STAT 52500 Class #11702 Generalized Linear Models Fall 2012

**Instructor:** Dr. Peng  
**Office:** LD224B  
**Tel. #:** 317-274-8070  
**Class time:** 1:30 – 2:45 PM WM  
**Location:** SL008  
**Office hours:** 4:30 - 6:30 PM WM or by appoint  
**Email:** hpeng@math.iupui.edu  
**Homepage:** http://www.math.iupui.edu/~hpeng

**Reference books:**  
(*) An Introduction to Generalized Linear Models by Dobson and Barnett.  
(1) Generalized Linear Models by McCullagh and Nelder.  
(2) Semiparametric regression by Ruppert, Wand and Carroll  
(3) Modeling Binary Data by Collett.  
(5) Biostatistical Methods by Lachin.  
(6) Applying Generalized Linear Models by Lindsey  
(7) Semiparametric Extensions to Generalized Linear Models by Muller  
(8) Model Selection and Model Averaging by Claeskens and Hjort.

**Prerequisite:** Official prerequisite can be found at [http://www.iupui.edu/~bulletin/iupui/2012-2014/schools/purdue-science/courses/index.shtml](http://www.iupui.edu/~bulletin/iupui/2012-2014/schools/purdue-science/courses/index.shtml).

**Official Course Description:** 3 credits. Official Bulletin description can be found at [http://www.iupui.edu/~bulletin/iupui/2012-2014/schools/purdue-science/courses/index.shtml](http://www.iupui.edu/~bulletin/iupui/2012-2014/schools/purdue-science/courses/index.shtml)

**Packages:** R package.

**Goal:** This course focuses on generalized linear models. It will also cover AIC and BIC, generalized estimating equations, and correlated binary data analysis. Students are expected to understand the basic concepts and able to perform statistical analysis of real data with statistical packages. Paper reading, class presentation, projects, etc. are also included.

**Evaluation:** Points are earned through a midterm test, a final exam, homework and project, each accounting for 25%. **Letter grades will be assigned on a comparative basis (a curve) based on individual’s total points.**

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<tr>
<th>Source</th>
<th>Percent</th>
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<tr>
<td>Midterm Test</td>
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<td>Final Exam</td>
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<td>Homework</td>
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<td>Project</td>
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Incompletes: Grades of Incomplete will only be given in accordance with the university policy available at [http://www.registrar.iupui.edu/incomp.html](http://www.registrar.iupui.edu/incomp.html). Specifically, students must be passing at the 3/4 mark of the semester to qualify for assigning an incomplete. The instructor must agree that an incomplete is appropriate and it must be approved by the Associate Chair of the Department of Mathematical Sciences.

Withdrawals: If you decide to withdraw from the course, be sure to process all paperwork by the appropriate deadlines outlined in the following table:

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<th>Times</th>
<th>Required Signatures</th>
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<tr>
<td>First Week</td>
<td>None</td>
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<td>After First Week</td>
<td>Advisor</td>
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<tr>
<td>1/2 mark of Semester</td>
<td>Advisor and Instructor</td>
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<tr>
<td>3/4 mark of Semester</td>
<td>Associate Chair, LD 270*</td>
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Official details can be found at: [http://registrar.iupui.edu/accal.html](http://registrar.iupui.edu/accal.html)

* After the 3/4 mark of the semester, course instructors cannot sign a drop slip. The student must see the Associate Chair of the Department of Mathematical Sciences. The School of Science Dean’s Office will not endorse a withdrawal after the 3/4 mark of the semester for students unless an extremely serious and documentable excuse is established.

* Withdrawal from classes requires approval of the instructor, the advisor, and the student’s dean or director after November 15, 2012. The School of Science Dean’s Office will not endorse a withdrawal after November 15, 2012, for School of Science majors unless an extremely serious and documentable excuse is established.

Accommodations: Students needing accommodations because of a disability will need to register with Adaptive Educational Services (AES) and complete the appropriate forms issued by AES before accommodations will be given. The AES office is located in Taylor.

Dishonesty and Student Misconduct: Cheating will result in a minimum penalty of receiving a grade of F in the course. The IUPUI Department of Mathematical Sciences expects all students to adhere to the regulations put forth in the “IUPUI Code of Student Rights, Responsibilities, and Conduct” concerning academic misconduct or personal misconduct. Procedures for imposing academic and disciplinary sanctions are outlined in the Code. The Code can be found at: [http://www.iupui.edu/code/](http://www.iupui.edu/code/)

Campus-Wide Policies Governing the Conduct of Courses at IUPUI: These can be found at [http://registrar.iupui.edu/course_policies.html](http://registrar.iupui.edu/course_policies.html), with links to specific policies in the general areas of attendance, academic policy, conduct and related policies.

Administrative Withdrawal: A basic requirement of this course is that you will participate in all class meetings and conscientiously complete all required course activities and/or assignments. Keep in touch with me if you are unable to attend, participate, or complete an assignment on time. If you miss more than half of the required activities within the first 25% of the course without contacting me, you may be administratively
withdrawn from this course. Administrative withdrawal may have academic, financial, and financial aid implications. Administrative withdrawal will take place after the full refund period, and if you are administratively withdrawn from the course you will not be eligible for a tuition refund. If you have questions about the administrative withdrawal policy at any point during the semester, please contact me.

**Important Dates** (Full details can be found at [http://registrar.iupui.edu/accal.html](http://registrar.iupui.edu/accal.html))

- Mon, Aug 20  First Day of Class  
- Mon, Sep 03   Labor Day – no classes  
- Mon, Oct 15  Fall Break begins  
- Tue, Oct 16  Fall Break ends  
- Wed, Nov 21  Thanksgiving recess begins (no class)  
- Sun, Nov 25  Thanksgiving recess ends (no class)  
- Fri, Dec 07  Final Examinations begin  
- Tue, Dec 11  Final Examinations – Weekday Classes begin  
- Mon, Dec 17  Final Examinations – Weekday Classes end  
- Fri, Dec 21  Official semester grades available in OneStart  
- Fri, Dec 21  Transcripts with semester grades available as of 12:00 noon

**Tentative contents to be covered (The instructor reserves the right to make changes without notice):**

- Chapter 1 Introduction  
  1.1 Background, Scope and Notations  
  1.2 Distributions related to the normal distribution  
  1.3 Quadratic forms  
  1.4 Estimation  

- Chapter 2 Model Fitting  
  2.1 Introduction  
  2.2 Examples  
  2.3 Some principles  

- Chapter 3 Exponential Family and GLM  
  3.1 Introduction  
  3.2 Exponential family  
  3.3 Properties with Exponential family  
  3.4 GLM  
  3.5 Examples  

- Chapter 4 Estimation  
  4.1 Introduction  
  4.2 An example  
  4.3 MLE  

- Chapter 5 Quasi-likelihood and Generalized Estimating Equations  
  5.1 Quasilikelihood functions and Estimation of Parameters
5.2 Optimal Estimating Functions
5.3 Generalized Estimating Equations

Chapter 6 Inference
6.1 Introduction
6.2 Sampling distribution for score statistics
6.3 Taylor series approximations
6.4 Sampling distributions for MLEs
6.5 Log-likelihood ratio test
6.6 Sampling distribution for deviance
6.7 Hypothesis testing

Chapter 7 Normal Linear Models
7.1 Introduction
7.2 Basic results
7.3 Multiple linear regression
7.4 ANOVA
7.5 ANOCVA
7.6 General linear models

Chapter 8 Binary Variables and Logistic Regression
8.1 Probability distribution
8.2 GLM
8.3 Dose response models
8.4 General logistic regression model
8.5 Goodness of fit statistics
8.6 Residuals
8.7 Other diagnostics

9 Count Data, Poisson Regression and Log-Linear Models
9.1 Introduction
9.2 Poisson regression and
9.3 Examples of contingency tables
9.4 Probability models for contingency tables
9.5 Log-linear models
9.6 Inference for log-linear models
9.7 Numerical examples
9.8 Over-dispersion and GEE

Chapter 10 Mixtures of Binomial/Multinomial Distribution and Markov Chains
10.1 Introduction
10.2 Binomial under exchangeability with applications in animal studies
10.3 Multinomial under exchangeability with applications in animal studies
10.4 Binomial under partial exchangeability with applications in Cow data

Chapter 11 Akaike’s information criterion and Bayesian Information criterion
11.1 Information criteria for balancing fit with complexity
11.2 MLE, Kullback-Leibler distance and AIC
11.3 Examples and illustrations
11.4 The BIC and examples
11.5 Consistency, efficiency and parsimony