Basic Statistical Concepts

Data and Variables

- **Data:** Facts or numbers collected from observations or **experiments.**
- **Variable**: Something that can change or vary, like age, height, or favorite color.
- **Sample**: The smaller group you actually study.
- **Population**: The whole group you want to know about.

Descriptive Statistics

- **Mean**: The average value (add up all numbers, divide by how many there are).
- **Variance/Standard Deviation**: Measures how spread out the numbers are from the mean.
- **Correlation (r):** A number between -1 and 1 showing how strongly two things are related.

Distribution & Randomness

- **Distribution**: Shows how often each value happens.
- **Random Variable**: A value that comes from a random process.
- **Random Number Generation**: Making random numbers using a computer, following certain rules.

Statistical Inference

- **Parameter**: The true value in the whole population.
- **Estimate**: Your best guess of the parameter, based on your sample.
- **Null Hypothesis (H0):** The idea that nothing is happening.
- **Alternative Hypothesis (H1):** The idea that there is an effect or difference.
- **p-value:** Tells you how likely your results are if the null hypothesis is true.
- **Significance Level (alpha):** The cutoff for deciding if something is "statistically significant" (often 0.05).

Errors and Power

- **Type I Error**: Saying there is an effect when there isn't (false positive).
- **Type II Error**: Missing a real effect (false negative).
- **Statistical Power:** The chance of finding a real effect if it exists.
- **Effect Size:** How big the effect is.

Simulation-Specific Terms

- **Sample Size (n):** How many data points you have in each simulated dataset.
- **Number of Repetitions (nrep):** How many times you repeat the simulation.
- **Model**: The math or stats formula you use (like a t-test or regression).
- **Parameter Space**: All the different combinations of sample size and effect size you try in simulations.
- **Reproducibility/Seed**: Setting a starting point for random numbers so you can get the same results if you run it again.

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