**Unit 7 – Hypothesis Testing Using Excel**

**Objective**

This exercise introduces hypothesis testing as a method for deciding whether observed sample differences reflect genuine population effects or random variation.

Using Excel’s Data Analysis Toolpak, I practiced both paired (related) and independent sample t-tests, as well as the F-test for equality of variances.

The activity builds essential quantitative skills for my future study on *Information Systems (IS) adoption by SMEs in Indonesia*, where similar statistical reasoning will support evaluation of regional or organisational differences.

**Exercise 7.1 – Paired Samples t-Test**

**Interpretation**

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A paired t-test was conducted to compare impurity levels after filtration with Agent 1 and Agent 2 across 12 batches. The mean impurity level for Agent 1 was 8.25 parts per 1000, while for Agent 2 it was 8.68 parts per 1000 giving a mean difference of −0.43 (Agent 1 − Agent 2). The test produced a t statistic of −3.26 with 11 degrees of freedom and a two-tailed p-value of 0.0075. Since this p-value is well below 0.05, the difference is statistically significant. This indicates that Agent 1 removes significantly more impurities than Agent 2, making it the more effective filtration agent.

**Exercise 7.2 – Independent Samples t-Test**

**Interpretation**

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A hypothesis test was carried out to assess whether the mean income of male Superplus Diamond cardholders exceeds that of females. An F-test for equality of variances gave an F value of 1.23 with a p-value of 0.218, indicating no significant difference in variances; thus, a two-sample t-test assuming equal variances was appropriate. The hypotheses tested were (H0: µM ≤ µF) and (H1: µM > µF). The t-test produced a t statistic of 3.27 with 118 degrees of freedom and a one-tailed p-value of 0.0007. Since the p-value is well below 0.05, the null hypothesis is rejected, providing strong evidence that male cardholders have a significantly higher mean income than females. On average, males earned £52.9k compared with £44.2k for females, a difference of about £8.7k.

**Reflective Analysis**

Conducting these hypothesis tests enhanced my understanding of statistical inference—how we generalise from sample data to population conclusions.  
Key insights:

* Assumptions matter: Normality and homogeneity of variance determine test validity.
* Choice of test: Paired vs independent t-tests depend on research design.
* Ethical reporting: Transparency about significance levels and limitations is essential for trustworthy research.
* Research application: In my SME IS study, similar tests could compare performance metrics between digital and non-digital SMEs or between regions.

**Skills Developed**

| **Skill** | **Description** |
| --- | --- |
| Hypothesis formulation | Translating practical questions into statistical hypotheses |
| Inferential testing | Executing t-tests and F-tests using Excel |
| Analytical interpretation | Explaining p-values and significance in context |
| Ethical analysis | Avoiding data misrepresentation and selective reporting |
| Application to research | Extending methods to SME IS adoption analysis |

**Conclusion**

This second data-analytics exercise provided hands-on experience with inferential statistics, reinforcing the connection between quantitative results and ethical interpretation.