

Absolutely essential topics (nearly 100% chance to appear on the exam)

- Definition of a p-value – probability of an outcome at least as extreme as the one observed in the study conditional on the null hypothesis being true.
- P-value misconceptions – not the probability of the null hypothesis being true, not to be interpreted as evidence for the null hypothesis, etc.
- Logical framework behind statistical testing – set up null hypothesis as a strawman, determine the distribution of outcomes under the null hypothesis (null distribution), compare the sample statistic to this distribution to find the p-value, use the p-value to make a conclusion.
- How to write a proper conclusion for a hypothesis test – should include the level of evidence (p-value), context about the data, and the direction/size of the effect (sample mean(s) or proportion(s)). Should *not* include phrases like “reject H_0 ” or “fail to reject H_0 ”.
- Appropriate data visualizations and tests for the four types of data we’ve discussed so far (one and two sample, categorical and quantitative).

High priority topics (very likely to appear)

- How to use output from a StatKey simulation to estimate a p-value
- The Z-score transformation and how it is used to create test statistics for the Z and T tests
- How to choose between various types of tests, including when the conditions for one of our “default tests” (Z or T) is violated.
- The relationship between sample size, effect size, and statistical significance
- Sampling bias and sampling variability – differences between what influences each, and how to identify when given details on how data were collected (see HW2)
- Type 1 and Type 2 errors – definitions will be on the formula sheet, but how to describe each in context, identify when one might have occurred, and describe how to reduce the likelihood of Type I versus Type II errors

Medium priority topics (moderate chance to appear)

- Why the two-sample Z-test needs to use a pooled proportion in the standard error
- How degrees of freedom relate to the shape of the t-distribution (larger df $\rightarrow$ more similar to Normal)
- Advantages/disadvantages of various types of similar data visualizations (ie: why use a conditional bar chart rather than a stacked one, or why use a histogram rather than a boxplot).

- How outliers impact various descriptive statistics (mean, median, standard deviation, etc.) and the results of hypothesis tests.
- Knowing when a log-transformation might be useful
- Being able to explain the difference between family-wise error control and false discovery rate control

Low priority topics (one or two topics from this list might appear)

- Paired data and that it should be analyzed using a one-sample T-test on the paired differences.
- How to perform the Bonferroni adjustment by hand (without R)
- How to interpret log-transformed results for a difference in means test.
- Differences between 1-sided and 2-sided tests.