STAT 218 Learning Objectives

- Big Picture Goals

12. Random sampling allows results of surveys and experiments to be extended to the population from which the sample was taken
13. Variability is natural, predictable, and quantifiable
19. How to interpret numerical summaries and graphical displays of data - both to answer questions and to check conditions (to use statistical procedures correctly)
29. Believe and understand why association is not causation
30. Believe and understand why random assignment in comparative experiments allows cause-and-effect conclusions to be drawn
34. The concept of a sampling distribution and how it applies to making statistical inferences based on samples of data (including the idea of standard error)
55. The concept of statistical significance, including significance levels and p-values
57. How to interpret statistical results in context
58. How to critique news stories and journal articles that include statistical information, including identifying whats missing in the presentation and the flaws in the studies or methods used to generate the information
61. How to determine the population to which the results of statistical inference can be extended, if any
62. Students should believe and understand why data beat anecdotes
80. Understand how simulation may be used to determine strength of evidence
89. Translating a research question/scenario into a null model

- In achieving these big picture goals, you should cover the following topics

1. Quantitative versus categorical variables
5. How to interpret histograms
7. Skewed and symmetric distributions
8. Measures of center (mean and median)
9. Sampling strategies: at least that not everything is a SRS
14. How to calculate variance and standard deviation (with caveats)
15. Characteristics of the normal distribution? Depends on how your class is structured
23. Distinguish between explanatory and response variables
25. Use scatterplots to identify patterns and outliers
26. Know what a line of best fit represents and how to use it to make predictions
31. Describe the sampling distribution of a statistic and define the standard error of a statistic
35. How to calculate (obtain?) confidence intervals for the population proportion, p
36. How to calculate (obtain?) confidence intervals for the population mean, μ
37. Interpret the result of a confidence interval in the context of the problem
39. Elementary probability rules
40. Probability rules for complements (necessary only if using normal distribution)
42. Addition rule (necessary only if using normal distribution)

47. Describe how changing the sample size and/or the confidence level will affect the width of the confidence interval
48. Given a study objective, choose appropriate null and alternative hypotheses, including determining whether the alternative should be one-sided or two-sided
49. Given a study and p-value, explain in context that p-value is a probability of getting a sample statistic as extreme or more extreme than what was seen in the sample given that the null hypothesis is true
51. Given a study, interpret the results of a test of significance in context
52. Given a study objective, significance level (α) and summary statistics, understand the steps involved in conducting a formal test of significance on a population mean (or a population proportion).
59. How to communicate the results of a statistical analysis
60. How to appropriately use statistical inference to answer research questions
63. Understand the difference between matched-pairs and two-sample data (if time allows)
69. Understand the importance of controlling for sources of extraneous variation in studies
72. The importance of examining graphs in describing a data set
76. Describing relations in a two-way table
81. Understand what a null model represents
82. Assumptions necessary for inference via simulation versus assumptions necessary for inference via traditional methods
83. Determining which analysis method is appropriate for a given scenario
87. Understand the relationship between hypothesis testing and confidence intervals
88. Understand that not all outcomes of a random experiment are equally likely
90. Representing null models in both words and symbols

- No-Nos

15. What happens to mean and variance when the unit of measurement is changed
17. Normal quantile plots
20. How to calculate the correlation (by hand)
21. How to calculate the estimated slope and intercept for lines of best fit (by hand)
45. Bayes' Theorem
68. Understand Simpson's paradox
78. The F distribution
86. Understand that $n > 30$ ensures the Central Limit Theorem holds