

SUMMARY: Wilcoxon Nonparametric Test for Comparing Two Groups

- 1. Assumptions:** Independent random samples from two groups, either from random sampling or a randomized experiment.
- 2. Hypotheses:**
 - H_0 : Identical population distributions for the two groups (this implies equal expected values for the sample mean ranks)
 - H_a : Different expected values for the sample mean ranks (two-sided), or
 - H_a : Higher expected value for the sample mean rank for a specified group (one-sided)
- 3. Test statistic:** Difference between sample mean ranks for the two groups (equivalently, can use sum of ranks for one sample, as discussed after Example 2).
- 4. P-value:** One-tail or two-tail probability, depending on H_a , that the difference between the sample mean ranks is as extreme or more extreme than observed.
- 5. Conclusion:** Report the P-value and interpret in context. If a decision is needed, reject H_0 if the P-value \leq significance level, such as 0.05.

SUMMARY: Sign Test for Matched Pairs

- 1. Assumptions:** Random sample of matched pairs for which we can evaluate which observation in a pair has the better response.
- 2. Hypotheses:** H_0 : Population proportion $p = 0.50$ who have better response for a particular group
 - $H_a: p \neq 0.50$ (two-sided) or $H_a: p > 0.50$ or $H_a: p < 0.50$ (one-sided)
- 3. Test statistic:** $z = (\hat{p} - 0.50)/se$, as shown in margin recall box.
- 4. P-value:** For large samples ($n \geq 30$), use tail probabilities from standard normal. For smaller n , use binomial distribution (discussed in Example 7).
- 5. Conclusion:** Report the P-value and interpret in context.

SUMMARY: Kruskal-Wallis Nonparametric Test for Comparing Several Groups

- 1. Assumptions:** Independent random samples from several (g) groups, either from random sampling or a randomized experiment
- 2. Hypotheses:**
 - H_0 : Identical population distributions for the g groups
 - H_a : Population distributions not all identical
- 3. Test statistic:** Uses between-groups variability of sample mean ranks
- 4. P-value:** Right-tail probability above observed test statistic value from chi-squared distribution with $df = g - 1$
- 5. Conclusion:** Report the P-value and interpret in context.

SUMMARY: Wilcoxon Signed-Ranks Test for Matched Pairs

- 1. Assumptions:** Random sample of matched pairs for which the differences of observations have a symmetric population distribution and can be ranked.
- 2. Hypotheses:**
 - H_0 : Population median of difference scores is 0.
 - H_a : Population median of difference scores is not 0 (one-sided also possible).
- 3. Test statistic:** Rank the absolute values of the difference scores for the matched pairs and then find the sum of ranks of the differences that were positive.
- 4. P-value:** Software can find a P-value based on all the possible samples with the given absolute differences. (For large samples, it uses an approximate normal sampling distribution, as discussed following.)
- 5. Conclusion:** Report the P-value and interpret in context.