

MATH 627 Generalized Linear Models with Applications
T Th 14:00 PM - 15:15 PM, Room: RB 118

Instructor: Dr. Jongwook Kim

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Office Hours: Tu 3:30-4:30 p.m., Th 3:30-4:30 p.m. or by appointment

Book: *An Introduction to Generalized Linear Models*, 4th ed., Annette J. Dobson and Adrain G. Barnett, CRC Press 2018

Software for this course: I will use the R computational software to illustrate examples and problem solving on Generalized Linear Models and its Applications.

Recommended Prerequisites: MATH 621 or DSCI 602 or permission of the department chairperson/MSDS program director.

Course Objectives: This course provides methods needed to analyze non-normal data. Topics include exponential family of distributions, an overview of generalized linear models. Models for continuous, discrete and count data.

Course Content: Topics may include:

1. Review of Topics Related to Generalized Linear Models (GLMs) :
 - Notations, Linear and Quadratic Forms
 - Related Distributions
 - R and R Markdown
2. Model Fitting Basics
 - Basic Steps in Model Fitting
 - Exploratory Data Analysis (EDA)
 - A Case Study Demonstrating an EDA
3. Foundations of Generalized Linear Models
 - Components of a Generalized Linear Model
 - The Exponential Family of Distributions
 - Properties of the Exponential Family of Distributions
4. Methods for GLMs: Estimation
 - Motivating Example
 - The Maximum Likelihood Estimation
5. Methods for GLMs: Inference

- The Sampling Distribution of the Score Statistic
- The Sampling Distributions of the MLE and Deviance
- Hypothesis Testing

6. Special Cases of GLMs

- The Normal Linear Regression Models
- Analysis of Variance Models
- Analysis of Covariance Models

7. Special Cases of GLMs (contd.)

- Model Diagnostics
- Model Selection

8. Logistic Regression Models for Binary Outcomes

- Dose-response Models
- General Logistic Regression Models

9. Logistic Regression Models for Binary Outcomes (contd.)

- Goodness of Fit Statistics
- Model Diagnostics

10. Logistic Regression Models for Nominal Outcomes

- Nominal Logistic Regression Model
- Examples

11. Logistic Regression Models for Ordinal Outcomes

- Cumulative Logit Model
- Proportional Odds Model
- Examples

12. Poisson Regression Models

- Poisson Regression Model
- Examples

13. Contingency Tables

- Contingency Tables for Cross-sectional studies
- Contingency Tables for Randomized Controlled Trials
- Contingency Tables for Case-control studies

14. Log-linear Models

- Log-linear Models for Contingency Tables
- Examples

15. Models for Time-to-Event Data

- Basics of Time-to-Event Data
- Models for Time-to-Event Data

Homework: Homework will be assigned from sections and contents of the book that we covered in class. You are expected to do all the assigned and suggested problems. Understanding their solutions is crucial to your success in this course. Late homework will not be accepted.

Midterm Exam: There will be two in-class mid-term exams. These will be held during the entire class period.

Final Exam: The final will be two hours and will cover material from the entire course.

Project: This final project requires students to form groups of 1–3 people to select a dataset and perform a comprehensive data analysis utilizing the specific methodologies learned throughout the course. While students may work together on the analysis, each person is required to submit the final project paper independently. The project may require the use of technology.

Final Grade: Your grade will be determined as follows:

Task	Points	Percent	Grade	Percent	Grade	Percent	Grade
HW	20	≥ 92	A	[80,83)	B -	[67,70)	D+
Project	20	[90,92)	A-	[75,80)	C+	[65,67)	D
Midterm1	20	[87,90)	B+	[72,75)	C	[62,65)	D-
Midterm2	20	[83,87)	B	[70,72)	C -	< 62	E
Final	20						
Total	100						

Important Dates:

Midterm1 February 19th, 2:00 - 3:10 PM
 Withdrawal Deadline March 19th
 Midterm2 March 26th, 2:00 - 3:10 PM
 Final April 28th, 12:00 - 2:00 PM (2 hrs)
 Project May 1st, 11:59 PM

Make-up exams will not be given unless you have a very serious reason for missing the exam. Also, you must contact me beforehand to get approval.

University Statement: We are committed to ensuring that all members of the community are welcome, through valuing the various experiences and worldviews represented at Ball State and among those we serve. We promote a culture of respect and civil discourse. If you need course

adaptations or accommodations because of a disability, please contact the instructor of record as soon as possible. Ball State's Disability Services Office coordinates services for students with disabilities; documentation of a disability needs to be on file in that office before any accommodations can be provided. Disability Services can be contacted at 765-285-5293 or dsd@bsu.edu.

Freedom of Expression: In this course, we are committed to fostering a learning environment that values intellectual diversity, encourages free expression, and promotes open inquiry. As members of the Ball State Community, we treat each person in the Ball State community with civility, courtesy, compassion, and dignity and respect and learn from differences in people, ideas, and opinions. Please review Ball State University's Statement on Freedom of Expression, the resources on Ball State's Freedom of Expression webpage, and Ball State's Beneficence Pledge.

Attendance:

- Absences will be excused for the following reasons: funeral or bereavement leave, jury duty, late course addition, military service, observance of religious holidays, pregnancy leave, participation in University- or department-approved activities as a student-athlete, and official University advisories.
- Students may also encounter other circumstances (e.g., car accidents, job interviews) that result in absences. Only faculty members can excuse these, and adjustments are at the discretion of the instructor. When possible, and with sufficient documentation, faculty are encouraged to support student educational activities.
- Students are expected to notify each instructor as soon as they anticipate an absence (e.g., funeral) or as soon as possible after the absence begins (e.g., unexpected illness or injury). Documentation may be required (with confidential information redacted as appropriate) if requested by the instructor.

Title IX:

Ball State University is committed to providing a safe and inclusive learning environment for all students. If you or someone you know has experienced sexual harassment—including sexual assault, dating violence, domestic violence, or stalking, please know that you are not alone. The University offers support services and resources. For more information or to report an incident, please visit bsu.edu/titleix or contact the Title IX Coordinator at 765-285-1545 or at titleix@bsu.edu.

As your instructor, I am a mandatory reporter under the Title IX policy and required to report any information I receive about possible sexual harassment. This includes information shared in class discussions, assignments, or private conversations.

What happens after I report? The Title IX Coordinator will email the person who experienced sexual harassment (complainant) and invite them to schedule a meeting. If the complainant chooses to meet with the Title IX Coordinator,

- Title IX Coordinator will offer supportive measures (e.g., counseling, extensions on deadlines, course-related adjustments, changes to work or class schedules, and/or referrals to campus offices), review the policy, and discuss options to move forward.
- If a complaint is filed by the complainant or the University, an investigation will begin following University policy.

University Grade Appeal Policy: If you believe you received a final course grade that does not reflect your performance due to fairness or a procedural issue, you have the right to file an appeal within 5 school days after final grades are posted by the Office of the Registrar. Review the University Grade Appeal Policy and Process.

Student Academic Ethics Policy: Honesty, trust, and personal responsibility are fundamental attributes of the university community. Academic dishonesty and other forms of academic misconduct threaten the foundation of an institution dedicated to the pursuit of knowledge and will not be tolerated. To maintain its credibility and reputation, and to equitably assign evaluations of scholastic and creative performance, Ball State University is committed to maintaining a climate that upholds and values the highest standards of academic integrity. Visit the VPAA's academic integrity website (Students tab) for resources on understanding academic integrity, citing sources properly, and avoiding inadvertent academic dishonesty. To learn about BSU's academic integrity expectations and students' rights, please read the University Student Academic Ethics Policy.

Academic integrity violations include giving or receiving an unfair academic advantage (cheating), presenting someone else's ideas or work as your own (plagiarism), and falsifying academic records. Unless otherwise indicated, you must work independently by yourself. Check with me if you are unsure whether something constitutes academic dishonesty. Examples of academic integrity violations include but are not limited to:

- Using resources not authorized by the faculty member (including devices, AI tools, hidden notes, and open books).
- Using commercial study websites to find answers to graded assignments (Chegg, Course Hero, StudyPool, OneClass, etc.).
- Without the instructor's written permission, giving away, buying, or selling graded assignments class notes, exams, study guides, or other course materials to other students or to third-party vendors (Course Hero, Chegg, 24HourAnswers, etc.).
- Working with another person on any assignment other than authorized group projects.
- Sharing or allowing others to access your files, whether done with permission or not.
- Reusing your own work from another semester, course, or section.
- Sharing answers with others during exams (passing notes, texting, whispering, gesturing).
- Discussing exam questions and answers with students who have not taken the exam.
- Soliciting others to complete work for you.

Generative AI Statement: All work submitted in this course must be your own and completed in accordance with Ball State University's Student Academic Ethics Policy. The use of ChatGPT or any other generative AI tools to produce or assist in producing course materials is prohibited.

The Learning Center:

The Learning Center offers free Tutoring and Academic Coaching for many courses at Ball State. Students can make appointments for online (Zoom) or in-person (NQ 350) appointments. To make

an appointment, visit myballstate.bsu.edu and click on “Navigate” in the Academic Tools section, or just go directly to bsu.navigate.eab.com.

Testing accommodations for students with disabilities are available for students who have received the appropriate documentation from Disability Services. Tests may be administered in the Learning Center. Supplemental Instruction is available in select courses. If you have an SI leader for your course, that person will provide students with information the first week of school regarding weekly study sessions. For more information about Learning Center programming, visit bsu.edu/learningcenter or call 765-285-1006. Follow us on Instagram: BallStateLC.

The Writing Center:

All writers improve with practice and feedback, so as a student in this course, you are encouraged to use the Writing Center (in Robert Bell 295 during weekdays, Bracken Library First Floor West in the evenings, or online during any of our regularly scheduled hours) to get additional feedback on your writing.

The Writing Center offers free planning, feedback, and accountability sessions (in person and online) to all students composing essays, reports, reflections, research projects, web content, lesson plans, slideshows, poster presentations, resumes, and other digital or print texts. To schedule a free appointment to discuss your writing, go to bsu.edu/writingcenter. Online and in-person appointments are available; however, plan ahead because appointments book quickly!

The Basic Needs Hub:

If you are having difficulty affording enough food, do not have a safe and reliable place to sleep, and/or experiencing an emergency or crisis, help is available through the Basic Needs Hub. The Basic Needs Hub has information, resources, and provides individualized support to students. To talk with a supportive staff member about your experience, receive one on one assistance, or learn more about resources, you can submit a Basic Needs Assistance Form.

The Counseling Center:

The Ball State University Counseling Center offers free and confidential services to all students. The Counseling Center is located in Lucina Hall, Room 320. To schedule an appointment, you can contact us at 765-285-1736. Ball State also offers a 24/7 Crisis Line, which can be reached at 765-285-HOPE (4673). The Crisis Line is a mental health resource for those who are struggling with any mental health concerns, including thoughts of self-harm and/or suicide.

At the Ball State Counseling Center, we see students for a variety of reasons, some of which include homesickness, relationship concerns, anxiety, and depression. At your first appointment, you will work with a therapist to create a plan that will connect you with resources that best fit your needs. We assist students with getting connected to therapy at our Center as well as connecting students to self-help resources, other on-campus resources, and community-based resources. All Ball State students also have access to several on-demand, self-help resources through a variety of different platforms. All of these resources, including a direct link to our website, can be found here.

The Speaking Center:

The Speaking Center is a free resource available to all members of the BSU community wanting to improve their public speaking abilities. We offer personalized coaching designed to help you become a more confident and effective speaker. Our trained coaches provide constructive feedback and support throughout the entire speech preparation process, whether you are in the early stages

of brainstorming ideas and organizing your thoughts, or you need to practice your delivery and refine your message.

The Center is in the David Letterman Communication and Media Building, room 302. To schedule an appointment, please access us through your Navigate app or use this direct link to sign up for a time. Appointments are available both in person and on Zoom. Appointments are available in person, on Zoom, and in virtual reality (VR) for those interested in practicing in an immersive speaking environment.

Course Schedule:

To support a learning experience that is responsive to the needs, interests, and pace of our class community, the course schedule may shift over the semester. The most current version of the schedule will always be available on Canvas. I encourage you to check Canvas regularly for updates and contact me if you have any questions. This syllabus is subject to change in the event of extenuating circumstances.