STAT 218 Learning Objectives

1. Quantitative versus categorical variables
2. Pie charts
3. Stem-and-leaf plots
4. How to construct histograms
5. How to interpret histograms
6. Relative frequency
7. Skewed and symmetric distributions
8. Measures of center (mean and median)
9. Sampling strategies
10. Understand the impact of unusual observations
11. Given a histogram, be able to determine the approximate location of the median and quartiles
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
14. How to calculate variance and standard deviation
15. What happens to mean and variance when the unit of measurement is changed
16. Characteristics of the normal distribution
17. Normal quantile plots
18. Using the normal table to find probabilities
19. How to interpret numerical summaries and graphical displays of data – both to answer questions and to check conditions (to use statistical procedures correctly)
20. How to calculate the correlation
21. How to calculate the estimated slope and intercept for lines of best fit
22. The relationship between correlation and estimated slope
23. Distinguish between explanatory and response variables
24. Make a scatterplot
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
27. Interpret the value of the squared correlation coefficient
28. Calculate residuals
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
31. Describe the sampling distribution of a statistic and define the standard error of a statistic
32. Describe the sampling distribution of $\overline{X}$
33. Describe the sampling distribution of $\widehat{p}$
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)
35. How to calculate confidence intervals for the population proportion, π
36. How to calculate confidence intervals for the population mean, μ
37. Interpret the result of a confidence interval in the context of the problem
38. Explain how inferences based on the t-distribution are robust
39. Elementary probability rules
40. Probability rules for complements
41. Multiplication rule
42. Addition rule
43. Conditional probability
44. Mutually exclusive and independent events
45. Bayes' Theorem
46. Determine appropriate degrees of freedom
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
50. Given a test statistic, calculate a p-value based on the standard normal distribution or t-distribution as appropriate
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)
53. Explain the relationship between a confidence interval and a two-sided hypothesis test
54. Given results from a hypothesis test, comment on the impact of sample size and the practical importance
55. The concept of statistical significance, including significance levels and p-values
56. The concept of confidence interval, including the interpretation of confidence level and margin of error

57. How to interpret statistical results in context
58. How to critique news stories and journal articles that include statistical information, including identifying what's missing in the presentation and the flaws in the the studies or methods used to generate the information
59. How to communicate the results of a statistical analysis
60. How to appropriately use statistical inference to answer research questions
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
63. Understand the difference between matched-pairs and two-sample data
64. Describe the sampling distribution of the difference between two means as specifically as possible
65. Conduct statistical inference based on matched-pairs data
66. Conduct statistical inference based on two-sample data
67. Define the placebo effect and explain the purpose of a placebo
68. Understand Simpson's paradox
69. Understand the importance of controlling for sources of extraneous variation in studies
70. Explain the advantages of using a double-blind experiment
71. Explain the advantages of using blocking
72. The importance of examining graphs in describing a data set
73. Sample spaces in probability models
74. The binomial distribution
75. Power and Type II error
76. Describing relations in two-way tables
77. Pooled vs unpooled variance in two-sample t-tests
78. The F distribution
79. Critical values in significance testing
80. Understand how simulation may be used to determine strength of evidence
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
84. Simulated standard error versus theoretical standard error
85. 2SD method versus traditional confidence interval

86. Understand that $n > 30$ ensures the Central Limit Theorem holds
87. Understand the relationship between hypothesis testing and confidence intervals
88. Understand that not all outcomes of a random experiment are equally likely
89. Translating a research question/scenario into a null model
90. Representing null models both in words and in symbols