STAT 213, SPRING 2018: SPECIFIC LEARNING OBJECTIVES

The following is a list of all the Concepts and Content SLOs in this course. Items in *italics* are expected to be familiar from a prerequisite course.

Linear Regression (30 SLOs).

A. Writing model equations from verbal descriptions

1. *Write down the prediction equation for simple linear regression model with a quantitative predictor*
2. Write down the prediction equation for a "two means" model with a reference group and a binary indicator variable
3. Write down the prediction equation for a "many means" model with a reference group and a set of binary indicator variables
4. Write down the prediction equation for a "two parallel lines" model
5. Write down the prediction equation for a "two non-parallel lines" model using an indicator variable and an interaction term
6. Write down the prediction equation for a "many lines" model using a combination of indicator variables and interaction terms

B. Interpreting coefficients

1. *Interpret the coefficients in a simple linear regression model with a quantitative predictor*
2. Interpret the coefficients in a "two means" model
3. Interpret the coefficients in a "many means" model
4. Interpret the coefficients in a "two parallel lines" model
5. Interpret the coefficients in a "two non-parallel lines" model
6. Interpret the coefficients in a "many lines" model

C. Model assessment

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1. *Sensibly diagnose violations of regression conditions in single predictor models using residual plots*
2. Sensibly diagnose violations of regression conditions in multiple predictor models using residual plots
3. Recognize the need for and apply appropriate variable transformations where applicable
4. Identify and distinguish outliers and high leverage cases using appropriate tools
5. Explain what multicollinearity is and why it can be a problem for inference
6. Recognize and explain instances of Simpson's Paradox in terms of changes in sign of regression coefficients when a collinear predictor is added to a model

D. Inference and prediction

1. *Accurately state what is being tested by t-tests of individual coefficients in a simple linear regression model*
2. *Accurately state what is estimated by confidence intervals of individual coefficients in a simple linear regression model*
3. Accurately state what is being measured by overall R^2
4. Distinguish "total value" from "added value" of a set of predictors
5. Accurately state what is being tested by t-tests of individual coefficients in a multiple linear regression model
6. Interpret confidence and prediction intervals for response variables in simple linear regression models
7. Interpret confidence and prediction intervals for response variables in multiple linear regression models

E. Comparison and selection of models

1. Identify what information a given nested test provides
2. Identify what models to compare to answer a targeted question
3. Explain the concept of overfitting and why it is a problem when doing model comparison
4. Explain how various fit measures (such as adjusted R^2, Mallow's C_p, and cross-validation error) deal with overfitting

5. Sensibly employ (cross-)validation as a model validation/selection tool

Logistic Regression (15 SLOs).

F. General Concepts

1. Explain the advantages of a logistic model over a linear model in the case of a binary response
2. Convert between probabilities, odds, and log odds
3. Distinguish the effect of changes to a predictor on probability vs. odds vs. log odds
4. Interpret tests of coefficients in logistic regression models.
5. Correctly interpret prediction intervals in logistic models
6. Identify and employ appropriate nested model comparisons to answer substantive questions
7. Sensibly employ metrics such as AIC, and cross-validation prediction error, to select among competing models

G. Writing down model equations from verbal descriptions

1. Write single predictor models in probability form
2. Write "two parallel lines" models in either probability or logit form
3. Write "two non-parallel lines" models in probability or logit form

H. Model interpretation

1. Interpret coefficients for single binary predictor model in terms of odds ratios
2. Interpret coefficients for single quantitative predictor model in terms of rate of change in odds
3. Construct and interpret confidence intervals for odds ratios in a single predictor model
4. Interpret coefficients in a "two parallel lines" model in terms of the effect of predictors on odds
5. Interpret coefficients in a "two non-parallel lines" model in terms of the effect of predictors on odds

Analysis of Variance (ANOVA) (20 SLOs).

I. General concepts

1. Identify hypotheses and interpret results for omnibus F tests
2. Explain the concept of familywise error rate (FWER)
3. Explain various popular methods for controlling FWER, and the relative strengths and weaknesses of each
4. Assess inference conditions using appropriate tools
5. Sensibly carry out model comparisons to answer specific research questions

J. One-way ANOVA

1. Write down models in standard ANOVA form from verbal descriptions
2. Interpret the coefficients in an ANOVA model
3. Translate between a one-way ANOVA model and a regression model
4. Translate between group means and model coefficients
5. Fill in ANOVA tables "by hand"

K. Two-way additive ANOVA models

1. Write down models in standard ANOVA form from verbal descriptions
2. Interpret coefficients
3. Translate between a two-way additive ANOVA model and a regression model
4. Translate between group means and model coefficients
5. Fill in ANOVA tables "by hand"

L. Two-way ANOVA models with interaction

1. Write down models in standard ANOVA form from verbal descriptions
2. Interpret main effects and interaction terms
3. Translate between ANOVA models and corresponding regression models
4. Translate between group means and model coefficients
5. Fill in ANOVA tables "by hand"