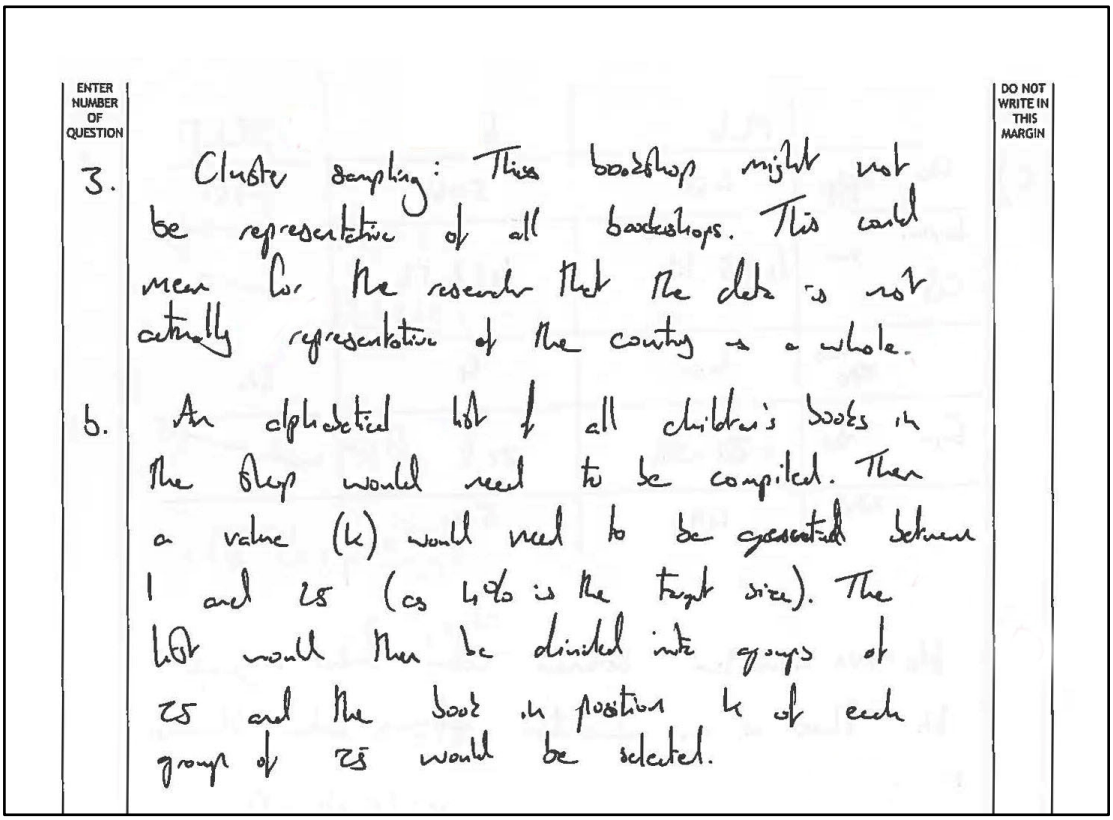
Candidate evidence

Response 1 – Question 3



ENTER NUMBER OF QUESTION

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3. Cluster sampling: This bookshop might not be representative of all bookshops. This could mean for the researcher that the data is not actually representative of the county as a whole.

b. An alphabetical list of all children's books in the shop would need to be compiled. Then a value (k) would need to be generated between 1 and 25 (as 4% is the target size). The list would then be divided into groups of 25 and the book in position k of each group of 25 would be selected.

Response 2 – Question 6

ENTER NUMBER OF QUESTION

6a) Bar Graph
- plots nominal data against numerical data
- can compare the differences between two

b

$\bar{x} = 2599.5$ $S = \sqrt{\frac{Sxx}{n-1}}$ 882944.5

$Sxx = \Sigma x^2 - \frac{(\Sigma x)^2}{n}$

$= 882944.5$

$= \sqrt{\frac{882944.5}{10-1}}$

$= 313.2170884$

$\bar{x} \pm \frac{\sigma}{\sqrt{n}}$

$\bar{x} \pm 1.96 \frac{313.2170884..}{\sqrt{10}}$

2599.5 ± 194.1339627

2599.5 ± 194.13

$\Rightarrow (2405.37, 2793.63)$

Assuming the samples are independent.

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ENTER NUMBER OF QUESTION

c.) Birch as the mean energy for birch is within the confidence interval for the sample kWh produced. can say this w/ 95% confidence

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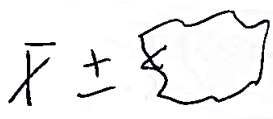
d.

2.57

$\bar{x} \pm$  $\frac{\sigma}{\sqrt{n}}$

$2599.5 \pm 2.57 \frac{313.2170884}{\sqrt{10}}$

$2599.5 \pm 254.5532062...$

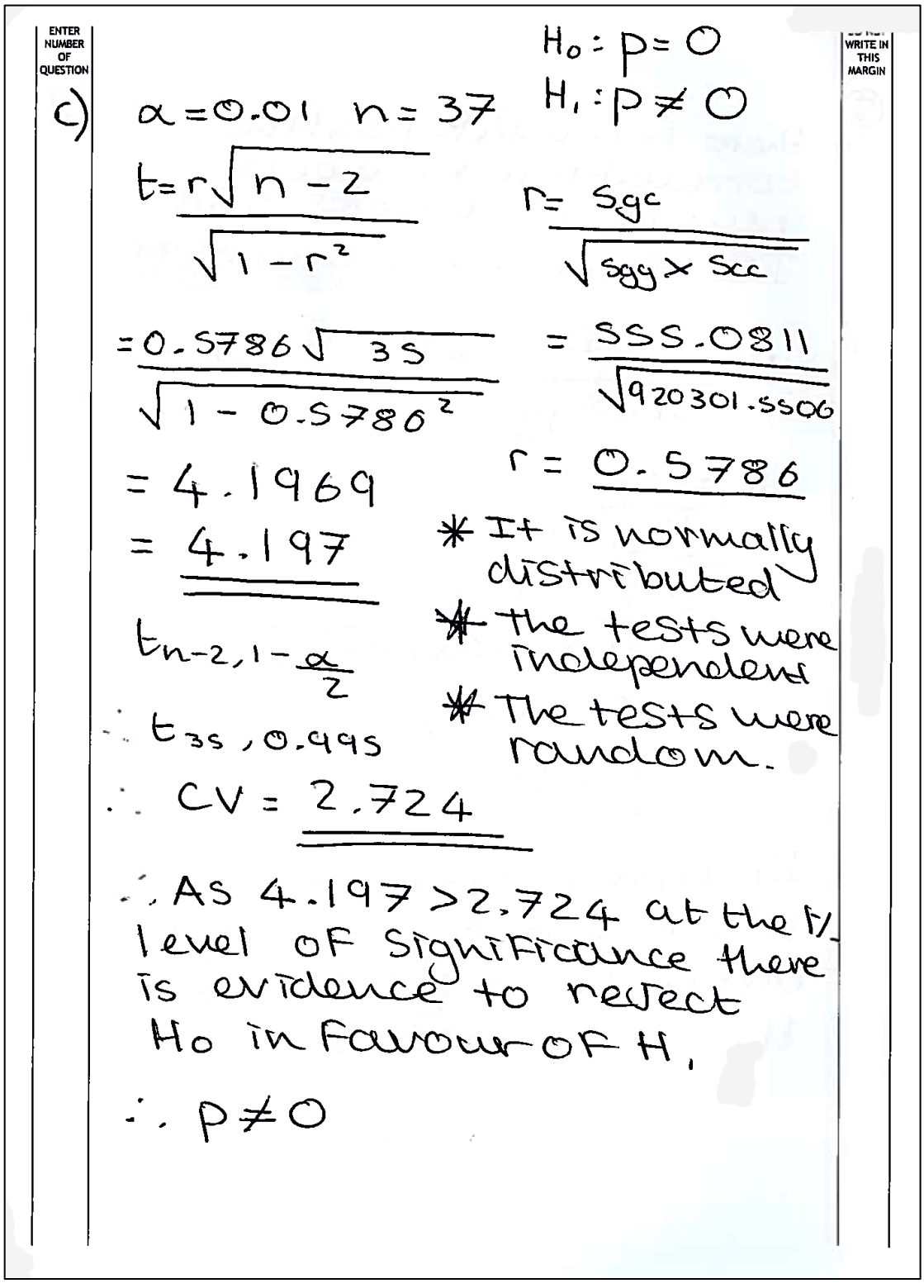
2599.5 ± 254.55

(~~2344.95~~, 2344.95)

2854.05

The Maple value is now within the confidence interval as well as birch so it could be either birch or maple.

Response 3 – Question 8



ENTER NUMBER OF QUESTION

c) $\alpha = 0.01 \quad n = 37$

$H_0 : p = 0$

$H_1 : p \neq 0$

$t = \dfrac{r\sqrt{n-2}}{\sqrt{1-r^2}}$

$r = \dfrac{S_{gc}}{\sqrt{S_{gg} \times S_{cc}}}$

$= \dfrac{0.5786\sqrt{35}}{\sqrt{1-0.5786^2}}$

$= \dfrac{555.0811}{\sqrt{920301.5506}}$

$= 4.1969$

$r = 0.5786$

$= 4.197$

* It is normally distributed
* the tests were independent
* The tests were random.

$t_{n-2,1-\frac{\alpha}{2}}$

$\therefore t_{35,0.995}$

$\therefore CV = 2.724$

$\therefore$ As $4.197 > 2.724$ at the 1% level of significance there is evidence to reject H_0 in favour of H_1.

$\therefore p \neq 0$

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Response 4 – Question 10

10) a) $X \equiv$ wingspan of seabird in cm

$X \approx N(50; 16)$

$n = 25$, $\bar{x} = 48.3$. (apply CLT since $n > 20$)

$H_0 : \mu = 50$

$H_1 : \mu < 50$ ($\alpha = 0.05$) ($\alpha = 0.01$) 1 tailed.

Test statistic

$$z = \frac{48.3 - 50}{\sqrt{\frac{16}{25}}} = -2.125$$

ENTER NUMBER OF QUESTION

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p value $= P(Z < -2.125 \mid H_0)$

$= 1 - \Phi 2.13$

$= 0.0166$

$p = 0.0166 < 0.05 = \alpha$
so reject H_0 at 5% sig level.

$p = 0.0166 > 0.01 = \alpha$
so do not reject H_0 at 1% sig. level.

∴ Furnishing evidence that mean wingspan of bird species has decreased significantly at the 5% sig level, but no evidence that mean wingspan has decreased significantly at 1% sig. level.

ENTER NUMBER OF QUESTION

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b) 5% sig level

1 tailed, 5% c.v. is (-) 1.64

$$-1.64 = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

$$= \frac{\bar{x} - 50}{\sqrt{\frac{16}{25}}}$$

$$= \frac{\bar{x} - 50}{0.8}$$

$$-1.312 = \bar{x} - 50$$

$$\bar{x} = 48.688 \qquad b = 48.688$$

1% sig level

1 tailed, 1% cv is (-)2.33

$$-2.33 = \frac{\bar{x} - 50}{\sqrt{\frac{16}{25}}}$$

$$-1.864 = \bar{x} - 50$$

$$\bar{x} = 48.136 \qquad b = 48.136$$

ENTER NUMBER OF QUESTION

If your sample mean $\leq$ 48.688, then conclude a significant decrease in mean wing span at 5% sig. level.

If your sample mean $\leq$ 48.136 then conclude a significant decrease in mean wing span at 1% sig level.

c) calculate sample variance (s^2) from a sample of size > 20. (Bioligist's sample size was 25.) Apply Central limit theorem and test using s to estimate σ, hence one may still employ z-statistics.

Otherwise use t-test for a diff

Otherwise employ t-test for difference in population mean

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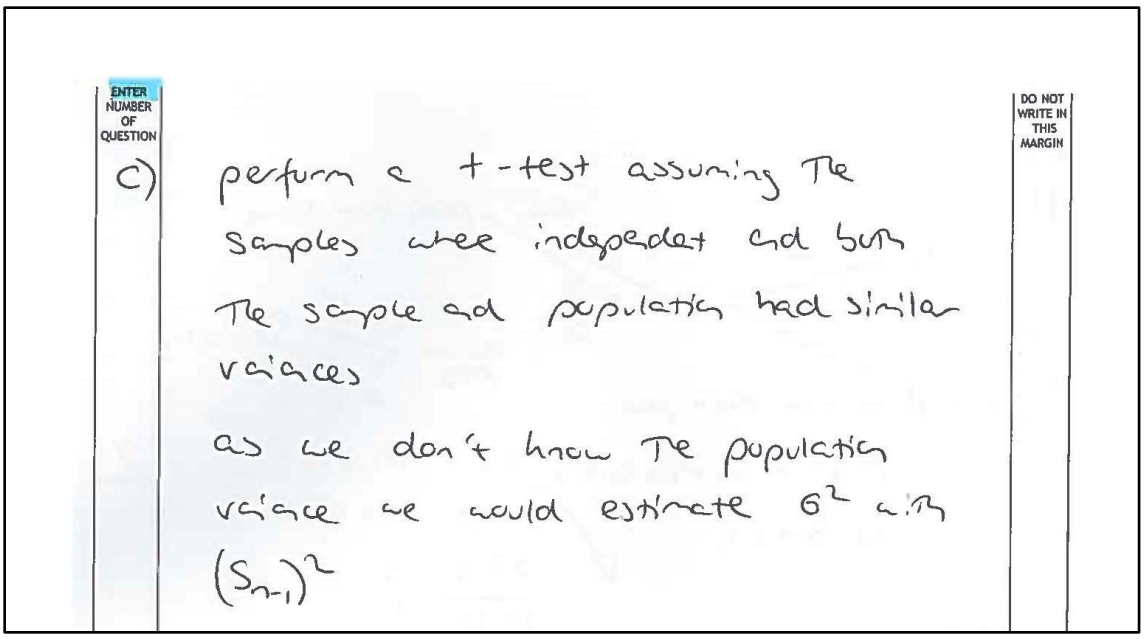
Response 5 – Question 10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c) perform a t-test assuming the samples were independent and both the sample and population had similar variances

as we don't know the population variance we would estimate σ^2 with $(s_{n-1})^2$

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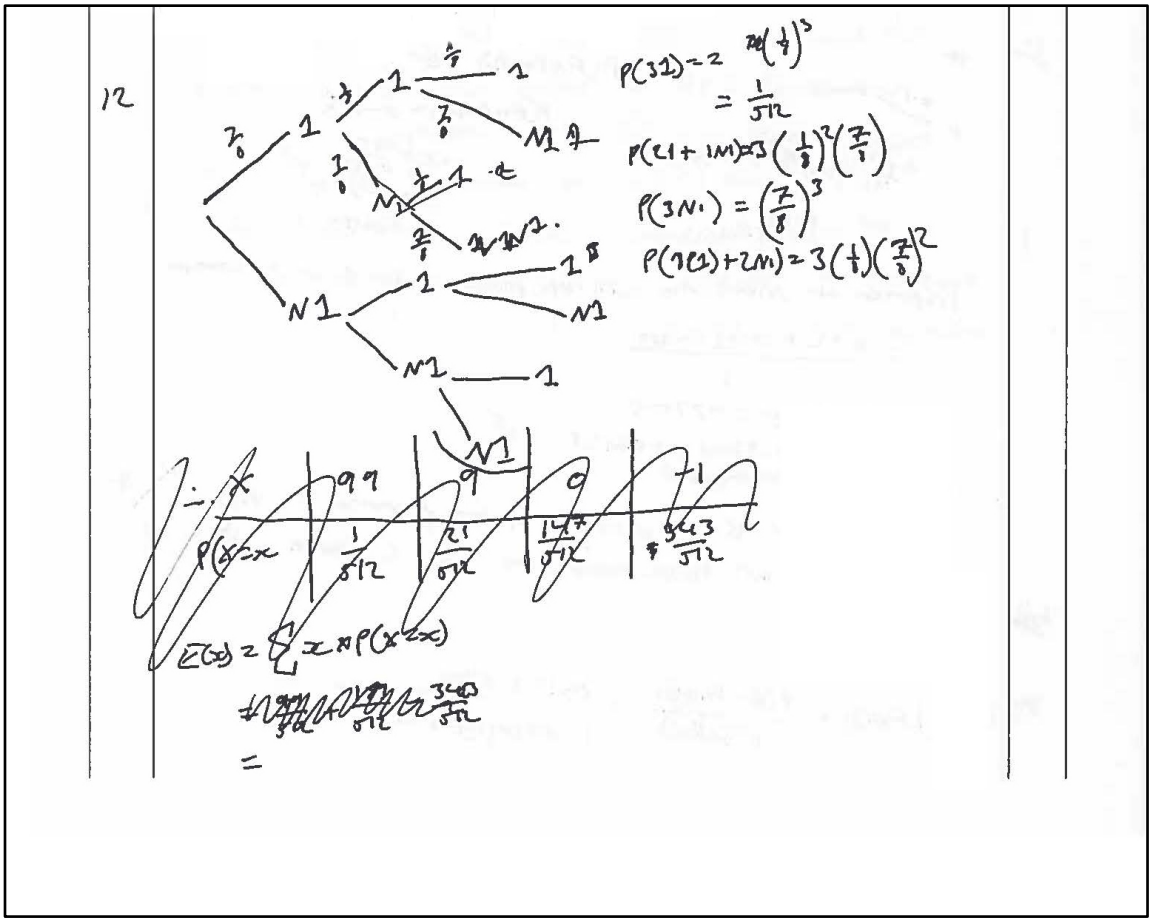
Response 6 – Question 12



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X	99	9	0	−1
$P(X=x)$	0·002	0·041	0·2971	0·6599

$E(X) = \sum x(P(X=x))$

$= 99(0.002) + 9(0.041) + -1(0.6599)$

$= -0.1029$

$SD(x) = \sqrt{\sum (x-\mu)^2 P(X=x)}$

$= \sqrt{(99+0.1029)^2(0.002) + (9+0.1029)^2(0.041) + (0.1029)^2(0.2971) + (-1+0.1029)^2(0.6599)}$

$= 4.8562$

b) i) $E(T) = 60(-0.1029) + 48(-0.06)$

$= £3.474$

$V(T) = 60(2.3582) + 48(-0.36)$

$= 1431.12$

$\therefore \sigma_T = 37.83$

ii) Assumption:

$E(Y)$ is also a fair game

iii) he is likely to make a small profit but could easily take a loss as the standard deviation is far larger than the profit.