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AI Diploma

Assessment Seven

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Statistical Tests:

Types:

Choosing a parametric test: regression, comparison, or correlation

Parametric tests usually have stricter requirements than nonparametric tests, and are able to make stronger inferences from the data. They can only be conducted with data that adheres to the common assumptions of statistical tests.

The most common types of parametric test include regression tests, comparison tests, and correlation tests.

	Predictor variable	Outcome variable	Research question example
Simple linear regression	• Continuous • 1 predictor	• Continuous • 1 outcome	What is the effect of income on longevity?
Multiple linear regression	• Continuous • 2 or more predictors	• Continuous • 1 outcome	What is the effect of income and minutes of exercise per day on longevity?
Logistic regression	• Continuous	• Binary	What is the effect of drug dosage on the survival of a test subject?

Regression tests

Regression tests are used to **test cause-and-effect relationships**. They look for the effect of one or more continuous variables on another variable.

Comparison tests

Comparison tests look for **differences among group means**. They can be used to test the effect of a categorical variable on the mean value of some other characteristic.

T-tests are used when comparing the means of precisely two groups (e.g. the average heights of men and women). ANOVA and MANOVA tests are used when comparing the means of more than two groups (e.g. the average heights of children, teenagers, and adults).

	Predictor variable	Outcome variable	Research question example
Paired t-test	• Categorical • 1 predictor	• Quantitative • groups come from the same population	What is the effect of two different test prep programs on the average exam scores for students from the same class?
Independent t-test	• Categorical • 1 predictor	• Quantitative • groups come from different populations	What is the difference in average exam scores for students from two different schools?
ANOVA	• Categorical • 1 or more predictor	• Quantitative • 1 outcome	What is the difference in average pain levels among post-surgical patients given three different painkillers?

MANOVA	• Categorical • 1 or more predictor	• Quantitative • 2 or more outcome	What is the effect of flower species on petal length, petal width, and stem length?

Correlation tests

Correlation tests **check whether two variables are related** without assuming cause-and-effect relationships.

These can be used to test whether two variables you want to use in (for example) a multiple regression test are autocorrelated.

	Predictor variable	Outcome variable	Research question example
Pearson's *r*	Continuous	Continuous	How are latitude and temperature related?

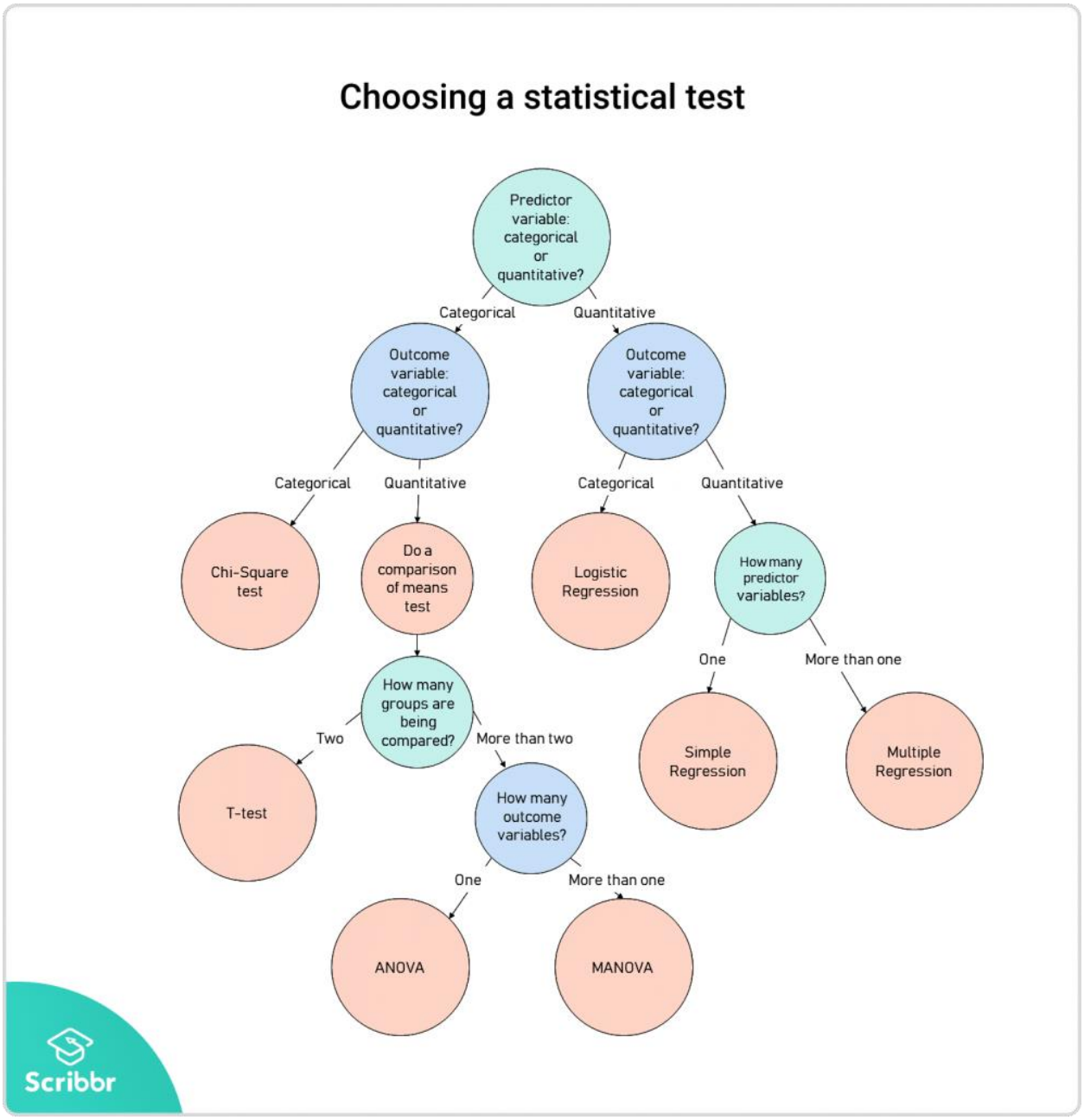
Choosing a nonparametric test

Non-parametric tests don't make as many assumptions about the data, and are useful when one or more of the common statistical assumptions are violated. However, the inferences they make aren't as strong as with parametric tests.

	Predictor variable	Outcome variable	Use in place of…
Spearman's *r*	• Quantitative	• Quantitative	Pearson's *r*
Chi square test of independence	• Categorical	• Categorical	Pearson's *r*
Sign test	• Categorical	• Quantitative	One-sample *t*-test
Kruskal–Wallis *H*	• Categorical • 3 or more groups	• Quantitative	ANOVA
ANOSIM	• Categorical • 3 or more groups	• Quantitative • 2 or more outcome variables	MANOVA
Wilcoxon Rank-Sum test	• Categorical • 2 groups	• Quantitative • groups come from different populations	Independent t-test

Wilcoxon Signed-rank test	• Categorical • 2 groups	• Quantitative • groups come from the same population	Paired t-test

Use:


Choosing a statistical test
Predictor variable: categorical or quantitative?
Categorical
Quantitative
Outcome variable: categorical or quantitative?
Outcome variable: categorical or quantitative?
Categorical
Quantitative
Categorical
Quantitative
Chi-Square test
Do a comparison of means test
Logistic Regression
How many predictor variables?
One
More than one
How many groups are being compared?
Simple Regression
Multiple Regression
Two
More than two
T-test
How many outcome variables?
One
More than one
ANOVA
MANOVA
Scribbr

References

[1] R.Bevans, "Scribbr," 28 12 2020. [Online]. Available: https://www.scribbr.com/statistics/statistical-tests/#:%7E:text=Statistical%20tests%20assume%20a%20null,predicted%20by%20the%20null%20hypothesis..