

Test Statistic

If $n \leq 25$: Test statistic is x = the number of times the less frequent sign occurs.

$$\text{If } n > 25: \text{ Test statistic is } z = \frac{(x + 0.5) - \left(\frac{n}{2}\right)}{\frac{\sqrt{n}}{2}}$$

P-Values

P-values are often provided by technology, or P-values can often be found using the z test statistic.

Critical Values

1. If $n \leq 25$, critical x values are found in Table A-7.
2. If $n > 25$, critical z values are found in Table A-2.

Hint: Because z is based on the *less* frequent sign, all one-sided tests are treated as if they were left-tailed tests.

CAUTION When using the sign test in a one-tailed test, we need to be very careful to avoid making the wrong conclusion when one sign occurs significantly more often than the other but the sample data contradict the alternative hypothesis, as in the following example.

Example 1 Data Contradicting the Alternative Hypothesis

Among 945 couples who used the XSORT method of gender selection, 66 had boys, so the sample proportion of boys is $66/945$, or 0.0698 (based on data from the Genetics & IVF Institute). Consider the claim that the XSORT method of gender selection increases the likelihood of baby *boys* so that the probability of a boy is $p > 0.5$. This claim of $p > 0.5$ becomes the alternative hypothesis.

Using common sense, we see that with a sample proportion of boys of 0.0698, we can never support a claim that $p > 0.5$. (We would need a sample proportion of boys *greater* than 0.5 by a significant amount.) The sample proportion of $66/945$, or 0.0698, *contradicts* the alternative hypothesis because it is not greater than 0.5.

Interpretation

An alternative hypothesis can never be supported with data that contradict it. We can never support a claim that $p > 0.5$ with a sample proportion of $66/945$, or 0.0698, which is *less than* 0.5.

When testing a claim, we should be careful to avoid making the fundamental mistake of thinking that a claim is supported because the sample results are significant; the sample results must be significant *in the same direction* as the alternative hypothesis.