Psychology 407

Statistical Methods, II

Spring 2014

Instructor(s):

Lawrence Hubert (Larry)
433 Psychology Building
Office Hours: Wednesday, 1–3

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425 Psychology Building

Teaching Assistants:

Ehsan Bokhari
418 Psychology Building
Office Hours: Thursday 1–3 (Psychology Room 458)

Ben Zimmerman
2420 Beckman Institute
Office Hours: Thursday 11–1

Lectures: Monday and Wednesday, 3–5; 32 Psychology Building

Lab/Tutorial: Friday, 3–5; 32 Psychology Building

Texts: (on the loaner flash drive)
    An Introduction to Statistical Learning (with Applications in R);
Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani;
Springer, 2013.
    Web Site: `http://www-bcf.usc.edu/~gareth/ISL/index.html`
    or:
`http://www.statlearning.com`

Applied Linear Regression (Third Edition); Sanford Weisberg; Wiley, 2005.

A Modern Approach to Regression with R; Simon J. Sheather; Springer, 2009.

Students are responsible for all material covered in lectures, tutorials, assigned readings, homework assignments, and handouts.

The final grade will use weights as follows: Assignments (.1), Midterm I (.3), Midterm II (.3), Final (.3)

Generally, homework will be assigned weekly with solutions due one week later at the beginning of lab. Solutions will be provided and discussed in the lab/tutorial sessions. Neatness, completeness, and clear communication counts.

Students should have a battery-operated calculator that has several memories, performs basic arithmetic, and finds square roots.

Exams will be closed-book and closed-note except for a limited number of handwritten "crib" sheets that can be brought into the exam.

Our web site for the class is:

`http://cda.psych.uiuc.edu/web_407_spring_2014/`

Topic Sequence

I. Review of simple correlation and regression

`correlation_regression_descriptive.pdf`

`correlation_regression_models.pdf`

`cross_validation_methods.pdf`

Lab: use of SYSTAT, R, Matlab

`matrix_notes_406_407.pdf`

II. Review of multiple regression

`matrix_reexpression_for_regression.pdf`

`multiple_regression.pdf`

`regression_miscellany.pdf`

III. Further multiple regression topics

`polynomial_regression.pdf`

`indicator_variables.pdf`

`manual_sci_evidence_multiple_regression.pdf`

two items on Henry A. Wallace:

`wallace_handout.pdf`
`wallace_beamer_talk.pdf`

`multivariate_multivariate_normal_2013.pdf`

IV. (New) Regression Classes in Matlab

Linear Models:
`LinearModel.fit`
Regularization: lasso; ridge regression

Generalized Linear Models:

```
GeneralizedLinearModel.fit
```
Regularization: lasso

Nonlinear Models:
```
NonLinearModel.fit
```
V. "Midterm" exam on items I, II, III, IV

VI. (One-way) analysis-of-variance (anova)
```
one_way_anova.pdf
```
```
comparisons_among_means.pdf
```
```
one_way_anova_model_two.pdf
```
VII. (Two-way) analysis-of-variance
```
two_way_anova.pdf
```
```
two_way_anova_repeated_measures_model_three.pdf
```
VIII. Nonparametric tests
```
chi_square_tests.pdf
```
```
randomization_paradigms.pdf
```
```
rank_correlation.pdf
```
IX. "Midterm" exam on items VI, VII, VIII

X. An Introduction to Statistical Learning: Selected Topics (as time will permit)

Eigenvector and Eigenvalue Decompositions

Singular Value Decomposition of a Matrix

Principal Components

Discriminant Analysis

Procrustes Analysis

Classification and Regression Trees
Ensemble Methods (Tree Bagging)
Cluster Analysis: K-Means and Hierarchical
Multidimensional Scaling: Nonmetric