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) $\mathrm{P}(X < 10.5)$; *(3 marks)*

(ii) $\mathrm{P}(10.0 < X < 10.5)$. *(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)*

Turn over ▶

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)*

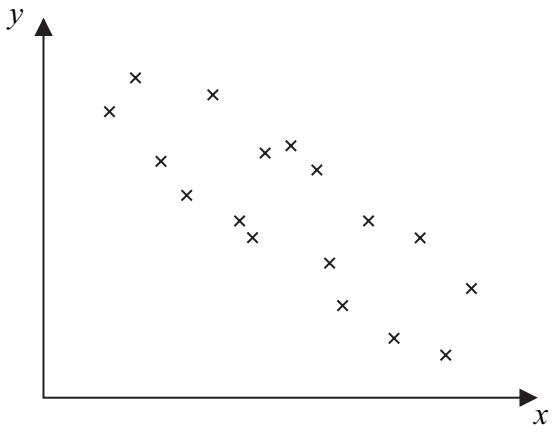
(ii) on at least 11 nights; *(2 marks)*

(iii) on more than 5 nights but fewer than 10 nights. *(3 marks)*

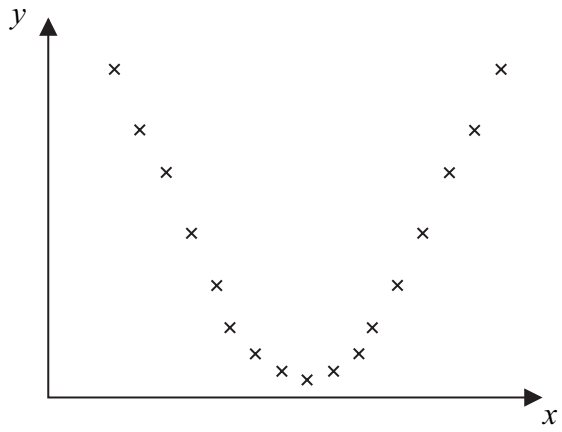
(b) Calculate the probability that, during a period of **3 weeks**, Sylvester chooses to stay outside on exactly 4 nights. *(3 marks)*

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

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

(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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