Handout: Summary of Statistical Tests


A. Parametrical statistical tests

<table>
<thead>
<tr>
<th>Name (Test Statistic)</th>
<th>Purpose</th>
<th>Measurement Level *</th>
<th>Corresponding Index of Strength of Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-sample <em>t</em>-test (<em>t</em>) (rarely used)</td>
<td>To test the predicted value of a man for a population</td>
<td>_</td>
<td>_</td>
</tr>
<tr>
<td><em>t</em>-test for independent groups (<em>t</em>), also called independent <em>t</em>-test</td>
<td>To test the difference between the means of 2 independent groups</td>
<td>N</td>
<td>point-biserial <em>r</em> (rarely used)</td>
</tr>
<tr>
<td><em>t</em>-test for dependent groups (<em>t</em>), also called paired <em>t</em>-test</td>
<td>To test the difference between the means of 2 related groups/sets of scores</td>
<td>N</td>
<td>point-biserial <em>r</em> (rarely used)</td>
</tr>
<tr>
<td>Analysis of variance/ANOVA (<em>F</em>)</td>
<td>To test the difference among the means of 3 or more independent groups (one-way) or groups for 2 or more IVs (multi-way)</td>
<td>N</td>
<td>eta² (rarely used)</td>
</tr>
<tr>
<td>Repeated measures ANOVA/RANOVA (<em>F</em>)</td>
<td>To test the difference among means of 3 or more related groups/sets of scores</td>
<td>N</td>
<td>eta² (rarely used)</td>
</tr>
<tr>
<td>Pearson product moment correlation (<em>r</em>)</td>
<td>To test the existence of a relationship or correlation between two variables</td>
<td>I, R</td>
<td><em>r</em>²</td>
</tr>
</tbody>
</table>

Note. * Measurement level of Independent Variable (IV) and Dependent Variable (DV): N = Nominal, I = Interval, R = Ratio.
### B. Non-parametrical statistical tests

<table>
<thead>
<tr>
<th>Name (Test Statistic)</th>
<th>Purpose</th>
<th>Measurement Level *</th>
<th>Corresponding Index of Strength of Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-square goodness-of-fit test ($\chi^2$)</td>
<td>To test the predicted value of a proportion for a population</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>Chi-square test of independence ($\chi^2$)</td>
<td>To test the difference in proportion in 2 or more independent groups</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Fisher’s exact test</td>
<td>To test the difference in proportions (2 X 2 table) when expected frequency for a cell &lt; 5</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>McNemar test ($\chi^2$)</td>
<td>To test the difference in proportions for 2 related groups (2 X 2 design)</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Cochran’s Q test ($Q$)</td>
<td>To test the difference in proportions for 3 or more related groups</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Mann-Whitney U-test ($U$)</td>
<td>To test the difference in the ranks of scores of 2 independent groups</td>
<td>N</td>
<td>O</td>
</tr>
<tr>
<td>Kruskal-Wallis test ($H$)</td>
<td>To test the difference in the ranks of scores of 3 or more related groups</td>
<td>N</td>
<td>O</td>
</tr>
<tr>
<td>Wilcoxon signed ranks test ($T$ or $z$)</td>
<td>To test the difference in the ranks of scores of 2 related groups</td>
<td>N</td>
<td>O</td>
</tr>
<tr>
<td>Friedman test ($\chi^2$)</td>
<td>To test the difference in the ranks of scores of 3 or more related groups</td>
<td>N</td>
<td>O</td>
</tr>
<tr>
<td>Spearman’s rank order correlation ($r_\varsigma$)</td>
<td>To test the existence of a correlation between two variables</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Kendall’s tau ($\tau$)</td>
<td>To test the existence of a correlation between two variables</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>
### C. Multivariate statistical analyses

<table>
<thead>
<tr>
<th>Name</th>
<th>Purpose</th>
<th>Measurement Level *</th>
<th>Number of--</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td>DV</td>
</tr>
<tr>
<td>Multiple correlation/regression</td>
<td>To test the relationship between 2 or more IVs and 1 DV; to predict a DV from 2 or more IVs</td>
<td>N, I, R</td>
<td>I, R</td>
</tr>
<tr>
<td>Analysis of covariance (ANCOVA)</td>
<td>To test the difference between the means of 2 or more groups, while controlling for 1 or more covariate</td>
<td>N</td>
<td>I, R</td>
</tr>
<tr>
<td>Multivariate analysis of variance (MANOVA)</td>
<td>To test the difference between the means of 2 or more groups for 2 or more DVs simultaneously</td>
<td>N</td>
<td>I, R</td>
</tr>
<tr>
<td>Multivariate analysis of covariance (MANCOVA)</td>
<td>To test the difference between the means of 2 or more groups for 2 or more DVs simultaneously, while controlling for 1+ covariate</td>
<td>N</td>
<td>I, R</td>
</tr>
<tr>
<td>Canonical analysis</td>
<td>To test the relationship between 2 sets of variables (variables on the right, variables on the left)</td>
<td>N, I, R</td>
<td>N, I, R</td>
</tr>
<tr>
<td>Factor analysis</td>
<td>To determine the dimensionality/structure of a set of variables</td>
<td>_</td>
<td>_</td>
</tr>
<tr>
<td>Discriminant analysis</td>
<td>To test the relationship between 2 or more IVs and 1 DV. To predict group membership; to classify cases into groups.</td>
<td>N, I, R</td>
<td>N</td>
</tr>
<tr>
<td>Logistic regression</td>
<td>To test the relationship between 2 or more IVs and 1 DV. To predict the probability of an event; to estimate relative risk.</td>
<td>N, I, R</td>
<td>N</td>
</tr>
</tbody>
</table>

**Note.** * Measurement level of the independent (IV), dependent variable, (DV), and covariates (Cov): N = Nominal, I = Interval, R = Ratio.
### Selected Statistical Symbols

Note. This list contains some commonly used symbols in statistics, in approximate alphabetical order, with English and Greek letters intermixed. Non-letter symbols are placed at the end.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Regression constant, the intercept</td>
</tr>
<tr>
<td>α</td>
<td>Greek alpha; significance level in hypothesis testing, probability of Type 1 error</td>
</tr>
<tr>
<td>b</td>
<td>Regression coefficient, slope of the line</td>
</tr>
<tr>
<td>β</td>
<td>Greek beta, probability of a Type II error; also, a standardized regression coefficient (beta weights)</td>
</tr>
<tr>
<td>$x^2$</td>
<td>Greek chi squared, a test statistic for several nonparametric tests</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence interval around estimate of a population parameter</td>
</tr>
<tr>
<td>df</td>
<td>Degrees of freedom</td>
</tr>
<tr>
<td>e</td>
<td>Base of natural logarithms, $e = 2.7183$</td>
</tr>
<tr>
<td>$n^2$</td>
<td>Greek eta squared, index of variance accounted for in ANOVA context</td>
</tr>
<tr>
<td>f</td>
<td>Frequency (count) for a score value</td>
</tr>
<tr>
<td>F</td>
<td>Test statistic used in ANOVA, ANCOVA and other tests</td>
</tr>
<tr>
<td>γ</td>
<td>Greek gamma, population effect size</td>
</tr>
<tr>
<td>$H_0$</td>
<td>Null hypothesis</td>
</tr>
<tr>
<td>$H_1$</td>
<td>Alternative hypothesis; research hypothesis</td>
</tr>
<tr>
<td>λ</td>
<td>Greek lambda, a test statistic used in several multivariate analyses (Wilks’ lambda)</td>
</tr>
<tr>
<td>µ</td>
<td>Greek mu, the population mean</td>
</tr>
<tr>
<td>M</td>
<td>Sample mean (alternative symbol for $\bar{x}$)</td>
</tr>
<tr>
<td>MS</td>
<td>Mean square, variance estimate in ANOVA</td>
</tr>
<tr>
<td>n</td>
<td>Number of cases in a subgroup of the sample</td>
</tr>
<tr>
<td>N</td>
<td>Total number of cases or sample members</td>
</tr>
<tr>
<td>p</td>
<td>Probability that observed data are consistent with null hypothesis</td>
</tr>
<tr>
<td>r</td>
<td>Sample Pearson product-moment correlation coefficient</td>
</tr>
<tr>
<td>$r_s$</td>
<td>Spearman’s rank order correlation coefficient</td>
</tr>
<tr>
<td>R</td>
<td>Multiple correlation coefficient</td>
</tr>
<tr>
<td>$R^2$</td>
<td>Coefficient of determination. Proportion of variance in Y attributable to Xs</td>
</tr>
<tr>
<td>$R_c$</td>
<td>Canonical correlation coefficient</td>
</tr>
<tr>
<td>ρ</td>
<td>Greek rho. population correlation coefficient</td>
</tr>
<tr>
<td>SD</td>
<td>Sample standard deviation</td>
</tr>
<tr>
<td>SEM</td>
<td>Standard error of the mean</td>
</tr>
<tr>
<td>σ</td>
<td>Greek sigma (lower case), population standard deviation</td>
</tr>
<tr>
<td>Σ</td>
<td>Greek sigma (upper case), sum of</td>
</tr>
<tr>
<td>SS</td>
<td>Sum of squares</td>
</tr>
<tr>
<td>t</td>
<td>Student’s $t$, a test statistic</td>
</tr>
<tr>
<td>U</td>
<td>Test statistic for the Mann-Whitney U-test</td>
</tr>
<tr>
<td>Y</td>
<td>Predicted value of Y, dependent variable in regression analysis</td>
</tr>
</tbody>
</table>