### Assigned Readings

* [Statistical Thinking](https://zief0002.github.io/statistical-thinking/)
  + [Modeling Sampling Variation](https://zief0002.github.io/statistical-thinking/modeling-sampling-variation.html)
  + [Sampling Variation and the Bootstrap Test](https://zief0002.github.io/statistical-thinking/sampling-variation-and-the-bootstrap-test.html)
  + [Experimental Variation and the Randomization Test](https://zief0002.github.io/statistical-thinking/experimental-variation-and-the-randomization-test.html)
  + [Quantifying Results: p-Value](https://zief0002.github.io/statistical-thinking/quantifying-results-p-value.html)

### Key Ideas

* Modeling Sampling Variation
  + When observed results deviate from what is expected under a particular model, we consider rejecting the model
  + We always expect variation due to chance when sampling. We have to determine how much sampling variation we expect.
  + The simulation process for hypothesis testing is to (1) create a model based on the hypothesis, (2) use the model to simulate results, (3) evaluate whether the actual data is compatible with the model
  + H0 means "null hypothesis", and is whatever hypothesis we will model and possibly nullify/reject
  + we use greek letters for population parameters and latin letters for sample statistics
* Sampling Variation and the Bootstrap Test
  + This section deals only with testing whether the means of two groups are equal to eachother, based on two samples that were selected with random sampling.
  + group comparisons are affected by sampling variation.
  + we need to understand how much variation we expect in a difference of means just because of chance, specifically, chance due to the process of random sampling.
  + we must model the random sampling process that was used to generate the data
  + When testing a "no difference between groups" model, we "combine" our two groups into a mega-sample and then select two bootstrap samples with replacement from the mega-sample. The mega-sample represents a world in which the two groups are selected from two populations that are exactly the same.
* Experimental Variation and the Randomization Test
  + This section deals only with testing whether two treatments are equal to each other, based on two groups that were randomly assigned to one treatment or the other.
  + Random allocation, on average, "equalizes" groups. This means that the only difference between the groups that we expect to affect them is the different treatments individuals receive based on which group they were randomly allocated to.
  + Experimental variation, a function of random chance based on our random allocation process, is a source of variability between groups. We have to figure out how much chance variation is expected.
  + We must model the random allocation process that was used to generate the data
  + When testing a "no difference between treatments" model, we combine our two groups into a mega-sample and then re-randomize, or re-randomly-allocation each individual to a group. This re-randomization represents a world in which the two treatments have exactly the same effect on individuals (and thus, a person's group assignment doesn't matter).
* Quantifying Results: p-value
  + the p-value is the number of simulated results at least as extreme as the observed result, divided by the total number of simulated results
  + the p-value represents the probability of observing a result at least as extreme as the observed sample under the hypothesized model
  + the p-value can never be zero. There is always a possibility of getting an extreme result due to chance variability, even if it is rare.
  + large p-values indicate that the observed data are more compatible with the results from the model. This means that the model is plausible.
  + small p-values indicate that the observed data are not very compatible with the results from the model. This means that the model may not be correct, although we can't know for sure.
  + [be sure to carefully read the ASA's six principles for p-values]