# e‑Portfolio Submission – Statistical Inference

This document contains my final write‑ups for the compulsory e‑Portfolio component covering **Unit 7 – Hypothesis Testing** and **Unit 8 – Summary Measures**. Screenshots of all Excel outputs are embedded below each results section.

## Unit 7 – Hypothesis Testing

### Overview

Two separate research questions were addressed with *t*‑tests:

1. **Container Designs:** Does Design 1 generate higher mean weekly sales than Design 2 across the same 10 stores?

2. **Weight‑Loss Diets:** Do participants on Diet A lose, on average, a different amount of weight than those on Diet B after six weeks?

### 7.1  Container Designs

| Element | Details |
| --- | --- |
| **Data source** | Exa 7.2B.xlsx – Sheet *Example 7.1* |
| **Variables** | Weekly units sold under Design 1 and Design 2 (matched pairs) |
| **Sample size** | 10 stores (paired) |
| **Test chosen** | Paired‑sample *t*‑test |
| **Assumption checks** | Differences approximated normal (n = 10). |

**Hypotheses**  
H₀ : μ\_D₁ − μ\_D₂ = 0  H₁ : μ\_D₁ − μ\_D₂ > 0 (one‑tailed, management expects Design 1 to improve sales)

**Excel output**  
Paired‑sample t‑test output – Container designs

**A table with numbers and words

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**Decision (α = 0.05)**  
*p* = 0.009 < 0.05 → **Reject H₀**.

**Interpretation**  
On average, Design 1 sells **≈ 13 units more per week** than Design 2 across the same stores. There is strong evidence (0.9 % chance of this difference arising by random variation) that Design 1 is superior.

### 7.2  Weight‑Loss Diets

| Element | Details |
| --- | --- |
| **Data source** | Exa 7.1B.xlsx – Sheet *Example 7.2 / Exercise 7.2* |
| **Variables** | Six‑week weight‑loss (kg) for Diet A and Diet B |
| **Sample size** | 50 per diet (independent) |
| **Equal‑variance check** | F‑test: p = 0.54 → assume equal variances |
| **Test chosen** | Independent‑samples *t*‑test (equal var) |

**Hypotheses**  
H₀ : μ\_A = μ\_B  H₁ : μ\_A ≠ μ\_B (two‑tailed)

**Excel output**  
Independent t‑test output – Weight‑loss diets

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**Decision (α = 0.05)**  
*p* = 0.0028 < 0.05 → **Reject H₀**.

**Interpretation**  
Diet A participants lost **≈ 1.63 kg more** than Diet B participants on average. The probability of such a difference under equal‑means is 0.28 %, indicating strong evidence that Diet A is more effective.

### Reflection on Unit 7

* Conducting the F‑test first prevented an inappropriate unequal‑variance *t*‑test.
* The one‑tailed versus two‑tailed distinction materially affected the Design study’s *p*‑value (0.009 vs 0.018).
* Next time I will produce QQ‑plots to visualise normality of differences rather than rely solely on the Shapiro‑Wilk statistic.

## Unit 8 – Summary Measures

### 8.1  Diet B Weight‑Loss Statistics

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**Commentary**  
Diet B’s central tendency (median 3.7 kg) and spread (IQR 3.45 kg) sit well below Diet A’s (median 5.64 kg, IQR 3.29 kg), corroborating the conclusion from the hypothesis test that Diet A is the preferable programme.

### 8.2  Brand Preferences – Area 2

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**Commentary**  
The distribution is markedly more balanced than Area 1 (where “Other” captured 60 %). Brand B leads formal brands at one‑third share, suggesting targeted promotions here could convert occasional users to loyal buyers.