LC 2015: Paper 2

Question 2 (25 marks)

Question 2 (a)

Number in the sample $n = 100$

Mean shopping spend $\bar{x} = 90 \cdot 45$

Standard deviation $\sigma = 20 \cdot 73$

$$\bar{\sigma} = \frac{\sigma}{\sqrt{n}} = \frac{20 \cdot 73}{\sqrt{100}} = 2 \cdot 073$$

Formulae and Tables Book
Statistics and Probability: Sampling
(standard error of the mean) [page 34]

$$\bar{\sigma} = \frac{\sigma}{\sqrt{n}}$$

n = Number in the sample
σ = standard deviation of the sample

Confidence interval: $\bar{x} - 1 \cdot 96\bar{\sigma} \leftrightarrow \bar{x} - 1 \cdot 96\bar{\sigma}$

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$90 \cdot 45 - 1 \cdot 96(2 \cdot 073) \leftrightarrow 90 \cdot 45 + 1 \cdot 96(2 \cdot 073)$

$€86 \cdot 39 \leftrightarrow €94 \cdot 51$

You can be 95% confident that the mean amount spent was in the range $€86 \cdot 39 < \mu < €94 \cdot 51$.

Marking Scheme Notes
Question 2 (a) [Scale 10C (0, 4, 8, 10)]

4:
- Relevant formula with or without substitution
- $\frac{1}{\sqrt{n}}$ with further work

8:
- $1 \cdot 96 \times \frac{\sigma}{\sqrt{n}}$ evaluated

Question 2 (b)

H_0: Mean $\mu = €94$ ← Null hypothesis: Mean spend is €94

H_1: Mean $\mu \neq €94$ ← Alternative hypothesis: Mean spend is not €94

Since the mean μ is in the confidence interval, you cannot reject the null hypothesis.

Marking Scheme Notes
Question 2 (b) [Scale 10D (0, 2, 5, 8, 10)]

2:
- One relevant step e.g. null hypothesis or alternative hypothesis stated
- Some work towards finding z
- Mention of $\pm 1 \cdot 96$

5:
- z calculated
- Either null or alternative hypothesis stated and relevant work towards finding z
- Confidence interval from (a) and either null or alternative hypothesis stated
- Confidence interval based on 100 (i.e. 89·94, 98·06) and either null or alternative hypothesis stated

8:
- z calculated and compared to $\pm 1 \cdot 96$ but:
  - o Not stating null hypothesis and/or alternative hypothesis correctly
  - o Not accepting or rejecting hypothesis
  - o Incorrect conclusion for hypothesis
- Incorrect use of 94 and confidence interval
- Incorrect use of 90·45 and confidence interval

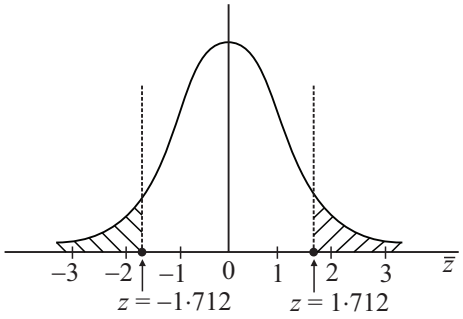
Question 2 (c)

Mean shopping spend $\bar{x} = 90 \cdot 45$

Standard error of the mean $\bar{\sigma} = 2 \cdot 073$

Mean amount spend $\mu = 94$

$$\bar{z} = \frac{\bar{x} - \mu}{\bar{\sigma}} = \frac{90 \cdot 45 - 94}{2 \cdot 073} = -1 \cdot 712$$



Formulae and Tables Book
Statistics and Probability: Probability distribution (standarding formula) [page 34]

$$\bar{z} = \frac{\bar{x} - \mu}{\bar{\sigma}}$$

n = Number in the sample
σ = standard deviation of the sample

$$\begin{aligned} p - \text{value} &= 1 - P(\bar{z} < 1 \cdot 712) + P(\bar{z} < -1 \cdot 712) \\ &= 1 - P(\bar{z} < 1 \cdot 712) + 1 - P(\bar{z} < 1 \cdot 712) \\ &= 2(1 - P(\bar{z} < 1 \cdot 712)) \\ &= 2(1 - 0 \cdot 9564) \\ &= 0 \cdot 0872 > 0 \cdot 05 \end{aligned}$$

p-value = 0·0872

Explanation: Because p = 8·72% is greater than 5% there is not a significant difference between the sample mean and the population mean. Any difference may be due to chance.

Marking Scheme Notes
Question 2 (c) [Scale 5C (0, 2, 4, 5)]
2: • Effort at finding $P(z < -1 \cdot 71)$
4: • p value correct
• Not contextualising answer correctly