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| **Nonparametric Test:**  A nonparametric test is a hypothesis test that does not require any specific conditions concerning the shape of populations or the value of any population parameters. Nonparametric tests are easier to perform (they do not require normally distributed populations). They can be applied to categorical data (such as genders of survey responds). They are less efficient than parametric tests. Stronger evidence is required to reject a null hypothesis. One of the easiest nonparametric tests to perform is the sign test. |
| **Sign Test:**  Its name comes from the fact that it is based on the direction or the plus or minus signs of observations in a sample and not on their numerical magnitudes.  It is a [non-parametric](https://www.statisticshowto.datasciencecentral.com/parametric-and-non-parametric-data/) or “distribution free” test, which means the test doesn’t assume the data comes from a particular distribution, like the[normal distribution](https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/normal-distributions/). The sign test is an alternative to a [one sample t test](https://www.statisticshowto.datasciencecentral.com/one-sample-t-test/) or a [paired t test](https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/t-test/#PairedTTest). It is also called the binominal sign test, with *p* = .5.  **Assumptions:**   * Data distribution: The Sign test is a non–parametric (distribution free) test, so we do not assume that the data is normally distributed. * Two sample: Data should be from two samples.  The population may differ for the two samples. * Dependent sample: Dependent samples should be a paired sample or matched. Also known as ‘before–after’ sample.   **Types of sign test:**   1. One sample: We set up the hypothesis so that + and – signs are the values of random variables having equal size. 2. Paired sample: This test is also called an alternative to the [paired sample t-test](http://www.statisticssolutions.com/resources/directory-of-statistical-analyses/paired-sample-t-test).  This test uses the + and – signs in paired sample tests or in before-after study. In this test, null hypothesis is set up so that the sign of + and – are of equal size, or the population means are equal to the sample mean.   **Procedure: (Small Samples)**  **One sample:**  In one sample sign test, we set up the null hypothesis that + and – signs are the values of a random variables having the binomial distribution with p= ½ i.e., H0.  Find the + and – signs for the given distribution. Put a + sign for value greater than the mean value , a minus sign for a value smaller than the mean value and a 0 for a value equal to the mean value.   1. Denote the total no. of signs (ignoring zeros) by ‘n’ and the no. of less frequent signs by ‘S’. 2. Obtain the critical value K of less frequent signs ‘S’ preferably at 5% level of significance by using the formula :      1. Compare the value of ‘S’ with the critical value (k). If the value of ‘S’ is greater than value of K then the null hypothesis is accepted otherwise rejected.   **Paired sample:**   1. Calculate the + and – sign for the given distribution.  Put a + sign for a value greater than the mean value, and put a – sign for a value less than the mean value.  Put 0 as the value is equal to the mean value; pairs with 0 as the mean value are considered ties. 2. Denote the total number of signs by ‘n’ (ignore the zero sign) and the number of less frequent signs by ‘S.’ 3. Obtain the critical value (K) at .05 of the significance level by using the following formula in case of small samples:      1. Compare the value of ‘S’ with the critical value (K). If the value of S is greater than the value of K, then the null hypothesis is accepted.  If the value of the S is less than the critical value of K, then the null hypothesis is accepted.   **Procedure: (large sample)**    In the case of large samples, S is compared with the Z value. |
| 1. A typing school claims that in a six week intensive course, it can train students to type, on the average at least 60 words per minute. A random sample of 15 graduates is given a typing test and the median number of words per minute typed by each of these students is given below:   81,76,53,71,66,59,88,73,80,66,58,70,60,56,55  Test the hypothesis that the median typing speed of graduates is at least 60 words per minute.   1. Use the sign test to see if there is a difference between the number of days until collection of an account receivable before and after a new collection policy. Use the 0.05 LOS level.  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Before | 30 | 28 | 34 | 35 | 40 | 42 | 33 | 38 | 34 | 45 | 28 | 27 | 25 | 41 | 36 | | After | 32 | 29 | 33 | 32 | 37 | 43 | 40 | 41 | 37 | 44 | 27 | 33 | 30 | 38 | 36 |      1. The following data relate to the daily production of cement a large plant of 30 days:   11.5,10.0,11.2,10.0,12.3,11.1,10.2,9.6,8.7,9.3,9.3,10.7,11.3,10.4,11.4,12.3,11.4,10.2,11.6,9.5,10.8,11.9,12.4,9.6,10.5,11.6,8.3,9.3,10.4,11.5  Use sign test to test the null hypothesis that the plant’s average daily production of cements is 11.2 m. tones at the 0.05 LOS level.   1. The effect of a social competence training is tested. 15 Subjects are tested before and after a training for social competence on a seven point scale. Data are ordinal scaled and not normal distributed. The question is, if social competence is enhanced by the training. Raw data are listed in the following table:  |  |  |  | | --- | --- | --- | | subject | before | after | | 1 | 5 | 6 | | 2 | 3 | 2 | | 3 | 4 | 4 | | 4 | 2 | 4 | | 5 | 1 | 3 | | 6 | 6 | 6 | | 7 | 7 | 7 | | 8 | 3 | 5 | | 9 | 2 | 3 | | 10 | 3 | 5 | | 11 | 5 | 5 | | 12 | 1 | 3 | | 13 | 4 | 4 | | 14 | 4 | 5 | | 15 | 3 | 2 |      1. As part of a market research study, a sample of 36 consumers were asked to taste two brands of ketchup and indicate a preference. Do the data shown following indicate a significant difference in the consumer preferences for the two brands?   18 preferred Brand A Ketchup (+ sign recorded)  12 preferred Brand B Ketchup (\_ sign recorded)  6 had no preference   1. A study is being conducted on whether entering college students gain weight during the freshman year. Below are the "Before" and "After" weights for a random sample of 30 students. Test to see whether there is a significant "gain" in weights after the freshman year in college.  |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Before** | **After** |  | **Before** | **After** | | 133 | 135 |  | 121 | 125 | | 152 | 160 |  | 144 | 140 | | 169 | 180 |  | 106 | 108 | | 156 | 154 |  | 182 | 175 | | 178 | 185 |  | 122 | 120 | | 220 | 226 |  | 110 | 114 | | 145 | 150 |  | 130 | 134 | | 138 | 140 |  | 165 | 165 | | 218 | 225 |  | 158 | 160 | | 140 | 140 |  | 106 | 105 | | 148 | 143 |  | 160 | 166 | | 98 | 102 |  | 122 | 125 | | 142 | 138 |  | 146 | 155 | | 170 | 182 |  | 112 | 115 | | 108 | 112 |  | 145 | 144 | |