One-Way ANOVA

Between-Group Mean Square	Within-Group Mean Square	F-Ratio
1) (Subtract overall mean of pop from each group's mean)^2	1) (subtract overall mean of pop from each group (sample) mean),	1) [(between group mean square) / (w/in-group mean square)]
2) (squared difference) (sample size)	2) then multiple each difference by (n-1)	2) if ~ 1, then btwn-groups & w/in-groups variances similar, accept H0
3) compute degree of freedom (number of groups minus 1)	3) calculate the grand sum	3) if >1, then reject H0
4) calculate between-groups mean square = [(btwn-group variance) / (df)]	4) calculate the degrees of freedom total (N-n of groups)	

One-Way ANOVA (cont)

5) calculate the w/in groups mean square = [(sum of squares) / (degrees of freedom total)]

- Analysis of Variance (compares means between 3+ samples)
Does not indicate which group(s) are different from which other groups (s)
- Parametric test
- Bonferroni post hoc test, reveals which specific means differed. Use if ANOVA was sig. using for pairwise comparison
- It multiplies each of the significance levels from the LSD test by the number of tests performed. If this value is greater than 1, then a significance level of 1 is used.

Chi-Square Test

1) calculate the expected frequency (E) = [(row total) (column total) / total sample N]	Standardized Residuals	Phi (Φ)	Cramer's V
2) for each cell, find (difference between overserved & expected counts)2	reveal what cell adds the most statistical value to the test.	to measure the strength of association of chi-square test	to measure the strength of association of chi-square test

Chi-Square Test (cont)

3) divide square difference by expected count for each cell, then sum results	2x2 table	greater than 2x2 table
4) df = [(n of rows -1) (n of columns -1)]		
5) check X2 table for significance at @ 0.05 alpha level		

- **Dependent & Independent nominal/nominal or nominal/ordinal data**
- H0= no relationship between variables; expected counts for each cells = observed counts
- n is greater/equal to 20; no expected frequencies less/equal to 5 in 20% or more of the cells

Fisher's Exact Test for Chi-Square

-Use when Chi-Square assumptions are violated (>20%)
- Very small samples

Spearman's Rank Correlation

1) Turn raw scores into ranks	Rho varies from -1 to +1
2) find d2 = (difference between rankings)2	-1 (a perfect negative correlation; as X increases, y decreases)
3) add up all the data in d2 column to obtain sumd2	0 = no association

Spearman's Rank Correlation (cont)

4) calculation spearman's rank correlation coefficient (rho) rs = [1- (6*sumd2)/N3-N)] df= n-2	+1 (a perfect positive correlation; as X increases, Y increases

- Measures of associate for two ordinal variables; whether a relationship exists, how strong it is, what is the direction/pattern of relationship) (what happens to one variable, happens to the other variable)
- Nonparametric version of Pearson correlation coefficient
- H0= no sig
independent = x ; dependent = y

Pearson's R Correlation Coefficient

r= Rho = measure of association (-1 to +1)

assumes x and y is normally distr. & linearly related

(Pearson's r)2 = PRE stat (strength of predicting amount of variance in Y based on X)

r2 = % of variance in dependent (Y) explained by independent (X)

usually **interval/ratio level data**

Parametric vs. Non-parametric Tests

Parametric	Non-Parametric
interval or ratio data	**nominal and/or ordinal data**
one-way ANOVA	Distribution free
Pearson's R Correlation Coefficient	Wilcoxon Signed-Rank Test for **Two Related Conditions**
	Mann-Whiteny U Test for **Two Independent Conditions**
	Wilcoxon Rank Sum Test for **Two Independent Conditions**
	Chi-Square Test

Parametric vs. Non-parametric Tests (cont)

	Kruskal-Wallis
	Spearman's Rank Correlation

Wilcoxon Rank-Sum & Mann-Whitney U tests

nonparametric equivalent of independent--sample t-test

nominal and/or ordinal data

Tests two independent conditions

Wilcoxon Signed-Rank

- Use this test for **two related conditions (paired, matched)**
- ordinal data
- nonparametric equivalent to the **dependent-sample t-test**
H0 = The two groups are identically distributed.

Kruskal-Wallis

nonparametric equivalent of one-way ANOVA

nominal or ordinal data, but more than two independent samples

uses chi-square distribution

Regression

Predicts **dependent (y)** based on value of **independent (x)**

Regression Formula: line that makes the sum of squares of the vertical distances of the data points from the line as small as possible

Principle of least-squares - finds estimates of parameters in a stat model based on observed data

y= a + bx; a= y-axis; b= slope

interval/ratio level data
assumes linear relationship
observes independent (x)

Correlation

Tests for	Difference between (r) and (r)2	Assumptions
How well X predicts Y	r= Pearson's correlation coefficient = measure of association	For each independent (x), dependent (y) must be normal
how "tightly the predicted values fit regression line	r^2 = PRE stat (strength of predicting amount of variance in Y based on X)	Dependent variable variances same for all independent values (homoscedasticity)
to what degree X covaries with Y	r^2 = % of variance in dependent (Y) explained by independent (X)	Avoid predictions outside the observed values; beware extremes; relationships must be linear over all values.
		linear relationship, observes independent (X)

usually, **interval/ratio level data**