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| **Wilcoxon Signed Rank Test: Tutorial** |
| 1. The median age of the onset of diabetes is thought to be 45 years. The ages at onset of a random sample of 30 people with diabetes are:   35.5 44.5 39.8 33.3 51.4 51.3 30.5 48.9 42.1 40.3 46.8 38.0 40.1 36.8 39.3 65.4 42.6 42.8 59.8 52.4 26.2 60.9 45.6 27.1 47.3 36.6 55.6 45.1 52.2 43.5  Assuming the distribution of the age of the onset of diabetes is symmetric, is there evidence to conclude that the median age of the onset of diabetes differs significantly from 45 years?   1. The average hourly number of messages transmitted by a communication satellite is believed to be 149. If there is a possibility that demand for this service may be declining, then test the null hypothesis that the average hourly number of relayed messages is 149 versus the alternative hypothesis that the average hourly number is less than 149. A random sample of 25 operation hours is selected. The numbers of messages relayed per hour is:   151, 144, 123, 178, 105, 112, 140, 167, 177, 185, 129, 160, 110, 170, 198, 165, 109, 118, 155, 102, 164, 180, 139, 166, 182  Is there any evidence of declining the use of the satellite?   1. The table below shows the hours of relief provided by two analgesic drugs in 12 patients suffering from arthritis. Is there any evidence that one drug provides longer relief than the other?      1. A study is run to evaluate the effectiveness of an exercise program in reducing systolic blood pressure in patients with pre-hypertension (defined as a systolic bloodpressure between 120-139 mmHg or a diastolic blood pressure between 80-89 mmHg). A total of 15 patients with pre-hypertension enroll in the study, and their systolic blood pressures are measured. Each patient then participates in an exercise training program where they learn proper techniques and execution of a series of exercises. Patients are instructed to do the exercise program 3 times per week for 6 weeks. After 6 weeks, systolic blood pressures are again measured. The data are shown below.  |  |  |  | | --- | --- | --- | | Patient | Systolic Blood Pressure  Before Exercise Program | Systolic Blood Pressure  After Exercise Program | | 1 | 125 | 118 | | 2 | 132 | 134 | | 3 | 138 | 130 | | 4 | 120 | 124 | | 5 | 125 | 105 | | 6 | 127 | 130 | | 7 | 136 | 130 | | 8 | 139 | 132 | | 9 | 131 | 123 | | 10 | 132 | 128 | | 11 | 135 | 126 | | 12 | 136 | 140 | | 13 | 128 | 135 | | 14 | 127 | 126 | | 15 | 130 | 132 |   Is there is a difference in systolic blood pressures after participating in the exercise program as compared to before?   1. Is there a difference between the [median](https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/statistics-definitions/mean-median-mode/#median)values for the following sets of treatment data for the twelve groups?   [wilcoxon signed rank test 1](https://www.statisticshowto.datasciencecentral.com/wp-content/uploads/2015/09/wilcoxon-signed-rank-test-1.png) |