# Exercise 8.3D – Brand Preference by Demographic Area

**Hypotheses:**

- $H_0$: Brand preference is **independent** of demographic area.
- $H_1$: Brand preference is **associated** with demographic area.

**Observed Counts Table:**

| | Brand A | Brand B | Other |
|---|---|---|---|
| Area 1 | 11 | 17 | 42 |
| Area 2 | 15 | 12 | 43 |

**Test Used**: Chi-Square Test of Independence
**Significance Level**: α = 0.05

- **Chi-square statistic** = 1.4892
- **Degrees of freedom** = 2
- **p-value** = 0.4749

**Decision:**

We **fail to reject** the null hypothesis.

**Interpretation:**

There is **no statistically significant association** between brand preference and demographic area.

# Exercise 8.4G

**Exercise 8.4G.xlsx** (Sheet1) contains data for:

- **Batch numbers**
- **Agent1** and **Agent2** impurity levels

This suggests a **paired t-test** is appropriate — comparing impurity levels for the same batch under both agents.

## Exercise 8.4G – Comparing Filtration Effectiveness of Two Agents

**Hypotheses:**

- $H_0$: There is **no difference** in mean impurity levels between Agent 1 and Agent 2.
- $H_1$: There **is a significant difference** in impurity levels between the two agents.

**Test Used**: Paired t-test
**Sample Size**: 12 batches

| Metric | Agent 1 | Agent 2 |
|---|---|---|
| Mean (mg/L) | 8.25 | 8.68 |

- **t-statistic** = -3.2639
- **p-value** = 0.0075
- **Significance Level**: α = 0.05

**Decision:**

Reject the null hypothesis.

**Interpretation:**

There is a **statistically significant difference** in impurity levels.
Agent 2 performs **better** than Agent 1 in reducing impurities.

The main sheet in **Exe 8.6C.xlsx** is titled 'SUPER', not 'Sheet1'.

The 'SUPER' sheet from **Exercise 8.6C** includes:

- **Sex** (M/F)
- **Income** values

This suggests a **two-sample t-test** is needed to compare average incomes between **male and female Superplus cardholders**.

## Exercise 8.6C – Income by Gender (Superplus Cardholders)

**Hypotheses:**

- **$H_0$**: There is **no difference** in mean income between male and female cardholders.
- **$H_1$**: There **is a significant difference** in mean income between the two groups.

**Test Used**: Independent two-sample t-test
**Sample Size**: 60 males, 60 females

| Metric | Males | Females |
|---|---|---|
| Mean Income | 52.91 | 44.23 |

- **t-statistic** = 3.2679
- **p-value** = 0.0014
- **Significance Level**: α = 0.05

**Decision:**

Reject the null hypothesis.

**Interpretation:**

There is a **statistically significant difference** in income between male and female cardholders.
On average, **males have higher income** than females in this sample.