

General Certificate of Education
June 2005
Advanced Subsidiary Examination

MATHEMATICS
Unit Statistics 1A

MS/SS1A/W



STATISTICS
Unit Statistics 1A

Thursday 9 June 2005 Morning Session

In addition to this paper you will require:

- an 8-page answer book;
 - the **blue** AQA booklet of formulae and statistical tables.
- 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.
- All necessary working should be shown; 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.

Information

- The maximum mark for this paper is 60.
- Mark allocations are shown in brackets.
- Unit Statistics 1A has a **written paper and coursework**.

Advice

- Unless stated otherwise, formulae may be quoted, without proof, from the booklet.

Answer **all** questions.

- 1 For each of a random sample of 10 customers, a store records the time, x minutes, spent shopping and the value, $\pounds y$, to the nearest 10p, of items purchased. The results are tabulated below.

Time (x)	13	4	5	10	9	17	23	16	2	16
Value (y)	12.5	5.7	2.3	18.4	7.9	17.1	17.9	18.6	8.3	21.3

- (a) (i) Calculate the value of the product moment correlation coefficient between x and y .
(3 marks)
- (ii) Interpret your value in context.
(2 marks)
- (b) Write down the value of the product moment correlation coefficient if the time had been recorded in seconds and the value in pence to the nearest 10p.
(1 mark)
- 2 (a) The volume, X millilitres, of toothpaste in medium-sized tubes may be assumed to be normally distributed with a mean of 56 and a standard deviation of 2.5.

Determine the probability that the volume of toothpaste in a tube is:

- (i) less than 60 ml; (3 marks)
- (ii) between 50 ml and 60 ml; (3 marks)
- (iii) exactly 55 ml. (1 mark)
- (b) The volume, Y millilitres, of toothpaste in large-sized tubes may be assumed to be normally distributed with a standard deviation of 3.4.

Given that 98 per cent of these tubes contain more than 100 ml of toothpaste, determine the mean volume of toothpaste in a large-sized tube. (4 marks)

3 A reliable estimate for the proportion of a population of fish with a certain disease is 60 per cent.

A test for the presence of the disease in a fish is possible. The test gives one of three conclusions: diseased, inconclusive, non-diseased.

For a **diseased** fish, the probabilities of these three conclusions are:

diseased	0.75
inconclusive	0.15
non-diseased	0.10

For a **non-diseased** fish, the probabilities of these three conclusions are:

diseased	0.05
inconclusive	0.15
non-diseased	0.80

- (a) A fish is selected at random. Using a tree diagram, or otherwise, calculate the probability that:
- (i) the fish has the disease and the test concludes that it is diseased; *(2 marks)*
 - (ii) the test concludes that the fish has the disease; *(3 marks)*
 - (iii) the test gives a correct conclusion. *(2 marks)*
- (b) Three fish, all with the disease, are tested.

Find the probability that the test concludes that two fish are diseased and one fish is non-diseased. *(3 marks)*

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 4 The time taken for a fax machine to scan an A4 sheet of paper is dependent, in part, on the number of lines of print on the sheet. The table below shows, for each of a random sample of 8 sheets of A4 paper, the number, x , of lines of print and the scanning time, y seconds, taken by the fax machine.

Sheet	1	2	3	4	5	6	7	8
x	10	16	23	27	31	35	38	44
y	2.4	3.5	3.2	4.1	4.1	5.6	4.6	5.3

- (a) Calculate the equation of the least squares regression line of y on x . *(4 marks)*
- (b) The following table lists some of the residuals for the regression line.

Sheet	1	2	3	4	5	6	7	8
Residual	-0.174	0.418		0.085	-0.254	0.906		-0.157

- (i) Calculate the values of the residuals for sheets 3 and 7. *(3 marks)*
- (ii) Hence explain what can be deduced about the regression line. *(2 marks)*
- 5 (a) At a particular checkout in a supermarket, the probability that the barcode reader fails to read the barcode first time on any item is 0.07, and is independent from item to item.
- (i) Calculate the probability that, from a shopping trolley containing 17 items, the reader fails to read the barcode first time on exactly 2 of the items. *(3 marks)*
- (ii) Determine the probability that, from a shopping trolley containing 50 items, the reader fails to read the barcode first time on at most 5 of the items. *(2 marks)*
- (b) At another checkout in the supermarket, the probability that a faulty barcode reader fails to read the barcode first time on any item is 0.55, and is independent from item to item.
- Determine the probability that, from a shopping trolley containing 50 items, this reader fails to read the barcode first time on at least 30 of the items. *(3 marks)*

- 6 On arrival at a business centre, all visitors are required to register at the reception desk. An analysis of the register, for a random sample of 100 days, results in the following information on the number, X , of visitors per day.

Number of visitors per day	Number of days
1 – 10	13
11 – 20	33
21 – 25	17
26 – 30	12
31 – 35	8
36 – 40	5
41 – 50	5
51 – 100	7
Total	100

- (a) Calculate an estimate of:
- μ , the mean number of visitors per day;
 - σ , the standard deviation of the number of visitors per day. (4 marks)
- (b) Give a reason, based upon the data provided, why X is **unlikely** to be normally distributed. (1 mark)
- (c) (i) Give a reason why \bar{X} , the mean of a random sample of 100 observations on X , may be assumed to be normally distributed. (1 mark)
- (ii) State, in terms of μ and σ , the mean and variance of \bar{X} . (2 marks)
- (d) Hence construct a 99% confidence interval for μ . (4 marks)
- (e) The receptionist claims that she registers on average more than 30 visitors per day, and frequently registers more than 50 visitors on any one day.

Comment on **each** of these **two** claims. (4 marks)

END OF QUESTIONS

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