Reference Tables

Table 1: Methods, Their Purposes, Typical Assumptions, Alternatives, Cross-Listed References

Note: (1) All methods assume that the samples are **simple random samples**, so that assumption is not listed individually.

(2) Alternatives are only listed if they are discussed in this Manual.

(3) Confidence intervals are not listed separately because they can be generated using the hypothesis test methods.

Method (with Section Number)	**Purpose**	**Assumptions (with Section Numbers)**	**Alternatives (with Section Numbers)**
1-Sample t-Test (15)	Tests single population mean	Underlying population is normally distributed (8, 10, 36) OR sample size is “large	1-Sample Mann-Whitney-Wilcoxon Test (30)
2-Independent-Sample t-Test (16)	Compares means of two independent populations	Underlying populations are normally distributed (8, 10, 36) OR sample sizes are both “large”	2-Sample Mann-Whitney-Wilcoxon Test: Independent Samples (31)
Paired Data t-Test (17)	Compares two population means when data is paired or dependent	Underlying population of differences is normally distributed (8,10,36) OR sample size is “large”	2-Sample Mann-Whitney-Wilcoxon Test: Repeated Measures (32)
1-Sample Variance Test (19)	Tests single population variance	Underlying population is normally distributed (8,10, 36)	

Method (with Section Number)	Purpose	Assumptions (with Section Numbers)	Alternatives (with Section Numbers)
F-test (20)	Compares two population variances	Underlying populations are normally distributed (8, 10, 36) Populations are independent of one another	
ANOVA: One-way (21)	Compares multiple population means when one factor is used	Underlying populations are normally distributed (8, 10, 36) OR sample sizes are "large" Samples are independent of one another Common variance (20)	Kruskal-Wallis Test (33)
ANOVA: Repeated Measures (22)	Compares multiple means when measurements are repeated on the same individuals	Underlying populations are normally distributed (8, 10, 36) OR sample sizes are "large" Samples are independent of one another Common variance (20) Sphericity holds (24)	Friedman's ANOVA (34)

Method (with Section Number)	Purpose	Assumptions (with Section Numbers)	Alternatives (with Section Numbers)
ANOVA: Two-Way (23)	Compares multiple population means when two or more factors are used	Underlying populations are normally distributed (8, 10, 36) OR sample sizes are “large” Samples are independent of one another Common variance (20)	
Mauchly’s Sphericity Test (24)	Checks repeated measures for sphericity	Differences between pairs of repeated measurements are normally distributed (8, 10, 36)	
Linear Correlation (25)	Checks for strength of linear relationship between two variables	Pairs come from a population that is bivariate normal	Non-parametric Correlation (37)
Simple Linear Regression (26)	Finds least-squares line relating two variables	“Strong” linear correlation (25) Bivariate normality; no pattern to residuals in scatterplot (27)	

Method (with Section Number)	Purpose	Assumptions (with Section Numbers)	Alternatives (with Section Numbers)
Multiple Regression (28)	Finds least-squares line that describes one response variable using multiple predictor variables	Relationship is linear; check scatter plots of response vs. each predictor Uncorrelated predictors (25) Common variance of residuals across predictors; check scatterplots of residuals vs. predictors (27) Underlying normal distribution for response variable (8, 10, 36) No significant outliers in response; check its boxplot	
Binomial or Proportion Test (29)	Tests one population proportion or compares two population proportions	If two samples are being compared, they must be independent of one another Underlying population(s) has/have binomial distributions Expected number(s) of successes and failures under the null hypothesis are greater than or equal to 5	

Method (with Section Number)	Purpose	Assumptions (with Section Numbers)	Alternatives (with Section Numbers)
1-Sample Mann-Whitney-Wilcoxon Test (30)	Tests single population median	Must be possible to rank data	
2-Sample Mann-Whitney-Wilcoxon Test: Independent Samples (31)	Compares medians of two independent populations	Independence both between and within samples Must be possible to rank data Populations have the same distribution OR difference is in location	
2-Sample Mann-Whitney-Wilcoxon Test: Repeated Measures/Paired Data (32)	Compares two population medians when data consists of repeated measurements	Must be possible to rank data Populations have the same distribution OR difference is in location	
Kruskal-Wallis Test (33)	Compares medians of multiple populations	Samples are independent of one another Must be possible to rank data Populations all have the same distribution OR difference is in location	

Method (with Section Number)	Purpose	Assumptions (with Section Numbers)	Alternatives (with Section Numbers)
Friedman's ANOVA (34)	Compares multiple medians when data consists of repeated measurements in blocks	Block variables are mutually independent Must be possible to rank data within blocks	
Chi-Square Test (35)	Tests contingency table data for independence of rows and columns	Data consists of frequency counts for the different categories in the table In each category, the expected frequency is greater than or equal to 5	
Shapiro Normality Test (36)	Tests for whether sample data is consistent with a normally distributed population	None	Graphical methods: Inspect Histogram (8) Normal Probability Plot (10)
Non-parametric Correlation (37)	Checks for more general correlation; need not be linear	For Spearman's rho: Ranking of the data must be possible For Kendall's tau: data must be either interval or ratio data so that differences can be computed	

Method (with Section Number)	Purpose	Assumptions (with Section Numbers)	Alternatives (with Section Numbers)
Binary Logistic Regression (38)	Classifies binary response variable based on values of independent variable(s)	Independent observations (no repeated measurements) No correlation in pairs of predictors (25) Linear relationship between the log-odds of the response variable and the predictor variables	
Multiple Comparisons: Means or Proportions (39)	Compares multiple means or multiple proportions and makes correction for multiple comparisons	Used following an ANOVA that indicates at least one mean is different from the rest	Multiple Comparisons: Medians (40)
Multiple Comparisons: Medians (40)	Compares multiple medians and makes correction for multiple comparisons	Use following a Kruskal-Wallis that indicates at least one median is different from the rest	

Bibliography

References

Conover, W. *Practical Nonparametric Statistics*. New York, NY: John Wiley and Sons, 1999.

Dancey, C., Reidy, J., Rowe, R. *Statistics for the Health Sciences*. Thousand Oaks, CA: SAGE, 2012.

Faraway, J. *Linear Models with R*. Boca Raton, FL: CRC Press, 2015.

Gibbons, J., Chakraborti, S. *Nonparametric Statistics*. Boca Raton, FL: Chapman and Hall CRC, 2010.

Hollander, M., Wolfe, D. *Nonparametric Statistical Methods*. New York, NY: John Wiley and Sons, 1973.

Hothorn, T., Everitt, B. *A Handbook of Statistical Analyses Using R*. Boca Raton, FL: CRC Press, 2014.

Kloke, J., McKean, J. *Nonparametric Statistical Methods Using R*. Boca Raton, FL: CRC Press, 2015.

Raykov, T. , Marcoulides, G. *Basic Statistics: An Introduction with R*. Rowman and LIttlefield: Lanham, MD, 2012.

Saville, D., Wood, G. *Statistical Methods: The Geometric Approach*. New York, NY: Springer-Verlag, 1991.

Sprent, P., Smeeton, N. *Applied Nonparametric Statistical Methods*. Boca Raton, FL: Chapman and Hall CRC, 2007.

http://imaging.mrc-cbu.cam.ac.uk/statswiki/FAQ/effectSize

R – basic program

R Core Team (2019). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

R packages

Torchiano M (2019). _effsize: Efficient Effect Size Computation_. doi: 10.5281/zenodo.1480624 (URL: https://doi.org/10.5281/zenodo.1480624), R package version 0.7.6, <URL: https://CRAN.R-project.org/package=effsize>.

Navarro, D. J. (2015) lsr: Learning statistics with R: A tutorial for psychology students and other beginners. (Version 0.5) University of Adelaide. Adelaide, Australia

John Fox and Sanford Weisberg (2019). car: An {R} Companion to Applied Regression, Third Edition. Thousand Oaks CA: Sage. URL: https://socialsciences.mcmaster.ca/jfox/Books/Companion/

Millard SP (2013). _EnvStats: An R Package for Environmental Statistics_. Springer, New York. ISBN 978-1-4614-8455-4, <URL: http://www.springer.com>.

Lüdecke D (2019). _sjstats: Statistical Functions for Regression Models (Version 0.17.6)_. doi: 10.5281/zenodo.1284472 (URL: https://doi.org/10.5281/zenodo.1284472), URL:https://CRAN.R-project.org/package=sjstats

Andri Signorell et mult. al. (2019). DescTools: Tools for descriptive statistics. R package version 0.99.28