**Exercise 7.1**

**Brief:** A one-tailed test conducted to determine whether ‘Filter Agent 1’ was

the more effective filtering agent compared to ‘Filtering Agent 2’ from the ‘DATA SET G (Filtration.xlsx)’.

In deciding, I will need to:

* Determine the hypothesis (null and alternate hypothesis)
* Calculate the differences
* Compute the test statistic
* Compare and conclude

**Hypothesis**

The null hypothesis (H0): The Filtering Agent 1 is not more effective than Filtering Agent 2. This would imply that the sample mean difference is ≥ 0.

Alternate hypothesis (H1): The Filtering Agent 1 is more effective than Filtering Agent 2. This implies that the sample mean difference is < 0.

**Difference Calculation**

Difference = Filtering Agent 1 – Filtering Agent 2

|  |  |  |  |
| --- | --- | --- | --- |
| **Batch** | **Agent1** | **Agent2** | **Difference** |
| 1 | 7.7 | 8.5 | -0.8 |
| 2 | 9.2 | 9.6 | -0.4 |
| 3 | 6.8 | 6.4 | 0.4 |
| 4 | 9.5 | 9.8 | -0.3 |
| 5 | 8.7 | 9.3 | -0.6 |
| 6 | 6.9 | 7.6 | -0.7 |
| 7 | 7.5 | 8.2 | -0.7 |
| 8 | 7.1 | 7.7 | -0.6 |
| 9 | 8.7 | 9.4 | -0.7 |
| 10 | 9.4 | 8.9 | 0.5 |
| 11 | 9.4 | 9.7 | -0.3 |
| 12 | 8.1 | 9.1 | -1.0 |

**Test Statistic**

Where:

Set criteria is 0.05

Mean of differences = Total differences/Sample size = -5.2/12 = -0.433

Standard deviation of differences (s\_d) =

Where squared deviations = Individual difference – Mean difference

|  |  |  |
| --- | --- | --- |
| Difference | Individual difference – Mean difference | Squared |
| -0.8 | -0.367 | 0.135 |
| -0.4 | 0.033 | 0.001 |
| 0.4 | 0.833 | 0.694 |
| -0.3 | 0.133 | 0.018 |
| -0.6 | -0.167 | 0.028 |
| -0.7 | -0.267 | 0.071 |
| -0.7 | -0.267 | 0.071 |
| -0.6 | -0.167 | 0.028 |
| -0.7 | -0.267 | 0.071 |
| 0.5 | 0.933 | 0.871 |
| -0.3 | 0.133 | 0.018 |
| -1.0 | -0.567 | 0.321 |

Sum of the squared deviations = 2.327

s\_d = = 0.460

**Calculate the t-Statistic**

t = mean of difference / s\_d (

t = -0.433 / 0.460 (

t = -3.26

**Compare and Decide with Critical Value**

Degree of freedom (df) = n-1 = 11

One-tailed test at α = 0.05

Critical t = -1.796

Since -3.26 is < -1.769, we will reject the null hypothesis and accept the alternate hypothesis which confirms that Filtering Agent 1 is more effective than Filtering Agent 2 (Berenson, 2020).

**Reference**

Berenson, M (2020) *Basic Business Statistics Concepts and Applications*. Fourteenth edition, global edition. Harlow, England: Pearson Education, Limited, 2020. Print.