

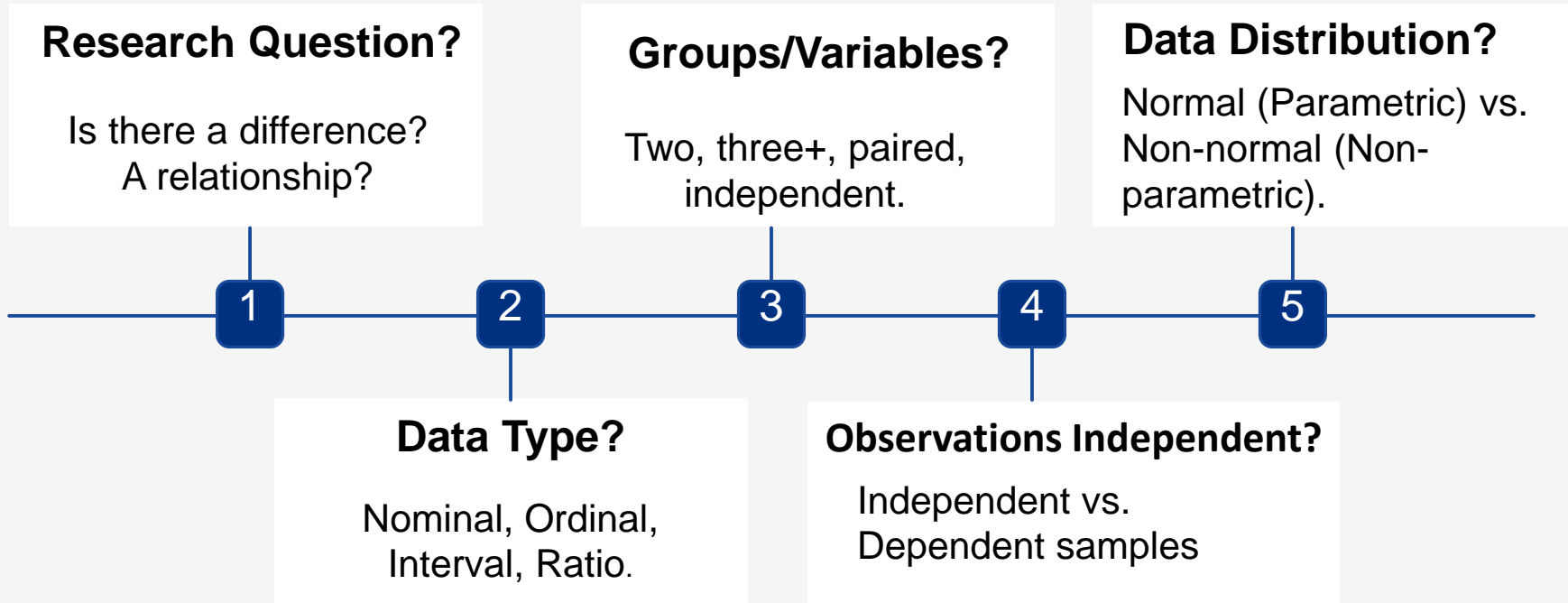
Choosing the Right Statistical Test

A Framework for Making Informed Decisions

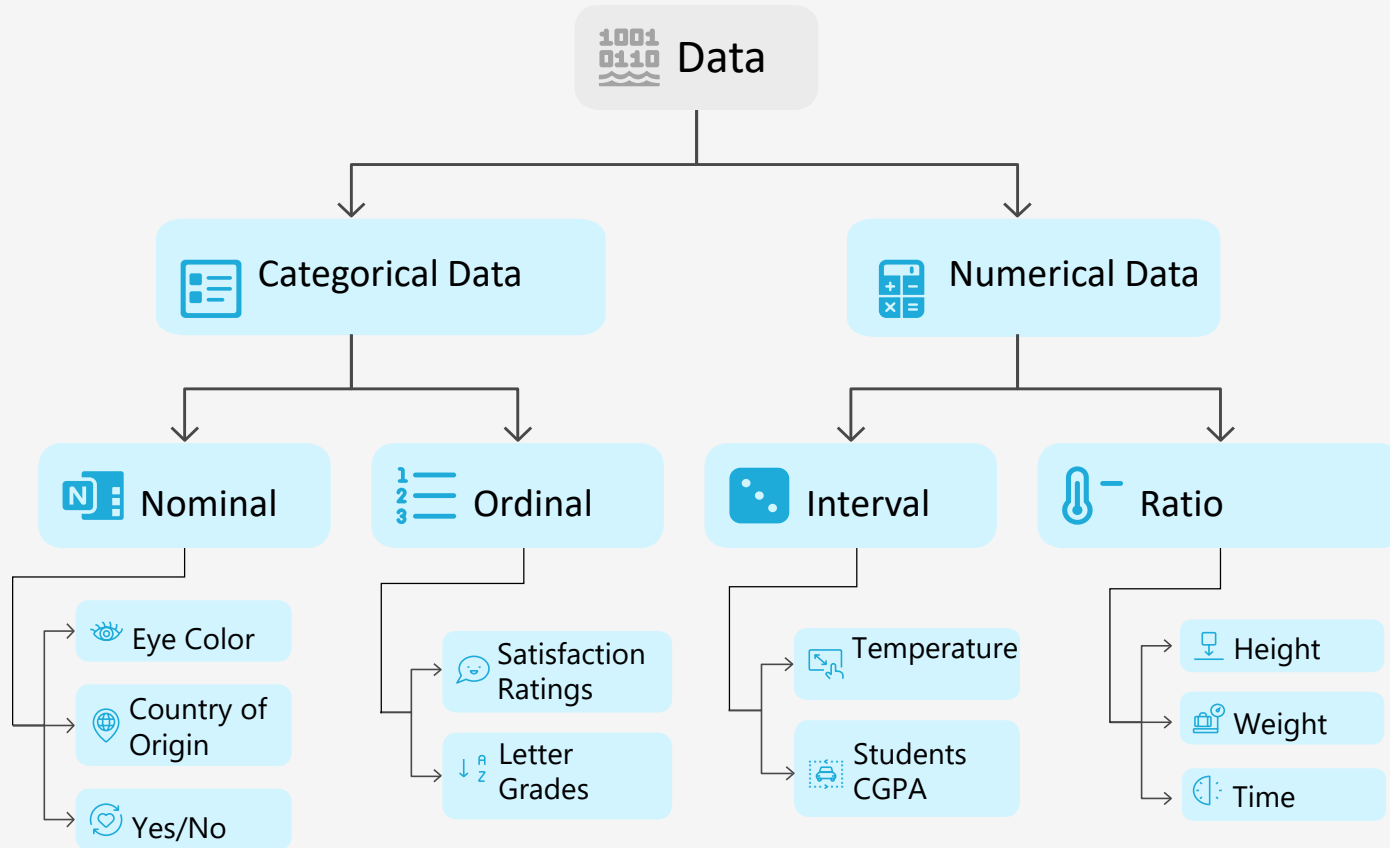
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August 22, 2025

Key Questions Before Choosing a Test



Types of Data



Before You Run the Test: Data Exploration is Key!

Proper exploration helps ensure your test selection is appropriate



Visualizing Data

Use histograms, box plots, and scatter plots to understand your data's distribution and relationships.



Checking for Outliers

Identify and decide how to handle extreme values that may influence your results.



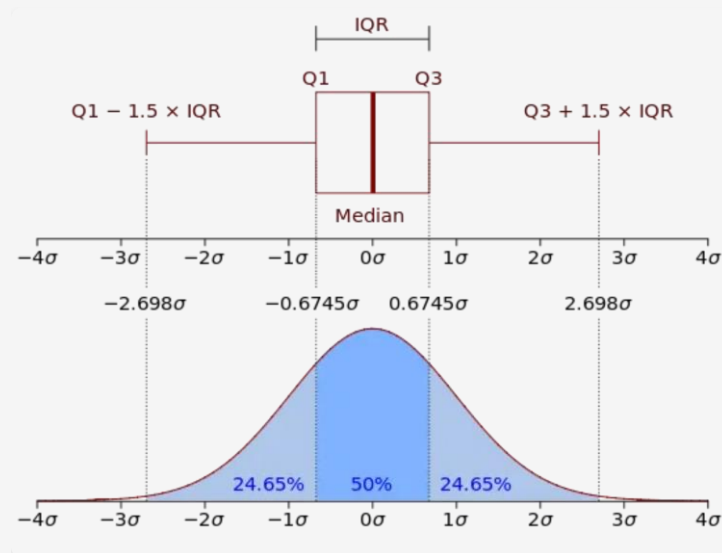
Assessing Normality

Use Q-Q plots and Shapiro-Wilk test to check if your data follows a normal distribution.



Assessing Homogeneity of Variances

Use Levene's test to check if different groups have similar variances.



Visual inspection is often more informative than relying solely on statistical tests for assumptions!

What is Distribution?

A **distribution** is the pattern of variation in a dataset, showing how frequently different values occur and how they are spread out. It helps us understand the central tendency, variability, and shape of our data.



Normal Distribution

Symmetrical, bell-shaped curve with most values clustering around the mean. Example: Heights in a population.



Skewed Distribution

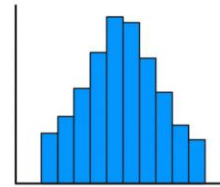
Asymmetrical with a longer tail on one side. Can be right-skewed or left-skewed. Example: Income distribution.



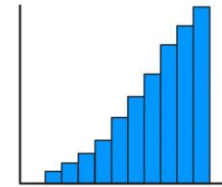
Bimodal Distribution

Has two peaks, indicating two different clusters or subgroups in the data. Example: Exam scores from two different classes.

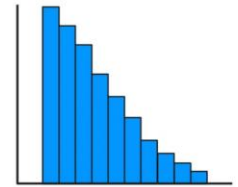
Histogram Distributions



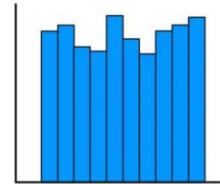
Normal distribution



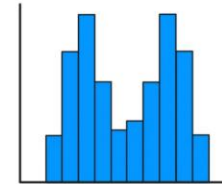
Left-skewed distribution



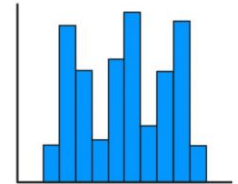
Right-skewed distribution



Uniform distribution



Bimodal distribution



Multimodal distribution

The shape of your data's distribution helps determine which statistical tests are appropriate to use. Parametric tests typically assume a normal distribution.

Dependent vs Independent Observations

Independent Observations

Observations or measurements that do not influence each other. Each data point is completely separate from other data points.

Examples:

- Random samples from different populations
- Different participants in control vs. treatment groups



Independent events

An events that are **not affected** by other events.

Two dice toss at the same time will have the same chance of outcome

Dependent Observations

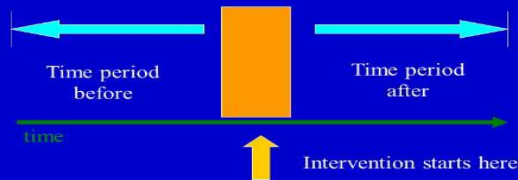
Observations or measurements that are related to or influenced by each other. Data points have a natural pairing or connection.

Examples:

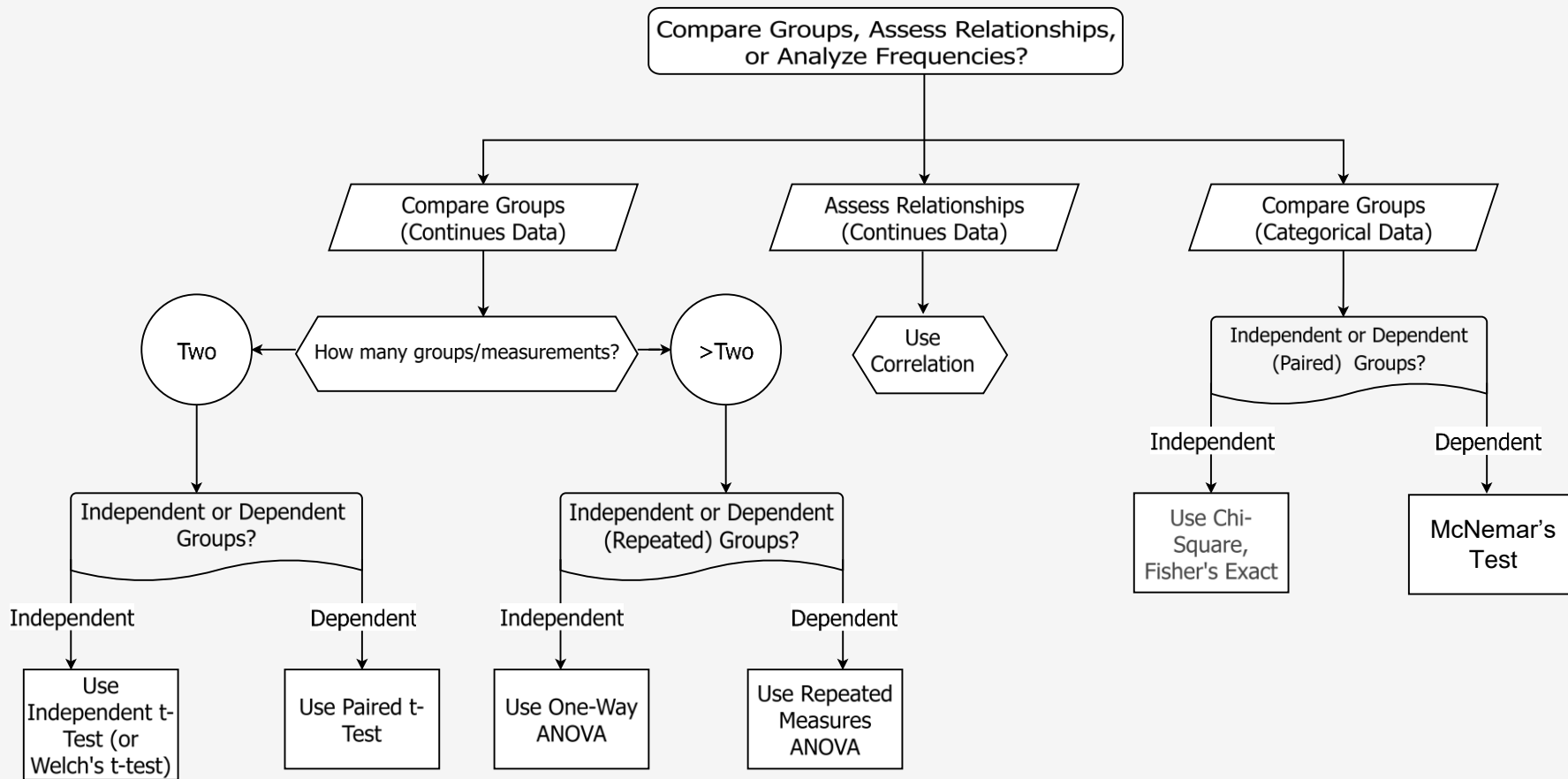
- Pre-test and post-test measurements on the same subjects
- Repeated measurements over time on the same subjects

Before-and-After Studies

- A “quasi-experimental” design that surveys exposures and disease status before and after an intervention

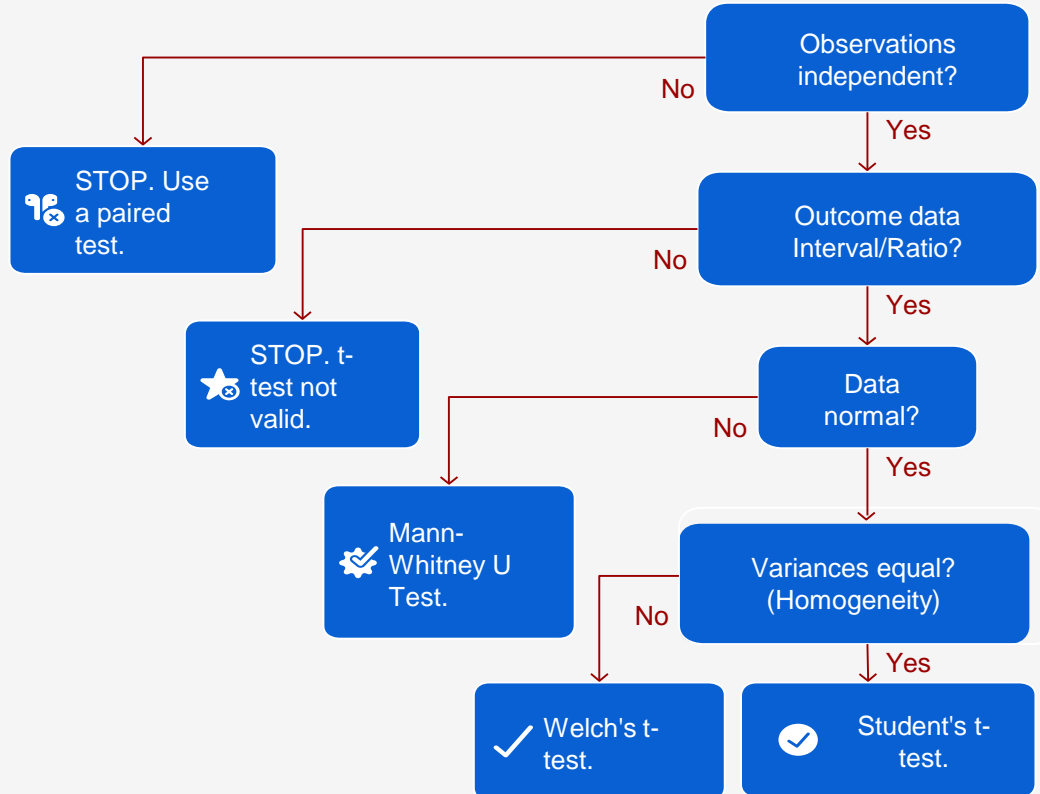


Statistical Test Selection Flowchart



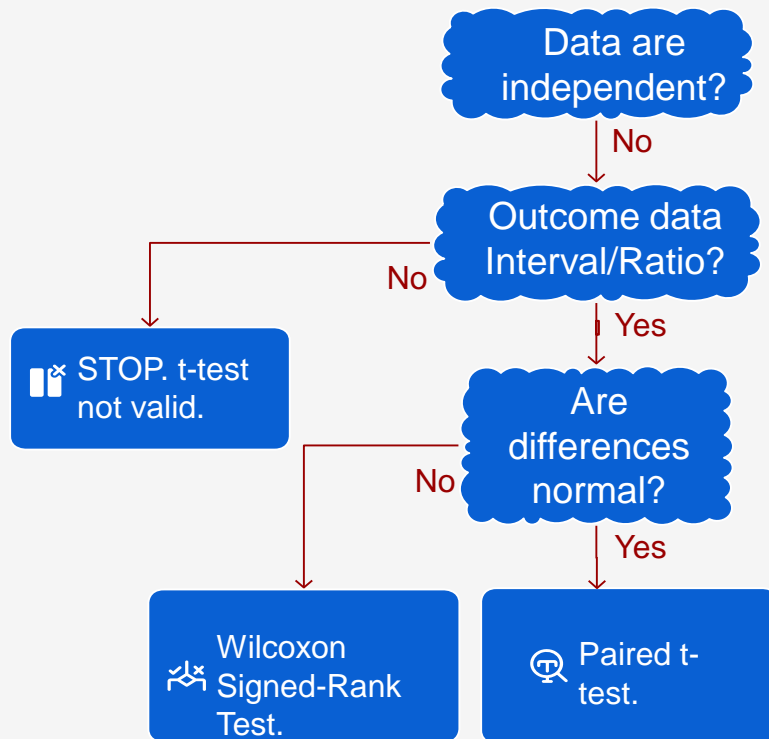
Comparing Two Independent Groups

Research Question: Is there a significant difference between two unrelated groups?



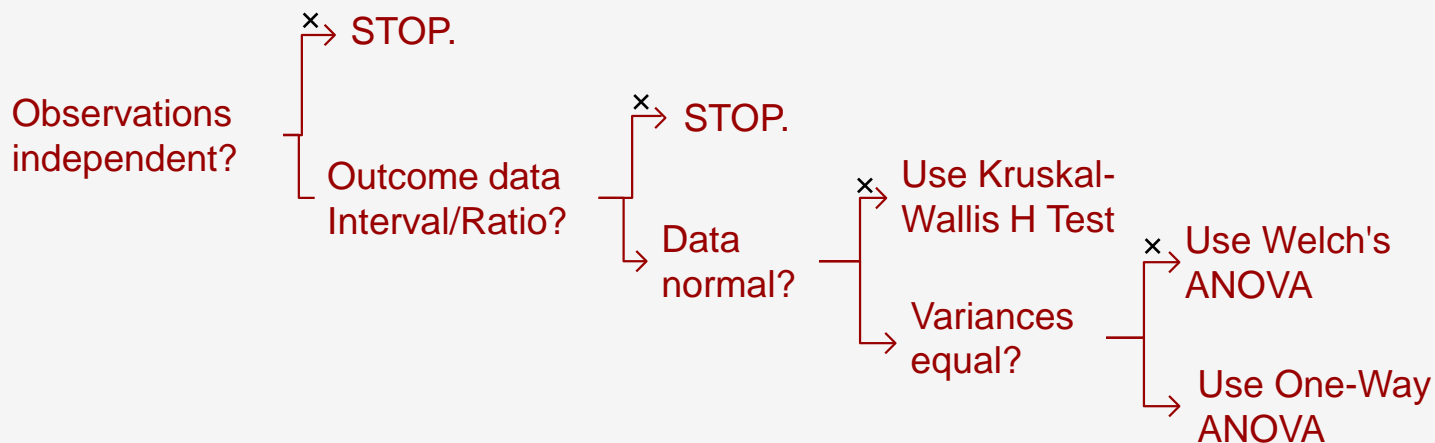
Comparing Two Dependent (Paired) Groups

Research Question: Is there a significant difference between two related measurements?



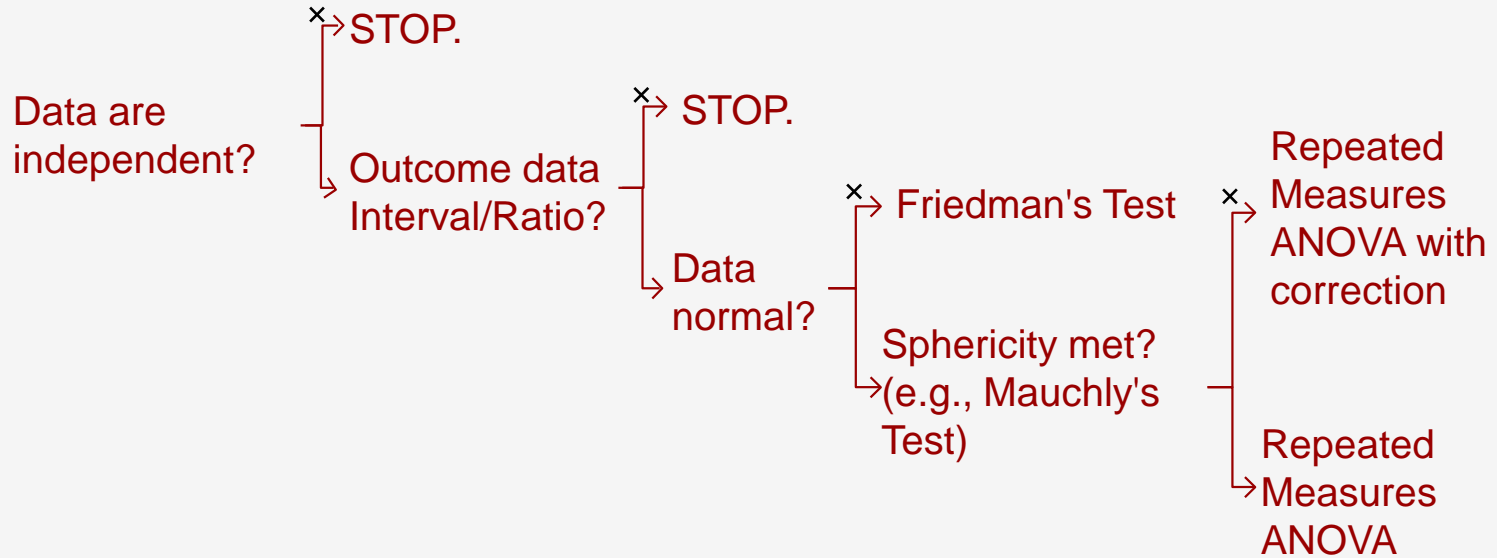
Comparing Three or More Independent Groups

Research Question: Is there a significant difference among three or more unrelated groups?



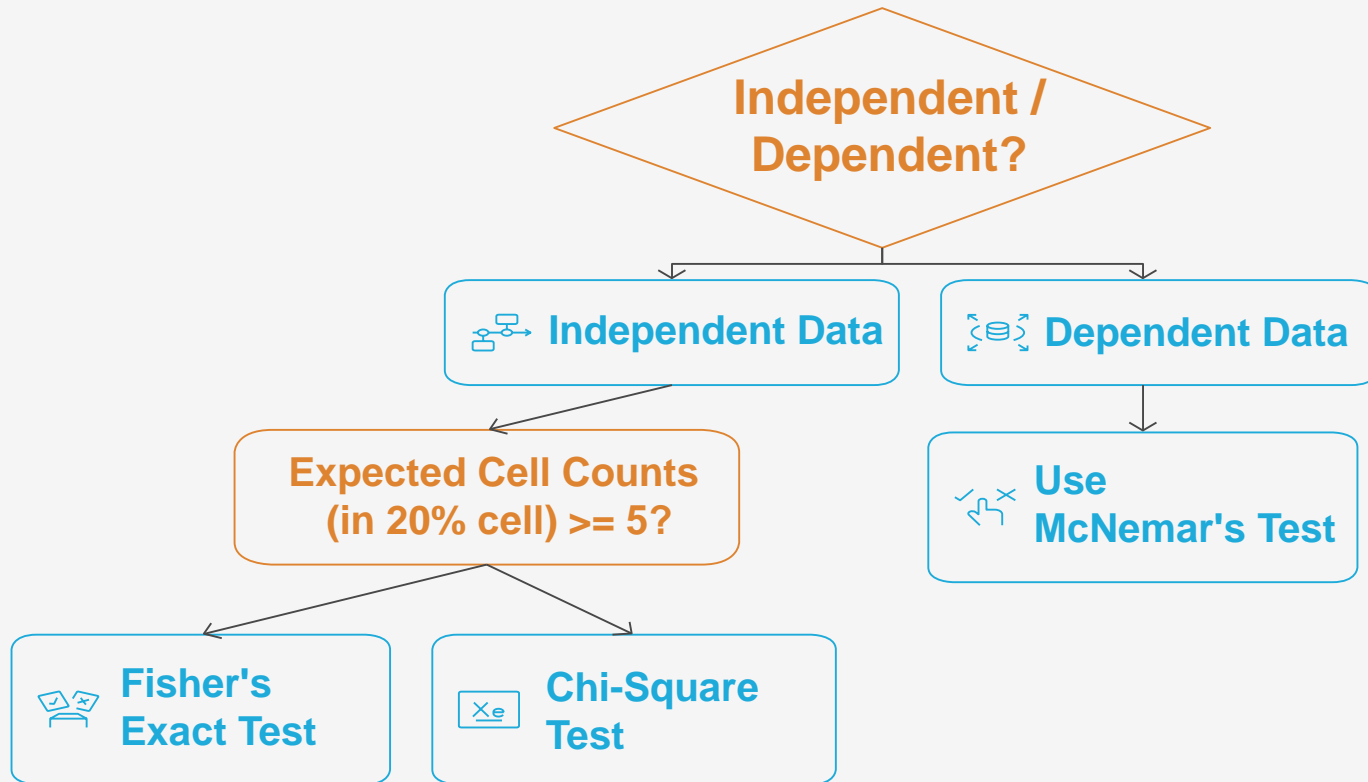
Comparing Three or More Dependent Groups

Research Question: Is there a significant difference across three or more related measurements?



Analyzing Categorical Data

Research Question: Are observed frequencies/proportions different from expected, or is there an association between categorical variables?



A Checklist for Test Selection

Question	Your Response
Research Question:	<i>What are you trying to find out?</i>
Number of Variables/Groups:	<i>How many are involved?</i>
Variable Type(s):	<i>Nominal, Ordinal, Interval, Ratio?</i>
Independence of Observations:	<i>Paired or Independent?</i>
Distribution:	<i>Normal or non-normal?</i>
Assumptions Met?	<i>Yes/No</i>
Chosen Test:	<i>Based on above criteria</i>
Alternative Test (if needed):	<i>If assumptions not met</i>

Thank You!

For taking the time to learn about selecting the right statistical test for your research needs.

Any Questions?

