**STAT 425, Section 3GR/3UG**
**APPLIED REGRESSION AND DESIGN**
**Spring 2021**

**Description:** This course provides the foundation for advanced statistical modeling with a focus on multiple strategies for analyzing data. The course explores linear regression, least squares estimates, F-tests, analysis of residuals, regression diagnostics, transformations, model building, generalized and weighted least squares, PCA, A/B testing, randomization tests, ANOVA, random effects, mixed effects, and longitudinal data. Statistical computing is an integral part of the course.

**Instructor:** Douglas Simpson, Professor, Department of Statistics, `dgs@illinois.edu`

**Teaching Assistant:** Yuxuan Lin (`yuxuan15@illinois.edu`)

**Course Aides:** Jilei Lin (`jileil2@illinois.edu`), Chahna Saraiya (`csarai2@illinois.edu`)

**Online System:** Moodle (`https://learn.illinois.edu`)

Course title at the Moodle website:
STAT 425 3GR/3UG SP21: Applied Regression and Design (Simpson, D)

**Lectures:** Online videos and slides released weekly and linked from our Moodle space.

**Zoom Office Hours:** Tue & Wed, 2:00–3:00 PM; Thu 8:00–9:00 AM

**TA Zoom Office Hours:** Mon & Fri, 2:00–3:30 PM

**Prerequisites:** STAT 410. Also, you will need a personal computer capable of running R and RStudio (Windows, MacOS, and linux versions are available)

**Resources:**

**Lecture Notes:** Primary notes will be provided on the class Moodle space.

**Online book:** Julian J. Faraway, *Practical Regression and Anova using R*
`http://cran.r-project.org/doc/contrib/Faraway-PRA.pdf`

**Software:** We will use the R and R Studio software environments for our statistical computing. R is the computing language and R Studio is an integrated development environment (IDE) for R . They are available free of charge from `http://cran.r-project.org/` and `http://www.rstudio.com/`.

**Ask questions online:** Campus Wire class feed.

**Course Work:** Biweekly homework assignments and quizzes, two Midterm Exams.

Homework is assigned approximately every two weeks. It must be submitted through GradeScope by the due date and time to receive credit.

Quizzes will be administered online in GradeScope.

The **Midterm Exams** are tentatively scheduled for **Tuesday, March 9** and **Tuesday, Apr 27**.

**Grading:** Weights for assessments: 10% Quizzes, 60% homework, 30% Midterm Exams.

**Outline of Topics**

**Module 1: Normal Linear Regression Models**

Simple Linear Regression
Multiple Linear Regression
Regression Diagnostics
Collinearity
Generalized and Weighted Least Squares
Variable selection methods
Polynomial regression
Splines basis and local polynomial smoothing
Principal Components Regression
Ridge Regression
Lasso
ANCOVA models

**Module 2: Experimental Design and ANOVA**

A/B testing
Randomization tests
Permutation tests
One-way and two-way ANOVA
Experimental Design/Blocking
Multiple Comparisons

**Module 3: Methods for Dependent Data**

Random effects models
Mixed effects models
Generalized Estimation Equations

**Academic Integrity:** Please familiarize yourself with Section 1-402 of the Student Code, concerning Academic Integrity Infractions. Please note especially these categories of infractions:

- Copying: Submitting the work of another as your own.
- Altering the answers given for an exam after the examination has been graded.
- Allowing another to copy from one's work.

Any work you submit must be your own, except as officially announced by the instructor.

**Disability Accommodations:** To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TTY), or e-mail a message to `disability@illinois.edu`.