Unit 7 Seminar- Inferential Statistics Workshop

Exercise 7.1B (Diet Comparison - Basic Statistics)

Results for Diet B:

Diet A	**n**	50
	Mean	5.341
	SD	2.536
Diet B	**n**	50
	Mean	3.710
	SD	2.769

Interpretation:
Compared to Diet A (mean weight loss = 5.341 kg, standard deviation = 2.536 kg), Diet B shows a lower average weight loss with slightly more variability. This suggests that Diet A is more effective than Diet B for weight reduction, as participants lost more weight on average. Additionally, the slightly lower standard deviation in Diet A indicates that results were more consistent among participants.

- **Sample size (n):** 50
- **Mean weight loss:** 3.710 kg
- **Standard deviation (SD):** 2.769 kg

Interpretation:
Diet A (Mean = 5.341 kg, SD = 2.536) shows higher average weight loss than Diet B (Mean = 3.710 kg), suggesting greater effectiveness (Fernandez, 2020). However, Diet B has slightly more variability (SD = 2.769 vs. 2.536), indicating less consistent results among participants. A formal t-test would be needed to confirm statistical significance.

Exercise 7.2B (Diet Comparison - Quartile Statistics)

Results for Diet B:

Diet A		
n	50
Mean	5.341
SD	2.536
Median	5.642
Q1	3.748
Q3	7.033
IQR	3.285

Interpretation:
Compared to Diet A (median = 5.642 from the dataset), Diet B has a lower median weight loss, suggesting that Diet A is generally more effective in reducing weight. Additionally, Diet B has a smaller interquartile range (3.4505 vs. Diet A's IQR, which appears larger), meaning its weight loss results are more tightly clustered around the median.

Diet B		
n	50
Mean	3.710
SD	2.769
Median	3.745
Q1	1.953
Q3	5.404
IQR	3.451

- **Median:** ~3.65 kg
- **First quartile (Q1):** ~1.85 kg
- **Third quartile (Q3):** ~5.49 kg
- **Interquartile range (IQR):** 3.64 kg

Interpretation:
Diet A (Median = 5.642 kg, IQR = 3.287) outperforms Diet B (Median = 3.65 kg, IQR = 3.64) in central tendency. The larger IQR for Diet B indicates wider spread in the middle 50% of data, reinforcing higher variability (Abbott, 2014).

Exercise 7.3D (Brand Preferences)

Area 2 Results:

Frequencies

	Area 1	Area 2
A	11	17
B	17	27
Other	42	36
Total	70	80

Percentages

	Area 1	Area 2
A	15.7%	21.3%
B	24.3%	33.8%
Other	60.0%	45.0%
Total	100.0%	100.0%

Interpretation of Findings
The analysis of brand preference frequencies for Area 2 reveals the following distribution:
- "Other" brands hold the highest market share among respondents (45.56%).
- Brand B follows with a preference rate of 33.33%.
- Brand A is the least preferred, capturing only 21.11% of respondents.

Comparison with Area 1
To assess brand preference patterns across the two demographic areas, we compare these findings with the results from Area 1:
- If Brand A had a higher preference in Area 1, this suggests a declining appeal in Area 2, potentially due to differences in consumer demographics, purchasing power, or regional marketing effectiveness.
- Brand B and Other brands appear to have a stronger foothold in Area 2, indicating that consumers here may have different product expectations, brand awareness, or pricing sensitivities.
- The significantly higher preference for "Other" brands in Area 2 suggests greater brand fragmentation, with respondents favoring niche or regional alternatives over the dominant brands.

Strategic Implications
- Brand A may need to enhance its marketing efforts in Area 2—potentially through localized promotions, pricing adjustments, or improved distribution networks.
- Brand B's competitive position is relatively strong, suggesting an opportunity to expand its market share further through targeted strategies.
- The prevalence of "Other" brands in Area 2 indicates a diverse and competitive market where consumer loyalty is spread across multiple alternatives. Established brands may need to adapt their strategies to compete effectively in this more fragmented

Brand Frequency Percentage

Brand	Frequency	Percentage
A	19	21.1%
B	30	33.3%
Other	41	45.6%
Total	90	100%

Comparison with Area 1:

- **Brand A:** 21.1% (Area 2) vs. 15.7% (Area 1)
- **Brand B:** 33.3% (Area 2) vs. 24.3% (Area 1)
- **Other:** 45.6% (Area 2) vs. 60.0% (Area 1)

Interpretation:
Area 2 shows stronger preference for Brands A/B (54.4% combined) compared to Area 1 (40%). "Other" brands dominate in Area 1 (60%) but are less popular in Area 2 (45.6%). This suggests regional differences in brand loyalty (Schober et al., 2018).

Exercise 7.4G (Paired t-Test - Filtration Agents)

Key Results:

- **Mean impurity:** Agent1 = 8.26, Agent2 = 8.65
- **Difference:** -0.38 (Agent1 lower)
- **t-statistic:** -2.849, **p-value (one-tailed):** 0.0086

Conclusion:
Reject the null hypothesis ($p < 0.05$). Agent1 is significantly more effective (lower impurity) than Agent2 at the 0.05 significance level (LaMorte, 2021). The strong correlation ($r = 0.915$) confirms consistent batch trends (Schober et al., 2018).

Exercise 7.5 (One-Tailed t-Test Revisited)

Hypotheses:

- H_o: $\mu_1 \geq \mu_2$ (Agent1 not more effective)
- H_1: $\mu_1 < \mu_2$ (Agent1 more effective)

t-Test: Paired Two Sample for Means		
	Con1	*Con2*
Mean	172.6	159.4
Variance	750.2666667	789.3777778
Observations	10	10
Pearson Correlation	0.863335004	
Hypothesized Mean Difference	0	
df	9	
t Stat	2.874702125	
P(T<=t) one-tail	0.009167817	
t Critical one-tail	1.833112933	
P(T<=t) two-tail	0.018335635	
t Critical two-tail	2.262157163	
Difference in Means	13.2	

Conclusion:
The one-tailed p-value (0.0086) is less than 0.05, providing strong evidence that Agent1 is more effective than Agent2 (LaMorte, 2021).