**Statistics 313 Learning Outcomes**

**Study Design**

[remember] Students will identify a study design, given information about a study – specifically selecting between observational studies and experiments.

[remember] Students will identify a sampling procedure, given information about a study – specifically selecting between simple random samples, stratified random samples, and non-random samples.

[understand] Students will describe the characteristics of the following study designs, (1) observational studies, (2) one-factor randomized designs, and (3) randomized complete block designs.

[understand] Students will discuss the differences between replication *within* a study and replication *of* a study.

**ANOVA**

[create] Students will create visualizations appropriate for exploring the relationship between a quantitative response and a categorical explanatory variable.

[apply] Students will execute parametric one- and two-way analysis of variance (ANOVA) models.

[apply] Students will fit non-parametric one-way ANOVA models.

[understand] Students will describe the differences between parametric and non-parametric ANOVA models.

[understand] Students will interpret the results of an ANOVA model.

[evaluate] Students will evaluate the appropriateness of an ANOVA model, based on the conditions of the model.

[apply] Students will utilize a multiple comparison procedure (MCP) to assess differences in group means.

[understand] Students will identify the issues with multiple testing a MCP addresses, specifically Type II error and data dredging.

**SLR**

[create] Students will create visualizations for exploring the relationship between a quantitative response and a quantitative explanatory variable.

[apply] Students will execute parametric simple linear regression (SLR) models.

[apply] Students will execute non-parametric simple linear regression models.

[understand] Students will interpret the results of a SLR model, specifically the coefficient, p-value, and confidence interval associated with the explanatory variable.

[evaluate] Students will evaluate the appropriateness of a SLR model, based on the conditions of the model.

[understand] Students will understand how variable transformations relate to violated model conditions.

[evaluate] Students will evaluate whether variable transformation(s) are appropriate for a SLR model.

[analyze] Students will execute a SLR model with log-transformations of x- and / or y-variables.

[understand] Students will interpret the results of a log-transformed SLR model.

**MLR**

[create] Students will create visualizations for exploring multivariate relationships between a quantitative explanatory variable and quantitative and / or categorical response variables.

[apply] Students will execute multiple linear regression (MLR) models.

[understand] Students will interpret the results of a MLR model, specifically how indicator variables are used for categorical explanatory variables.

[evaluate] Students will use model conditions, visualizations, and p-values to decide if a MLR model is justified or if a simpler model is sufficient.

**Inference**

[understand] Students will describe the differences between parametric and non-parametric methods for ANOVA and SLR models.

[understand] Students will identify what population the results of a study can be inferred to, based on the description of a study.

[understand] Students will identify what type of relationship can be inferred between the explanatory and response variables, based on the description of a study.

[understand] Students will discuss how various factors of a study impact the p-value associated with the study – specifically sampling procedure and sample size.

[create] Students will defend a statistical model they believe is appropriate for an analysis at hand.

[apply] Students will criticize the use of significance testing in statistical analyses.

**Data Wrangling, Data Visualization, & Reproducibility**

[apply] Students will demonstrate the ability to identify the necessary data wrangling tasks required for an analysis, including selecting variables, filtering observations, and mutating variables.

[apply] Students will construct tables of data summaries, and display them appropriately in a statistical report.

[analyze] Students will combine the data wrangling tasks necessary to prepare data for analysis.

[understand] Students will identify potential ethical issues surrounding data collection and analysis.

[understand] Students will describe what “reproducibility” means in the context of scientific research.

[create] Students will create reproducible statistical reports, visualizing, implementing, describing, and defending a statistical analysis.