Probability and Sampling

- Know the definition of a random process and a random variable
    - Understand how sampling from a population relates to the concepts of random processes and random variables
- Understand how sampling bias and sampling variability can lead to a sample being different from the population it was drawn from
    - Know the definition of sampling bias and ways it might occur
    - Understand factors that influence sampling variability (sample size, variability within the population)

Confidence Intervals

- Know the reasons why confidence intervals are used (ie: accounting for uncertainty in a meaningful way)
- Know the general form of a confidence interval: Point Estimate +/- Margin of Error
    - Under a Normal probability model, the margin of error is c*SE where "c" is a calibration constant from the N(0,1) distribution that defines the middle P% of the distribution and "SE" is the standard error of the point estimate.
- Understand the definition of a confidence level as the long-run success rate of the procedure that produced the interval
- Know how to interpret confidence intervals as a range of plausible values, including how to decide whether conclusions like "no association" are supported or refuted by a confidence interval
- Understand the factors that influence confidence interval width
- Know when to use the t-distribution instead of the Normal distribution and why it's necessary

Hypothesis Tests

- Know how to set up null and alternative hypotheses for a given scenario using both words and statistical symbols.
- Understand the concept of a null distribution, including how it relates to the null hypothesis and the p-value, as well as how it might be simulated in scenarios like tests involving single proportion.
    - Understand how probability models such as the Normal distribution can be used to represent the null distribution

- Understand p-values, including how to find them, what they mean, how to interpret them, and the common misconceptions associated with p-values and hypothesis testing
    - Know how to estimate the p-value from a simulated null distribution (ie: StatKey output)
- Know how to make appropriate 1-sentence conclusions
    - Know to include 1-context, 2-strength of evidence, 3-direction (if a relationship is found).
    - Do not include direct references to the null hypothesis unless asked
    - Do not make generic statements like “reject H0” or “fail to reject H0”.
- Understand hypothesis testing decision errors
    - Be familiar with significance thresholds (ie: $\alpha = 0.05$) and how they are used to make decisions.
    - Understand the tradeoffs/relationship between Type I and Type II errors
    - Understand the problems that can arise when performing multiple hypothesis tests within a single study
        - Have a conceptual understanding of the Bonferroni correction and false discovery rate control, including what they seek to achieve and how they differ.