

# STAT 215, FALL 2017: SPECIFIC LEARNING OBJECTIVES

## CONCEPTUAL UNDERSTANDING

### General Modeling Concepts.

#### A. Model construction and evaluation

1. Identify and assess regression conditions and know how to assess them using various standard plots and metrics
2. Accurately state what is being tested by  $t$ -tests of individual coefficients
3. Accurately state what is estimated by confidence intervals of individual coefficients
4. Understand the meaning of variance components in regression and ANOVA models
5. Interpret confidence and prediction intervals for response variables in MLR setting
6. Identify multicollinearity and understand its effects

#### B. Model comparison and selection

1. Understand the distinction between overall value and added value of a predictor, and connect these concepts to  $F$  and  $t$  tests of coefficients or groups of coefficients
2. Understand various fit measures, their properties, differences, and strengths and weaknesses
3. Understand the concept of overfitting, and how and whether fit measures account for it
4. Understand the logic of cross-validation and the connection to overfitting

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**Concepts About Specific Models.**

## C. Linear Regression

1. Write down models in standard form from verbal descriptions
2. Understand the role in a model of continuous predictors and their coefficients in isolation
3. Understand the role in a model of binary indicator variables and their coefficients in isolation
4. Understand the role in a model of grouped indicators representing a single categorical variable
5. Understand the role in a model of interactions between binary indicators and their coefficients
6. Understand the role in a model of interactions between binary indicators and continuous predictors
7. Understand the role in a model of interactions between multiple continuous predictors

## D. One-way ANOVA

1. Write down models in standard form from verbal descriptions
2. Interpret the coefficients in an ANOVA model
3. Translate between an ANOVA and regression model
4. Identify hypotheses and interpret results for omnibus  $F$  tests
5. Understand the concept of familywise error rate and mechanisms for controlling it

## E. Two-way ANOVA

1. Write down models in standard form from verbal descriptions
2. Interpret main effects and interaction terms
3. Estimate main effects and interaction terms from cell means
4. Understand the degrees of freedom counts for each source of variability

## F. Logistic Regression

1. Write down models in standard form from verbal descriptions

2. Understand why a distinct model is useful for binary responses
3. Write the basic model in both the probability and logit forms
4. Convert between probabilities, odds, and log odds
5. Interpret the coefficients
6. Construct confidence intervals for the response on various scales (odds ratio, log odds ratio)
7. Understand the general principle of maximum likelihood fitting
8. Interpret likelihood ratio tests for nested models

### MODELING IN PRACTICE

- G. Engage in the data exploration and modeling process in an open-ended way from beginning to end in scenarios with the following characteristics. Exploration should incorporate visualizations chosen to highlight aspects of the data that are particularly germane to the question(s) at hand; modeling should include consideration of a variety of candidate models which are assessed using standard methods and interpreted in the real-world context of the data.
1. Quantitative response and one quantitative predictor
  2. Quantitative response and one categorical predictor (with at least levels)
  3. Quantitative response and a mix of predictors, including interaction terms
  4. Quantitative response from a designed experiment with at least two categorical factors, which may interact
  5. Binary response and a mix of predictors