Chapter 8: Test of Statistical Hypotheses

8.4 The Wilcoxon Signed Rank Test

Normality assumption, is it always met? Answer is _____

In those cases **nonparametric** (distribution-free methods), should be considered.

Sign Test

Let X be a continuous-type random variable and let m denote the median of X. Also let $X_1, X_2, ..., X_n$ denote the observations of a random sample from this distribution.

1. Write the Null and Alternative Hypothesis

2. Find the test statistic

3. Find the p-value

4. Make the decision

Example 1. Let X denote the length of time in seconds between two calls entering a call center. Let m be the unique median of this continuous-type distribution. Test whether the median is less than 6.2. Observations are,

x_i :	6.8	5.7	6.9	5.3	4.1	9.8	1.7	7.0	2.1	19.0	18.9	16.9	10.4	44.1	2.9	2.4	4.8	18.9	4.8	7.9

The Wilcoxon Signed Rank Test (Wilcoxon Test)

Assumptions:

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1. Write the Null and Alternative Hypothesis

2. Find the test statistic

3. Find the p-value

4. Make the decision

(a) Technical:

(b) English:

Example 2. Suppose the lengths of $n = 10$ sunfish are

x_i :	5.0	3.9	5.2	5.5	2.8	6.1	6.4	2.6	1.7	4.3

we would like to test if the population median is greater than 3.7. Perform a Wilcoxon signed rank test.

Example 3. Let m be the median of a symmetric distribution of the continuous type. Test whether the m is more than 160. Observations are,

x_i :	176.9	158.3	152.1	158.8	172.4	169.8	159.7	162.7	156.6	174.5	184.4	165.2	147.8	177.8	160.1	160.5

Two medians with paired data

Example 4. We consider some paired data for percentage of body fat measured at the beginning and the end of a semester. Let m equal the median of the differences, $x - y$.

Use the Wilcoxon statistic to test the hypothesis that the median of the differences (m) is positive.

The differences are listed below:

1.8	-3.1	0.1	1.1	0.6	-5.1	9.2	0.2	0.4	0.0	1.9	-0.4	-1.5	1.4	-1.0	2.2	0.8	-0.4	2.0	-5.8	-3.4	-2.3	3.0	2.7	0.2	3.2