TESTING WHETHER THE POPULATION MEAN IS EQUAL TO SOME VALUE

You collect a simple random sample from a population of ratio-level or interval-level values.

Any population distribution (more realistic scenario)

You must have large sample size (N >= 30) to proceed. You can use the ***z-test*** to get an approximate solution.

Normally-distributed population

- Population standard deviation unknown
  - Large sample size (N >= 30)
    - ***z-test*** (approximate but easier to calculate)
    - ***t-test*** (exact but might be harder to calculate using tables)
  - Small sample size (N < 30)
    - ***t-test*** (exact)
- Population standard deviation known (unlikely)
  - ***z-test*** (exact) - this is the ideal case but unlikely to actually occur

TESTING WHETHER THE MEANS OF TWO POPULATIONS ARE IDENTICAL, GIVEN TWO SETS OF INDEPENDENT SAMPLES

You collect two sets of independent simple random samples from populations of ratio-level or interval-level values (e.g., subjects are randomly-picked to receive either one of two experimental treatments).

Any population distribution (more realistic scenario)

- Large sample size (N >= 30)
  - ***two-sample z-test***
  - ***Mann-Whitney U test*** a.k.a. *Wilcoxon rank-sum test*(non-parametric, and will even work on ordinal-level measurements) - tests whether two samples are drawn from the same population (and, by implication, their distributions and means are equal)
- Small sample size (N < 30)
  - ***Mann-Whitney U test*** a.k.a. *Wilcoxon rank-sum test*

Normally-distributed population

- Population standard deviations unknown but assumed to be equal (called *homogeneity of variances*)
  - Large sample size (N1 >= 30, N2 >= 30)
    - ***two-sample z-test***
  - Small sample size (N1 < 30, N2 < 30)
    - ***two-sample t-test***
- Population standard deviations known (unlikely)
  - ***two-sample z-test***

TESTING WHETHER ONE POPULATION HAS VALUES THAT ARE CONSISTENTLY GREATER THAN OR LESS THAN THOSE OF THE OTHER POPULATION, GIVEN TWO SETS OF PAIRED SAMPLES

You collect a set of paired samples from two populations of ratio-level or interval-level values (e.g., each subject is given both experimental treatments).

Any population distribution (more realistic scenario)

The following non-parametric tests can even be used for ordinal-level values.

- ***Wilcoxon signed-rank test*** - tests whether the *median* difference between pairs of observations is zero
- ***Sign test*** - tests whether there are equal numbers of pairs of observations that exhibit increases and decreases in value

The population of differences between pairs are normally-distributed

That's right, you read that correctly! The following test assumes that the differences in the pairs amongst the population are normally-distributed, which might make it difficult to apply.

- ***paired t-test*** - tests whether the *mean* difference between pairs of observations is zero

TESTING WHETHER THE MEANS OF MORE THAN TWO POPULATIONS ARE IDENTICAL

You collect the same sets of ratio-level or interval-level measurements from several different groups (e.g., people's heights) and want to determine whether the means of all of the groups' respective populations are identical.

Any population distribution (more realistic scenario)

The following non-parametric test can even be used for ordinal-level values, but it assumes that the observations in each group come from distributions with the same *shape* (less stringent thanhomoscedasticity, though):

- ***Kruskal-Wallis test*** - tests whether the mean *ranks* of samples are identical (not exactly the same as testing whether the means are identical)

Normally-distributed and homoscedastic population

Homoscedastic means that the within-group variances for all groups are identical (e.g., the variance in heights within each group of people are identical).

- ***One-way anova*** - tests whether the means of all populations are identical

TESTING WHETHER TWO VARIABLES ARE CORRELATED

You collect pairs of ratio-level or interval-level measurements from a population, where each of the two elements in each pair measures a different property (e.g., height and weight).

- ***Pearson correlation test*** - tests the degree of *linear* correlation
- ***Spearman rank correlation test*** - (non-parametric, and will even work on ordinal-level measurements) - tests the degree of (not necessarily linear) correlation

TESTING WHETHER THE OBSERVED FREQUENCIES OF CATEGORICAL (NOMINAL) VARIABLES DEVIATE SIGNIFICANTLY FROM THEIR EXPECTED FREQUENCIES

The following are *goodness-of-fit* tests on counts (frequencies) of observations of categorical (a.k.a. nominal) variables.

These tests can be computationally expensive, so they are not recommended for N > 1000:

- ***Exact binomial test*** - can only be used to test the frequencies of two categorical values such as male vs. female (use exact multinomial test for > 2 values)
- ***Randomization test*** - should give the same result as the exact test if run enough times, but is intuitively easier to explain

These tests require that the expected counts in each category not be too small (the smallest expected count greater than 5 will suffice):

- ***Pearson's chi-square test*** - can be used to test the frequencies of two or more categorical values

TESTING WHETHER THE PROPORTIONS IN TWO DIFFERENT GROUPS ARE IDENTICAL

You have two categorical variables, each of which have two or more possible values.

- ***Chi-square test of independence*** - doesn't work well if the smallest expected count is too small, say less than 5
- ***Fisher's exact test of independence***

Cited from <http://www.pgbovine.net/stats.htm>