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.

MS/SS1A/W

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)*

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)*

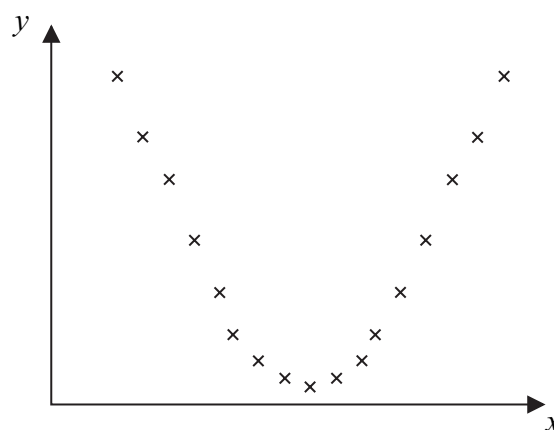   (iii) on more than 5 nights but fewer than 10 nights. *(3 marks)*

(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)
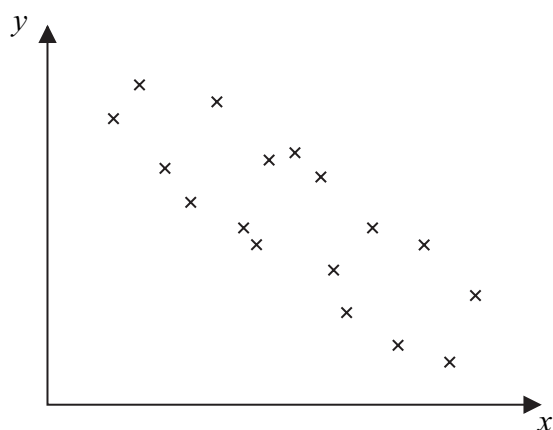
(b)

(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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