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| **Wilcoxon signed rank test**  Developed in 1945 by the statistician Frank Wilcoxon, the signed rank test was one of the first "nonparametric" procedures developed. It is used to   1. Test the null hypothesis that the median of a distribution is equal to some value. 2. Compare two sets of scores that come from the same participants.   For example, you could use a Wilcoxon signed-rank test to understand whether there was a difference in smokers' daily cigarette consumption before and after a 6 week hypnotherapy program (i.e., your dependent variable would be "daily cigarette consumption", and your two related groups would be the cigarette consumption values "before" and "after" the hypnotherapy program).  **Difference between Mann Whitney U test and Wilcoxon signed rank test**  When two samples are related, the Mann Whitney U test is not applicable, therefore Wilcoxon signed rank test is used.  **Difference between sign test and Wilcoxon signed rank test**  The sign test is intuitive and extremely simple to perform. However, one immediately obvious disadvantage is that it simply allocates a sign to each observation, according to whether it lies above or below some hypothesized value, and does not take the magnitude of the observation into account. Omitting information on the magnitude of the observations is rather inefficient and may reduce the statistical power of the test. An alternative that does account for the magnitude of the observations is the Wilcoxon signed rank test.  The types of questions that the Wilcoxon Test can help us answer include things like:   * Are test scores different from 5th grade to 5th grade for the same students? * Does a particular drug have an effect on health when tested on the same individuals?   **Assumptions**   1. **Dependent variable** should be measured at the **ordinal** or **continuous level**. 2. **Independent variable** should consist of **two categorical**, **"related groups"** or **"matched pairs"**. 3. The **distribution of the differences between the two related groups** needs to be **symmetrical in shape.**   **Working Procedure** **(Paired data)**   1. State the null and alternative hypothesis 2. Choose LOS 3. Calculate each paired difference, di = xi − yi , where xi , yi are the pairs of observations. 4. Rank the dis, ignoring the signs (i.e. assign rank 1 to the smallest |di |, rank 2 to the next etc.) 5. Label each rank with its sign, according to the sign of di . 6. Calculate R+, the sum of the ranks of the positive dis, and R−, the sum of the ranks of the negative dis. 7. Calculate W=Min(R+,R-) 8. Calculate      1. Calculate      1. Calculate      1. Conclusion: 2. If z value< ztab, accept null hypothesis. 3. If z value> ztab, reject null hypothesis.   **Working Procedure** **(Single set of observations)**   1. State the null (the median value is equal to some value M) and alternative hypothesis. 2. Choose LOS 3. Calculate the difference between each observation and the hypothesised median, di = xi − M. 4. Apply Steps 4-11 as above. |
| * 1. The average score on a vocational training test has been known to be 64. Recently several changes have been carried out in the program; the effect of these changes on performance on the test is unknown. It is therefore desirable to test the null hypothesis that the average score for all people who will complete the program will be 64 versus the alternative that it will not be 64. The following random sample of scores is available:   87,91,65,31,8,53,99,44,42,60,77,73,42,50,79,90,54,39,77,60,33,41,42,85,71,50  Is there evidence that the average score for all people who will complete the program will be 64?   * 1. Let Xi denote the length, in centimeters, of a randomly selected pygmy sunfish, i = 1, 2, ... 10. If we obtain the following data set:   5.0 3.9 5.2 5.5 2.8 6.1 6.4 2.6 1.7 4.3  Can we conclude that the median length of pygmy sunfish differs significantly from 3.7 centimeters?   * 1. Ten workers were given on the job training with a view to shorten their assembly time for a certain mechanism. The results of the time (in minutes) and motion studies before and after the training program are given below:  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Worker | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | Before | 61 | 62 | 55 | 62 | 59 | 74 | 62 | 57 | 64 | 62 | | After | 59 | 63 | 52 | 54 | 59 | 70 | 67 | 65 | 59 | 71 |   Is there evidence that the training program has shortened the average assembly time?   * 1. A research team wants to test whether a new teaching method increases the literacy of children. Therefore, the researchers take measure the literacy of 10 children before and after the teaching method has been applied. The literacy is measured on a scale from 0 to 10, with 10 indicating high literacy. The initial baseline shows an average literacy score of 5.9 and after the method has been used the average increases to 7.6. Is there evidence that the new teaching method has increases the literacy of children?  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Students | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | Before | 1 | 5 | 4 | 5 | 0 | 5 | 2 | 0 | 6 | 1 | | After | 7 | 7 | 10 | 9 | 8 | 3 | 2 | 2 | 6 | 8 | |