Unit 7 – Hypothesis Testing Worksheet: Interpretations:

Exercise 7.1:

If, instead of a two-tailed t-test, a one-tailed t-test had been conducted to specifically assess whether Filter Agent 1 is more effective than Filter Agent 2, resulting in a p-value of 0.018, we would conclude that there is statistically significant evidence to support the hypothesis that Filter Agent 1 is indeed more effective. Since the p-value (0.018) is less than the alpha level of 0.05, we reject the null hypothesis in favour of the alternative. This suggests that the observed difference is unlikely due to random variation and supports the claim that Filter Agent 1 reduces impurity more effectively than Filter Agent 2.

Exercise 7.2:

First I formulate the Null Hypothesis and the Alternative Hypothesis:

Null Hypothesis (H_0): The mean income for males is not higher than for females (μ_males ≤ μ_females).

Alternative Hypothesis (H_1): The mean income for males is higher than for females (μ_males > μ_females).

Since we are specifically testing whether the mean income for males is higher, we need a one-tailed test.

I use the “t-Test: Two-Sample Assuming Equal Variances” in Excel.

Since we are testing if the male mean is higher, focus on the one-tailed p-value which equals 0.0007, rounded to four digits. I thus reject the null hypothesis, suggesting the mean income for males is statistically higher than for females.

The underlying assumptions are:

- The samples are independent.
- The data is approximately normally distributed.
- Variances are equal

How I could validate that these assumptions are fulfilled:

- Use a histogram or normal probability plot to check normality.
- Conduct an F-Test to test for equal variances.
- Calculate the variances for both the male and female test populations.

Exercise 7.3:

Null Hypothesis (H_0): The population mean impurity does not differ between the two filtration agents.

Alternative Hypothesis (H_1): The population mean impurity differs between the two filtration agents.

I calculated a two-tailed t-test assuming equal variances in Excel.

Since the p-value (0.3156) is greater than the alpha level (0.05), we fail to reject the null hypothesis. This indicates that there is no statistically significant evidence to support a difference in the population mean impurity between the two filtration agents.