Tuesday 22 January 2008 1.30 pm to 2.45 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 4 (enclosed).

You may use a graphics calculator.

Time allowed: 1 hour 15 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/SS1A/W.
- 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 60.
- The marks for questions are shown in brackets.
- Unit Statistics 1A has a **written paper and coursework**.

Advice

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

Answer **all** questions.

- 1 In large-scale tree-felling operations, a machine cuts down trees, strips off the branches and then cuts the trunks into logs of length X metres for transporting to a sawmill.

It may be assumed that values of X are normally distributed with mean 3.3 and standard deviation 0.16.

Determine:

- (a) $P(X < 3.5)$; *(3 marks)*
- (b) $P(X > 3.0)$; *(3 marks)*
- (c) $P(3.0 < X < 3.5)$. *(2 marks)*

- 2 David and his partner, Amber, both work at their district hospital. The probability that David cycles to work each morning is 0.85. On a morning when David cycles to work, the probability that Amber cycles to work is 0.80. On a morning when David does not cycle to work, the probability that Amber cycles to work is 0.30.

- (a) Calculate the probability that, on a particular morning:
- (i) they both cycle to work; *(2 marks)*
- (ii) only Amber cycles to work; *(2 marks)*
- (iii) exactly one of them cycles to work. *(2 marks)*
- (b) Assuming that decisions as to whether to cycle to work are independent from day to day, calculate the probability that, during a period of 4 working days, they both cycle to work on exactly 3 of the days and neither of them cycles to work on the other day. *(4 marks)*

- 3 The volume, x litres, of magnolia emulsion paint in each of 60 identical containers is measured. The following statistics are calculated from the results.

$$\text{Mean, } \bar{x} = 10.191 \qquad \text{Standard deviation, } s = 0.13759$$

- (a) (i) Stating a necessary assumption about the 60 containers, construct a 99% confidence interval for the mean volume of magnolia emulsion paint in such containers, giving the limits to two decimal places. *(5 marks)*
- (ii) Labels on the containers indicate a volume of 10 litres of magnolia emulsion paint.

Comment on the likely accuracy of this labelling. *(2 marks)*

- (b) Indicate, with a reason, whether or not you made use of the Central Limit Theorem in answering part (a)(i). *(1 mark)*

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

Roseen is a self-employed decorator who wishes to estimate the times that it will take her to decorate bedrooms based upon their floor areas. She records the floor area, $x \text{ m}^2$, and the decorating time, y hours, for each of 10 bedrooms she has recently decorated.

x	11.0	22.0	7.5	21.0	13.0	16.5	14.0	16.0	18.5	20.5
y	15.0	35.0	16.0	23.5	24.0	17.5	14.5	27.5	22.5	34.5

- (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 . *(4 marks)*
- (c) Draw your regression line on **Figure 1**. *(2 marks)*
- (d) (i) Use your regression equation to estimate the time that Roseen will take to decorate a bedroom with a floor area of 15 m^2 . *(2 marks)*
- (ii) Making reference to **Figure 1**, comment on the likely reliability of your estimate in part (d)(i). *(2 marks)*

- 5 For each of the Premiership football seasons 2004/05 and 2005/06, a count is made of the number of goals scored in each of the 380 matches. The results are shown in the table.

Number of goals scored in a match	Number of matches	
	2004/05	2005/06
0	30	32
1	79	82
2	99	95
3	68	78
4	60	48
5	24	30
6	11	9
7	6	6
8	2	0
9	1	0
Total	380	380

- (a) For the number of goals scored in a match during the **2004/05** season:
- determine the median and the interquartile range; *(4 marks)*
 - calculate the mean and the standard deviation. *(4 marks)*
- (b) Two statistics students, Jole and Katie, independently analyse the data on the number of goals scored in a match during the **2005/06** season.
- Jole determines correctly that the median is 2 and that the interquartile range is also 2.
 - Katie calculates correctly, to two decimal places, that the mean is 2.48 and that the standard deviation is 1.59.

Use your answers from part (a), together with Jole's and Katie's results, to compare briefly the two seasons with regard to the average and the spread of the number of goals scored in a match. *(2 marks)*

6 A travel agency in Tunisia offers customers a 3-day tour into the Sahara desert by either coach or minibus.

- (a) The agency accepts bookings from 50 customers for seats on the coach. The probability that a customer, who has booked a seat on the coach, will **not** turn up to claim the seat is 0.08, and may be assumed to be independent of the behaviour of other customers.

Determine the probability that, of the customers who have booked a seat on the coach:

(i) two or more will **not** turn up;

(ii) three or more will **not** turn up. *(4 marks)*

- (b) The agency accepts bookings from 15 customers for seats on the minibus. The probability that a customer, who has booked a seat on the minibus, will **not** turn up to claim the seat is 0.025, and may be assumed to be independent of the behaviour of other customers.

Calculate the probability that, of the customers who have booked a seat on the minibus:

(i) all will turn up;

(ii) one or more will **not** turn up. *(4 marks)*

- (c) The coach has 48 seats and the minibus has 14 seats. If 14 or fewer customers who have booked seats on the minibus turn up, they will be allocated a seat on the minibus. If all 15 customers who have booked seats on the minibus turn up, one will be allocated a seat on the coach. This will leave only 47 seats available for the 50 customers who have booked seats on the coach.

Use your results from parts (a) and (b) to calculate the probability that there will be seats available on the coach for all those who turn up having booked such seats.

(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 4**.

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 4)