MATH 484/564 Regression/Applied Statistics

Course Description: This course introduces the basic statistical regression model and design of experiments concepts. Topics include simple linear regression, multiple linear regression, least square estimates of parameters; hypothesis testing and confidence intervals in linear regression, testing of models, data analysis and appropriateness of models, generalized linear models, design and analysis of single-factor experiments. Credit may not be granted for both MATH 484 and MATH 564. (3-0-3)

Enrollment: Required for B.S. in Statistics; Elective B.S. in Applied Math, M.S. in Applied Math, Ph.D. in Applied Math, and all the professional master programs of the AMATH.

Textbooks: M. Kutner, C.J. Nachtsheim, J. Neter, W. Li, *Applied Linear Statistical Models*, 5th edition (with Student CD). McGraw-Hill/Irwin

References:

1. W. N. Venables and B. D. Ripley (2002). *Modern Applied Statistics with S*, 4th Edition. Springer.

Software: R

Prerequisites: MATH 474 or MATH 476 or MATH 563, min grade of C.

Objective:

1. Students will learn about the regression models and basic design of experiments concepts and their applications in various fields of science and engineering.
2. Students will be able to formulate real life problems using regression models.
3. Students will be able to use statistical software to estimate the models from real data, and draw conclusions and develop solutions from the estimated models.
4. Students will learn to use visual and numerical diagnostics to assess the soundness of their models.
5. Students will learn to communicate the statistical analyses of substantial data sets through explanatory text, tables and graphs.
6. Students will learn to combine and adapt different statistical models to analyze larger and more complex data.

Lecture Schedule: Two 75-min sessions per week.

Course Outlines

1. Simple LInear Regression (8 hours)
    - Linear regression with one predictor variable
    - Inferences in regression and correlation analysis

- Diagnostics and remedial measures
- Simultaneous inference in regression analysis
- Matrix approach to simple linear regression analysis

2. Multiple linear regression (10 hours)
    - Multiple linear regression, estimation and prediction
    - Regression models for quantitative and qualitative predictors
    - Model selection and validation
    - Diagnostics
    - Remedial measures
3. Logistic regression, Poisson regression and Generalized linear models (8 hours)
    - Logistic regression, inference, model selection, tests for goodness of fit, diagnostics, prediction
    - Poisson regression
    - Generalized linear models
4. Design and analysis of single-factor experiment (4 hours)
    - Experimental studies, observational studies, and causation
    - Experimental studies: basic concepts
    - Overview of standard experimental designs
    - Single-factor ANOVA model

Assessment

Homework	20—30%
Mid-Exam(s)	30—20%
Project	20%
Final Exam	30%

Syllabus by: Lulu Kang and Despina Stasi, 02/05/2018