Categorical ↔ Categorical

Are X groups 1 or 2
more likely to be in Y groups A or B?

Significance:

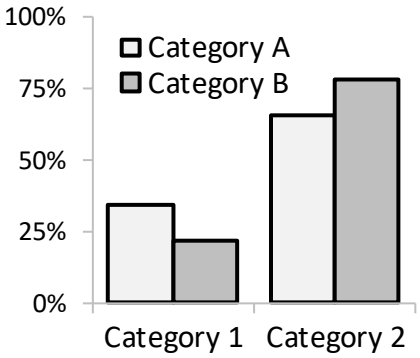
Chi Square χ^2

Strength:

Cramer's V

Are (1) H.S. or (2) college students more likely to prefer (A) Math or (B) Science?

Bar Chart



Numeric → Categorical

Are higher/lower values of X
more likely to be in Y groups A or B?

Significance:

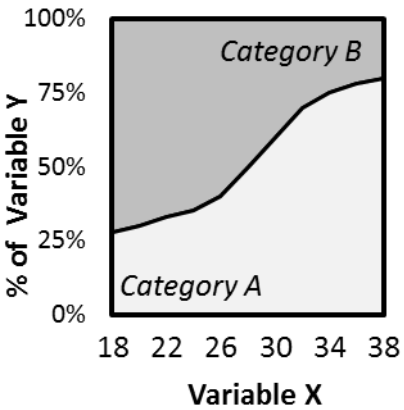
Logistic Regression

Strength:

Odds Ratio

Is (X) age related to the likelihood of studying at the (A) library or (B) home?

Area Chart



Categorical → Numeric

Do X groups 1 or 2
have higher/ lower values of Y overall?

Significance:

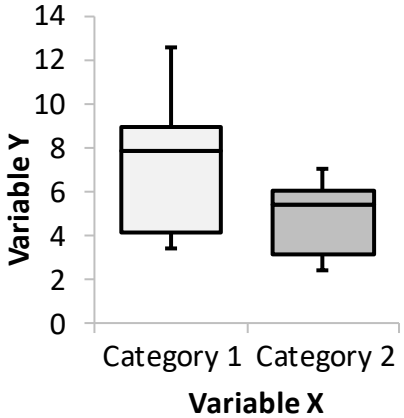
t-test / ANOVA

Strength:

Cohen's D

Do (1) Mason graduates and (2) UVA graduates get different (Y) numbers of job interviews?

Box Plot



Numeric ↔ Numeric

Are higher/lower values of X
associated with higher/lower values of Y?

Significance:

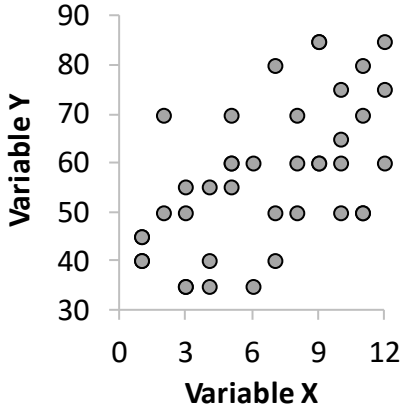
Correlation

Strength:

Pearson's r

Is the (X) number of class sessions attended related to (Y) scores on the final exam?

Scatter Plot



Categorical ↔ Categorical

Compare or Examine Associations with Group Membership

Chi-Square (χ^2) examines a contingency table (or crosstabulation) of nominal variables (ideally 2-5 groups), comparing the frequencies expected if there were no relationship to actual / observed frequencies.

See also:

Binomial Test	for 1 Proportion (1 variable with 2 levels)
Fisher's Exact	for 2x2 tables, allows cells having < 5 expected obs
McNemar's	for repeated measures / paired samples
Kendall's tau	for Ordinal variables
Kruskal Gamma	for Ordinal variables with many ties
Log-linear	for 3+ Nominal variables

Yates correction is used when cells have < 5 observed values

Numeric → Categorical

Understand or Predict Group Membership

Logistic Regression models the relationship between a Binary DV and one or more IVs. A linear combination of the values of all IVs produces a predicted likelihood (in log-odds) of being in one group over the other.

See also:

Multinomial / Ordinal Logistic Regression	for nominal / ordinal DVs with 3+ values
Linear Probability Model	name when using Linear Regression to predict probabilities (also a Binary DV)
Discriminant Functions Analysis (DFA)	for a linear combination of Gaussian variables that best discriminates among 3+ groups
Log-linear Analysis	for multiple nominal IVs only; better for testing interactions between the factors

Categorical → Numeric

Compare Group Means

Analysis of Variance (ANOVA) compares means from independent groups formed by 1+ Nominal IVs. If any IV has 3+ levels, post-hoc tests are used to test pairwise differences. *aka* Between Subjects ANOVA

See also:

t-Test	ANOVA for just 1 IV having only 2 groups
Z-Test	t-Test for known s and/or large samples
Kruskal-Wallis H / Mann-Whitney U	ANOVA / t-Test for an Ordinal or Non-Parametric DV
Factorial ANOVA	name when testing interactions among 2+ IVs
MANCOVA	Multiple (2+) correlated DVs and a numeric Covariate
Within Subjects ANOVA/t-Test	Compare a change or difference in paired values; aka Repeated Measures, Dependent Samples

Numeric → Numeric

Understand or Predict Values

[Pearson's] Correlation evaluates the strength of a *linear* association, or shared variance, between 2 numeric variables. For Non-Parametric or Ordinal variables, use Spearman's [Rank-Order] Correlation.

See also:

[Linear] Regression	creates a linear combination/equation of the values of all IVs to produce a predicted value of the DV
General[ized] Linear Models	extension of Regression to allow for for non-normal distributions of the response variable or residuals
Hierarchical Linear Modeling (HLM)	when observations have variables for shared group characteristics (e.g., students within schools)

In Regression, nominal variables can be included as numeric IVs when expressed as multiple binary variables (through Dummy Coding).