

13.6: Chapter 13 Formulas

Ranking Data

- Order the data from smallest to largest.
- The smallest value gets a rank of 1.
- The next smallest gets a rank of 2, etc.
- If there are any values that tie, then each of the tied values gets the average of the corresponding ranks.

Wilcoxon Signed-Rank Test

n is the sample size not including a difference of 0.

When $n < 30$, use test statistic w_s , which is the absolute value of the smaller of the sum of ranks. CV uses table in Figure 13-5. If critical value is not in tables then use an online calculator:

<http://www.socscistatistics.com/tests/signedranks>.

When $n \geq 30$, use z-test statistic:

$$z = \frac{\left(w_s - \left(\frac{n(n+1)}{4}\right)\right)}{\sqrt{\left(\frac{n(n+1)(2n+1)}{24}\right)}}$$

Sign Test

H_0 : Median = MD_0

H_1 : Median $\neq MD_0$

p-value uses binomial distribution with $p = 0.5$ and n is the sample size not including ties with the median or differences of 0.

- For a two-tailed test, the test statistic, x , is the smaller of the plus or minus signs. If x is the test statistic, the p-value for a two-tailed test is $2 * P(X \leq x)$.
- For a right-tailed test, the test statistic, x , is the number of plus signs. For a left-tailed test, the test statistic, x , is the number of minus signs. The p-value for a one-tailed test is the $P(X \geq x)$ for a right-tailed test, or $P(X \leq x)$ for a left-tailed test.

Mann-Whitney U Test

When $n_1 \leq 20$ and $n_2 \leq 20$:

$$U_1 = R_1 - \frac{n_1(n_1+1)}{2}, U_2 = R_2 - \frac{n_2(n_2+1)}{2}.$$

$U = \text{Min}(U_1, U_2)$

CV uses table in Figures 13-8 or 13-9. If critical value is not in tables then use an online calculator:

<https://www.socscistatistics.com/tests/mannwhitney/default.aspx>.

When $n_1 > 20$ and $n_2 > 20$ use z-test statistic:

$$z = \frac{\left(U - \left(\frac{n_1 \cdot n_2}{2}\right)\right)}{\sqrt{\left(\frac{n_1 \cdot n_2 (n_1 + n_2 + 1)}{12}\right)}}$$

“For instance, a race of hyperintelligent pan-dimensional beings once built themselves a gigantic supercomputer called Deep Thought to calculate once and for all the Answer to the Ultimate Question of Life, the Universe, and Everything. For seven and a half million years, Deep Thought computed and calculated, and in the end announced that the answer was in fact Forty-two - and so another, even bigger, computer had to be built to find out what the actual question was.”

(Adams, 2002)

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