One-way Table

$$\chi^2_{df} = \sum_{i=1}^{k} \frac{[n_i - E(n_i)]^2}{E(n_i)}, \quad df = k-1$$

$$E(n_i) = np_{i,o}$$

Two-way Table

$$\chi^2_{df} = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{[n_{ij} - \hat{E}(n_{ij})]^2}{E(n_i)}, \quad df = (r-1)(c-1)$$

$$\hat{E}(n_{ij}) = \frac{r_i c_j}{n}$$

Nonparametric Tests

Wilcoxon rank sum

T_A = rank sum of sample A

or

T_B = rank sum of sample B

Wilcoxon signed ranks

T_- = negative rank sum

or

T_+ = positive rank sum

Kruskal-Wallis

$$H = \frac{12}{n(n+1)} \sum \frac{R_j^2}{n_j} - 3(n+1), \quad df = p-1$$

Friedman

$$F_r = \frac{12}{bp(p+1)} \sum R_j^2 - 3b(p+1), \quad df = p-1$$

Spearman's Rank Correlation Coefficient

$$r_s = \frac{SS_{uv}}{\sqrt{SS_{uu}\, SS_{vv}}}$$

$$SS_{uv} = \sum u_i v_i - \frac{\sum u_i \sum v_i}{n}$$

$$SS_{uu} = \sum u_i^2 - \frac{\left(\sum u_i\right)^2}{n}$$

$$SS_{vv} = \sum v_i^2 - \frac{\left(\sum v_i\right)^2}{n}$$

u_i = Rank of the ith observation in sample 1.

v_i = Rank of the ith observation in sample 2.

n = Number of pairs of observations.

Shortcut Formula for r_s: $r_s = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$, where $d_i = u_i - v_i$