Sections 4.4 – 4.5: Standardized Rulers & Resistance

Formalizing the Intuition

Sally the Statypus says: Bill was just telling me that you guys are already pros at calculating z-scores! He said you didn't even need a formula to figure out how many "SD Rulers" away that giant Megaplaty was in the last block.

CHAPTER 4

1. The Unveiling: The Standardized Ruler

Look back at your Section 4.2 worksheet. You were asked to find how many Standard Deviations our 2.4kg Megaplaty was from the center. You essentially used the Standard Deviation as a "standard ruler."

Statypus Insight: The Formal Z-Score Formula

A **Z-Score** is the universal mathematical way of saying "How many standard rulers away is this dot?" The real formula uses the true **parameters** of a population: the mean (μ) and the standard deviation (σ).

$$z = \frac{x - \mu}{\sigma}$$

Because we are biologists working in the field, we don't yet know the values for every platypus on Earth. For our Snowy River Catchment audit, we will treat our sample statistics as our best available approximations: $\mu \approx 1.35$kg and $\sigma \approx 0.32$kg.

Reflection: The Catchment Audit

If you trap a **1.9kg** adult in the Snowy River Catchment, use the formal formula above to calculate its z-score. (Show your substitution using the parameter symbols!)

☐ **Textbook Dive:** z-scores allow us to compare things that aren't on the same scale. For more step-by-step examples of this "Universal Translator," see **Section 4.4** in your textbook.

2. The Resistance Lab (Section 4.5)

Skim Section 4.5 and then head to the Desmos Exploration at the end of the section. Your goal is to manipulate the data points to satisfy the 6 challenges posed in the textbook.

Bill the Statypus says: Don't worry about drawing the graphs here. Instead, I want you to describe the "mechanics" of your solution. For each challenge, write 1–2 sentences explaining exactly **how** you moved the points to get the result. You can reload your browser if you want to start from scratch.

Task 1: Create a dataset where the Mean is significantly larger than the Median.
How did you do it?

Task 2: Create a dataset where the Mean is significantly smaller than the Median.

Task 3: Create a dataset where the Mean and Median are approximately equal.

Task 4: Move a point so the Median stays the same, but the Mean changes.

Task 5: Move a point so the Mean stays the same, but the SD changes.

Task 6: Create a dataset where the Standard Deviation is larger than the IQR.

Reflection: The Big Reveal

Based on your work above, which center (Mean or Median) and which ruler (SD or IQR) are most "Resistant" to being pushed around by extreme outliers? Why?