

The Upgrade: Calculating the Evidence

1. From Theory to Script (25 Minutes)

In the previous block, we saw the “Safety Net” visually. Now, we apply it to a real experimental audit. You are testing whether a control group of plants meets the industry standard height of **5.0 units**.

Step 1: Prep the Audit Data

In your R console, create the dataset by filtering the built-in `PlantGrowth` data:

```
auditdata <- PlantGrowth$weight[ PlantGrowth$group == "ctrl" ]
```

Step 2: Get the Template

Navigate to Section 10.2.3: One-Sample Hypothesis Test Code on the Statypus site.

Step 3: Run the Test

Copy the code block from the website into a new R script. Adapt the variables to test if the mean of your `auditdata` is significantly different from $\mu = 5.0$.

Task: The Manual vs. The Machine

Record the following results from your script output:

- Sample Mean (\bar{x}): _____
- Calculated t -statistic: _____
- The p -value: _____

Question: With only $n = 10$ plants ($df = 9$), your “Safety Net” is quite wide. Look at your t -score. Does it need to be *larger* or *smaller* than 1.96 to be considered significant? Why?

2. Enter the Hero: The `t.test()` Shortcut

After years of Lead Engineers sweating over manual calculations, R introduced a single function designed to do everything you just did—the t -calculation, the degrees of freedom check, and the p -value lookup—in one heroic stroke.

Task: In your console, type and run the following:

```
t.test( auditdata, mu = 5.0 )
```

Comparison Audit: Compare the output of this one-line “Hero” to the manual script you built on Page 1.

Did the results match exactly? Yes No

Question: If the hero `t.test()` is so powerful, why did we spend the first half of this section learning about the “Safety Net” and calculating things by hand? What happens to a Lead Engineer who trusts the shortcut without understanding the distribution underneath?

3. Interpreting the Evidence

The Verdict: Our Null Hypothesis was $\mu = 5.0$.

- If your p -value is less than 0.05, you **Reject** the Null.
- If your p -value is greater than 0.05, you **Fail to Reject**.

What is your decision? Write a brief sentence explaining if these plants are significantly different from the 5.0 standard.

Final Reflection: As a Lead Engineer, you often have to choose between a small, fast audit ($n = 10$) or a large, expensive audit ($n = 500$). How does the t -distribution physically “punish” you for choosing the smaller sample size? (Hint: Think about the distance your t -score has to travel to reach the tail).