STAT 703/J703
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-*Lecture 19*-

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Today

Other Tests Continued

- Two-sample t-test
- Power for the Two-sample t-test
- Mann-Whitney-Wilcox Test

11.2.1: Let $X_1, \ldots X_n$ be an independent random sample from a population that is normal with mean μ_x and variance σ^2, and let $Y_1, \ldots Y_m$ be an independent random sample from a population that is normal with mean μ_Y and variance σ^2, such that both samples are independent.

Consider testing about the means.

The likelihood ratio statistic statistic says to reject for large values of

$$1+\frac{mn}{m+n}\left(\frac{(\bar{x}-\bar{y})^2}{\sum_{i=1}^{n}(x_i-\bar{x})^2-\sum_{i=1}^{n}(y_i-\bar{y})^2}\right)$$

11.2.2 - Power of a Test?

For many of the discrete distributions it was pretty straightforward to figure out the power of the test.

With the two-sample t-test we need to use a non-central chi-square.

Non-central Chi-square

A non-central chi-square distribution is similar to a chi-square, except the numerator is shifted by a non-centrality parameter.

$$t_{\delta,df=v}=\frac{Z+\delta}{\sqrt{\frac{\chi^2_{df=v}}{v}}}$$

Where the Z and chi-square are independent.

11.2.3 What if the data is the data is not normal?

What if we don't know the distribution of the data?

In this case a new paradigm must be used.

Many procedures in statistics are based on replacing the data with ranks.

In the Mann-Whitney-Wilcoxon test all of the data in both groups are replaced by their ranks from smallest to largest.

The population that tends to have larger values will have more large ranks.

Another way to look at it is by considering if the probability that a randomly chosen member of one group is less than a randomly chosen member of another group.

You can show that the number of pairs where $X<Y$ is equal to the sum of the ranks of $Y - m(m+1)/2$.