LC 2013: Paper 2

Question 7 (75 marks)

Question 7 (a)

Marriage rate												Death rate							
	9	8	7	7	6	6	5	5	3	3	4								
2	2	2	2	2	1	1	1	0	0	0	5								
											6	1	3	3	4	7	8		
											7	1	3	6	9				
											8	3	5	6	6	7	7	7	9
											9	0	0	0					
														Key: 7|6 = 76					

Question 7 (b)

The marriage rates range from 43 to 52 and are grouped at the top of the plot.
The death rates range from 61 to 90 and are grouped at the bottom of the plot.

Marking Scheme Notes

Question 7 (a) [Scale 15D (0, 4, 7, 11, 15)]

4:
- A correct element of the plot entered
- Key given without entering any elements

7:
- One side of the plot correct without the key
- Ten elements on each side correct, without the key
- Ten elements in total correct, with the correct key

11:
- A correct plot without the key
- A plot with five or less elements incorrect with the correct key
- Correct plot and key but data not ordered

Question 7 (b) [Scale 5B (0, 3, 5)]

3:
- A correct but incomplete difference given

Question 7 (c)

Marriage rate												Death rate							
	9	8	7	7	**6**	**6**	5	5	3	3	4								
2	2	2	2	**2**	**1**	1	1	0	0	**0**	5								
											6	1	3	3	4	7	8		
											7	1	3	6	9				
											8	3	5	6	6	7	7	7	9
											9	0	0	0					
														Key: 7|6 = 76					

Marriage rates: 43, 43, 45, 45, **46**, **46**, 47, 47, 48, 49, **50**, 50, 50, 51, 51, **51**, **52**, 52, 52, 52, 52

⇧ Lower quartile Q_1 ⇧ Median Q_2 ⇧ Upper quartile Q_3

Median = 50 (Middle value when the numbers are arranged in order)
Interquartile range = $Q_3 - Q_1 = 51.5 - 46 = 5.5$ [Get the mean of the 2 numbers for each quartile.]

Marking Scheme Notes
Question 7 (c) [Scale 10C (0, 4, 7, 10)]
4: • Describes the median or interquartile range
• Relevant work towards finding the median or the interquartile range
• Writes the range of the marriage rate
7: • One correct answer
• Substantially correct work in each part
• Correct answers using the data for the birth rate or the death rate

Question 7 (d) (i)

Mean death rate $= \frac{1645}{21} = 78 \cdot 3$

Formulae and Tables Book
Statistics and probability:
Mean from a list of n numbers
[page 33]

$$\mu = \frac{\text{Sum of all the numbers}}{\text{Number of numbers}} = \frac{\sum x}{n}$$

Deaths
90
89
87
90
86
90
87
86
85
87
83
79
76
73
71
68
67
64
63
63
61
1645

Marking Scheme Notes
Question 7 (d) (i) [Scale 10C* (0, 4, 7, 10)]
4: • Writes the formula for the mean
• Finds the value of n or adds some of the elements
7: • Correct substitution into the formula without calculation
• Incorrect substitution into the formula with calculation
* Penalise one mark for incorrect or omitted roundoff, provided full marks otherwise [Accept 78 in this context.]
Note: A correct answer without work shown, award full credit

Question 7 (d) (ii)

Mean = 78·3
Standard deviation = 10·3
Range of values within 1 standard deviation of the mean
= [78·3 – 10·3, 78·3 + 10·3] = [68, 88·6]

Marriage rate												Death rate							
	9	8	7	7	6	6	5	5	3	3	4								
2	2	2	2	2	1	1	1	0	0	0	5								
											6	1	3	3	4	7	**8**		
											7	**1**	**3**	**6**	**9**				
											8	**3**	**5**	**6**	**6**	**7**	**7**	**7**	9
											9	0	0	0					
															Key: 7|6 = 76				

List of death rates within 1 standard deviation of mean: 68, 71, 73, 76, 79, 83, 85, 86, 86, 87, 87, 87

Marking Scheme Notes
Question 7 (d) (ii) [Scale 5C (0, 3, 4, 5)]
3: • Finds one correct boundary
4: • Finds both correct boundaries without elements listed
• Finds one correct boundary with the correct elements

Question 7 (e)

Year: 2010

165 births $\rightarrow$ 10 000 people

1 birth $\rightarrow$ $\dfrac{10\ 000}{165}$ people

75 174 births $\rightarrow$ $\dfrac{10\ 000}{165} \times 75\ 174 = 4\ 556\ 000$ people

Question 7 (f)

Year: 2010

61 deaths $\rightarrow$ 10 000 people

$\dfrac{61}{10\ 000}$ deaths $\rightarrow$ 1 person

$\dfrac{61}{10\ 000} \times 4\ 556\ 000 = 27\ 791$ deaths $\rightarrow$ 4 556 000 people

Question 7 (g)

The birth rates given are per 10 000 of the population. If the population in 2000 was greater than in 1990, more children could have been born in 2000 than in 1990 even though the birth rate in 2000 was lower.

Marking Scheme Notes
Question 7 (e) [Scale 5C (0, 3, 4, 5)]
3: • Identifies 165 as the birth rate or recognises the rate is per 10 000
4: • One correct outcome for each category
• Correct fraction without calculation
• Fraction with one element incorrect, correctly calculated

Question 7 (f) [Scale 5C (0, 3, 4, 5)]
3: • Identifies 61 as the death rate
• Carries forward the answer from (e)
4: • Correct fraction without calculation
• Fraction with one element incorrect, correctly calculated

Question 7 (g) [Scale 5B (0, 3, 5)]
3: • A plausible reason with some relevant reference to the data

Question 7 (h)

$$1990 \text{ ratio} = \frac{151}{90} = 1 \cdot 68$$

$$2010 \text{ ratio} = \frac{165}{61} = 2 \cdot 7$$

Prediction: The population of the country is expected to increase.
Reason: The increase in the ratio from 1990 to 2010 suggests that more children are being born for each person that dies.

Question 7 (i)

There is a strong negative correlation.
With the increasing birth rate, the population is getting younger and the death rate is declining.

Marking Scheme Notes

Question 7 (h) [Scale 10C (0, 4, 7, 10)]

4:
- One correct ratio found
- A prediction with some merit
- Two correct ratios based on years rather than events

7:
- Two correct ratios found and a prediction or a reason
- One correct ratio with some merit in the prediction and reason
- A prediction with a reason, both having merit

Question 7 (i) [Scale 5B (0, 3, 5)]

3:
- Relationship described as negative correlation
- Relevant reason about the population change