One Sample t Test

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> ### Descriptive Statistics

> (Outcome) |> describeMoments()

Summary Statistics for the Data
              N       M      SD    Skew    Kurt
Outcome   8.000   4.000   3.117   0.151  -0.467

> ### Inferential Statistics

> (Outcome) |> estimateMeans(mu = 7)

Confidence Intervals for the Means
           Diff      SE      df      LL      UL
Outcome  -3.000   1.102   7.000  -5.606  -0.394

> (Outcome) |> testMeans(mu = 7)

Hypothesis Tests for the Means
           Diff      SE      df       t       p
Outcome  -3.000   1.102   7.000  -2.722   0.030

> (Outcome) |> standardizeMeans(mu = 7)

Confidence Intervals for the Standardized Means
              d      SE      LL      UL
Outcome  -0.963   0.438  -1.792  -0.089
```

These values are produced by the "Descriptives" commands. See the earlier annotated output for details of how these are computed from frequency distributions.

The Standard Error of the Difference ("SE") provides an estimate of how spread out the distribution of all possible random sample mean differences would be. Here it's calculated as:

$$SE_M = \frac{SD}{\sqrt{N}} = \frac{3.117}{\sqrt{8}} = 1.102$$

This section provides a confidence interval around (centered on) the Mean Difference ("Diff"). Calculation requires the appropriate critical value. Specifically, the *t* statistic (with 7 *df*) that has a probability of .05 equals 2.365. As a result:

$$CI_{DIFF} = M_{DIFF} \pm (t_{CRITICAL})(SE_M) = -3.000 \pm (2.365)(1.102)$$

Thus, the researcher estimates that the true population mean difference is somewhere between -5.606 and -.394 (knowing that the estimate could be incorrect).

The "t", "df", and "p" columns provide the results of the statistical significance test. First, *t* provides the standardized statistic for the mean difference:

$$t = \frac{M - \mu}{SE_M} = \frac{-3.000}{1.102} = -2.722$$

The *t* statistic follows a non-normal (studentized or *t*) distribution that depends on degrees of freedom. Here, *df* = *N* – 1 = 8 – 1 = 7. A *t* with 7 *df* that equals -2.722 has a two-tailed probability (*p*) of .030, a statistically significant finding.

The Mean Difference ("Diff") is the difference between the sample mean (*M* = 4) and the user-specified test value (*u* = 7). For the example, the sample had a mean one point higher than the test value. This raw effect size is important for the significance test, the confidence interval, and the effect size.

Cohen's "d" provides a standardized effect size for the difference between the two means.

$$d = \frac{M - \mu}{SD} = \frac{-3.000}{3.117} = 0.963$$

Given Cohen's heuristics for interpreting effect sizes, this would be considered a large effect.