



General Certificate of Education
Advanced Subsidiary Examination
January 2010

Mathematics

MS/SS1A/W

Unit Statistics 1A

Statistics

Unit Statistics 1A

Wednesday 13 January 2010 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.

You may use a graphics calculator.

Time allowed

- 1 hour 15 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/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.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- 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 Draught excluder for doors and windows is sold in rolls of nominal length 10 metres.

The actual length, X metres, of draught excluder on a roll may be modelled by a normal distribution with mean 10.2 and standard deviation 0.15.

(a) Determine:

(i) $P(X < 10.5)$; (3 marks)

(ii) $P(10.0 < X < 10.5)$. (3 marks)

(b) A customer randomly selects six 10-metre rolls of the draught excluder.

Calculate the probability that all six rolls selected contain more than 10 metres of draught excluder. (3 marks)

- 2 Lizzie, the receptionist at a dental practice, was asked to keep a weekly record of the number of patients who failed to turn up for an appointment. Her records for the first 15 weeks were as follows.

20 26 32 a 37 14 27 34 15 18 b 25 37 29 25

Unfortunately, Lizzie forgot to record the actual values for two of the 15 weeks, so she recorded them as a and b . However, she did remember that $a < 10$ and that $b > 40$.

(a) Calculate the median and the interquartile range of these 15 values. (4 marks)

(b) Give a reason why, for these data:

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

(ii) the standard deviation **cannot** be used as a measure of spread. (2 marks)

- 3 The table shows, for each of a random sample of 7 weeks, the number of customers, x , who purchased fuel from a filling station, together with the total volume, y litres, of fuel purchased by these customers.

x	230	184	165	147	241	174	210
y	4551	3410	3252	3756	3787	4024	4254

- (a) Calculate the equation of the least squares regression line of y on x . (4 marks)
- (b) Estimate the volume of fuel sold during a week in which 200 customers purchase fuel. (2 marks)
- (c) Comment on the likely reliability of your estimate in part (b), given that, for the regression line calculated in part (a), the values of the 7 residuals lie between approximately -415 litres and $+430$ litres. (2 marks)
- 4 Each school-day morning, three students, Rita, Said and Ting, travel independently from their homes to the same school by one of three methods: walk, cycle or bus. The table shows the probabilities of their independent daily choices.

	Walk	Cycle	Bus
Rita	0.65	0.10	0.25
Said	0.40	0.45	0.15
Ting	0.25	0.55	0.20

- (a) Calculate the probability that, on any given school-day morning:
- (i) all 3 students walk to school; (2 marks)
- (ii) only Rita travels by bus to school; (2 marks)
- (iii) at least 2 of the 3 students cycle to school. (4 marks)
- (b) Ursula, a friend of Rita, never travels to school by bus. The probability that:

Ursula walks to school when Rita walks to school is 0.9;

Ursula cycles to school when Rita cycles to school is 0.7.

Calculate the probability that, on any given school-day morning, Rita and Ursula travel to school by:

- (i) the same method; (3 marks)
- (ii) different methods. (1 mark)

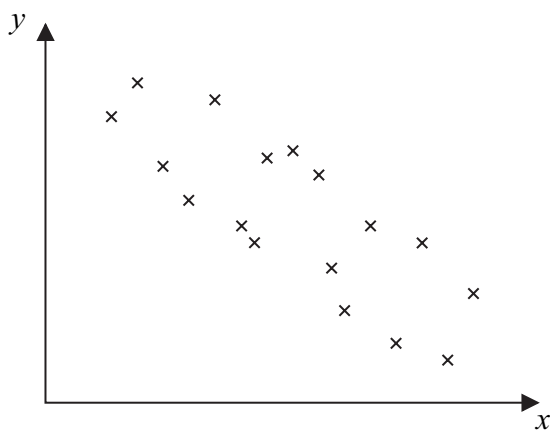
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- 5 The probability that Barry's cat, Sylvester, chooses to stay outside all night is 0.35, and the cat's choice is independent from night to night.

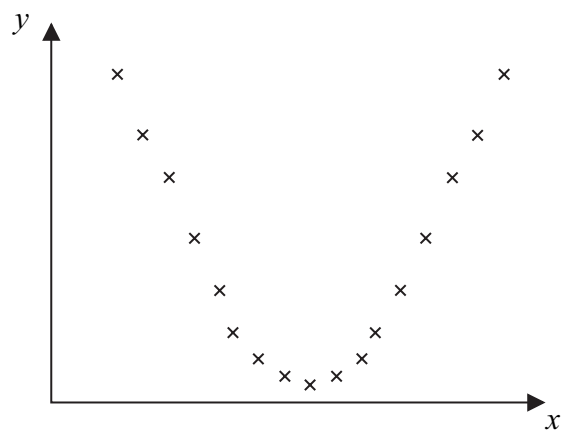
- (a) Determine the probability that, during a period of 2 weeks (14 nights), Sylvester chooses to stay outside:
- (i) on at most 7 nights; (2 marks)
 - (ii) on at least 11 nights; (2 marks)
 - (iii) on more than 5 nights but fewer than 10 nights. (3 marks)
- (b) Calculate the probability that, during a period of **3 weeks**, Sylvester chooses to stay outside on exactly 4 nights. (3 marks)

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

(a)



(b)



(4 marks)

- 7 Cherie Glass is a salesperson for RDW Ltd, a replacement door and window company. Her supervisor, Wyn Doe, believes that Cherie spends too long discussing options with potential clients. With this in mind, he records the times, t minutes, that Cherie spends in discussions with 50 potential clients.

From these 50 times, Wyn finds that

$$\sum t = 3155 \quad \sum (t - \bar{t})^2 = 7180.5$$

- (a) Stating a necessary assumption about the 50 times, calculate unbiased estimates of the mean, μ , and the variance, σ^2 , for the time, in minutes, that Cherie spends with potential clients. Give your answers to one decimal place. *(3 marks)*
- (b) Hence construct a 99% confidence interval for μ . *(4 marks)*
- (c) Given that RDW Ltd expects its salespeople to spend, on average, no longer than 60 minutes with potential clients, comment on Wyn's belief. *(2 marks)*
- (d) State why, in constructing your confidence interval, use of the Central Limit Theorem was necessary. *(1 mark)*
- (e) Given that $\mu = 62$, state the probability that a 99% confidence interval for μ will **not** contain 62. *(1 mark)*

END OF QUESTIONS

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