University of Manitoba
Department of Statistics

STAT 3550: Nonlinear Regression Models

Winter Term 2023

Course Details

Course Number & Title:	STAT 3550, Nonlinear Regression Models
Section & CRN:	Section A01, CRN: 62052
Course Schedule:	Tuesdays/Thursdays 11:30 a.m. – 12:45 p.m, Room 315, Buller Building.
Prerequisites:	One of STAT 3450, the former STAT 3470, or the former STAT 3120
Co-requisites:	One of STAT 3100, the former STAT 3800, or the former STAT 3600 and STAT 3150. No special permissions are given with respect to prerequisites.

Instructor Contact Information

Instructor:	Yi Xiong
Office Location:	364 Machray Hall
Email:	yi.xiong@umanitoba.ca
Office Hours:	Tuesday 1:30p.m.-2:30p.m., or by appointment. Changes/additions to be announced on UMLearn.

Course Materials and Technology

Textbook:	R.H. Myers, D.C. Montgomery, G.G. Vining and T.J. Robinson (2010). Generalized Linear Models with Applications in Engineering and Sciences, 2nd Edition, Wiley.
Other reference:	P.K. Dunn and G.K. Smyth (2018). Generalized Linear Models with Examples in R, Springer.
Statistical Software:	The numerical computation and data analysis are done mainly using the statistical software `R (cran.r-project.org/)` or `RStudio (rstudio.com/products/rstudio/)`. In addition, the `R Markdown (rmarkdown.rstudio.com/lesson-1.html)` may be helpful when you are drafting manuscripts containing both numerical outputs and source codes. These three are all freely available for Linux, Macintosh, and Windows.

Course Objectives and Contents

This course is meant to follow up STAT3450, with a focus on nonlinear regression models. By reviewing linear regression models, you will reinforce the understanding of least-square estimation and maximum likelihood estimation, which serve as the groundwork to appreciate nonlinear regression models and generalized linear models (GLM). The primary goal of this course is to gain a solid understanding of nonlinear regression modelling in both theoretical and practical perspectives. You are required to learn analytical skills in conducting regression analysis with GLMs using `R`, which is essential to your future success as a statistician.

The following is a list of topics to be covered in the course.

1. Review linear regression models (Chap. 2) and review `R`(2.5 weeks)
2. Introduce nonlinear regression models, extend the estimation procedures including generalized least-square estimation and maximum likelihood estimation to nonlinear regression models, discuss basic statistical inference in nonlinear regression (Chap. 3) (3 weeks)
3. Introduce Logistic and Poisson regression models, discuss maximum likelihood estimation and basic statistical inference (Chap. 4) (3 weeks)
4. Generalize knowledge in Module 3 to generalized linear models (GLMs) by introducing the exponential family of distributions and extending estimation procedures and statistical inference in GLMs (Chap. 5) (3 weeks)
5. Optional topics (TBD) (Time permitting)

Important Dates

The following dates are important as to how the course will progress throughout the term.

Date	Information
Jan 10	First lecture- course overview
Jan 20	Last date to DROP this course
Jan 23	Last date to ADD this course
Feb 14	Midterm 1
Feb 21-24	Winter Term break - no classes
Mar 14	Midterm 2
Mar 22	Last day to VW the course
Apr 11	Last lecture
Apr 14-28	Final Examination Period

The dates for the tests are tentative (and subject to change at my discretion). Changes are subject to Section 2.8 of the ROASS Procedure.

Course Assessments

Assignments: There will be four assignments. Assignments will include theoretical and computing problems. The computing problems involving data analysis are to be done using R(Studio). You are encouraged to discuss assignments with peer students. However, each student must hand in his or her own copy of each assignment with personalized solutions, including comments, discussions, explanations and interpretations, and R code. Copying in whole or in part from anywhere, including other students, books and the web constitutes a case of academic dishonesty and could have serious consequences. Assignment due dates will be specified as soon as questions are released. NO late submission will be accepted.

Midterms: There will be two 75-minute in-class midterms, *tentatively* scheduled for February 14 and March 14, 2023. There will be NO make-up midterms. If you miss a midterm with a valid cause and inform the instructor as soon as possible (within 48 hours), the weight of the midterm may be added to the final exam.

Final Exam: The final exam will be two hours in duration and will be scheduled by the Registrar's Office. The final exam will be cumulative while emphasizing on the material after the second midterm. If you miss the final exam, you should contact a student advisor from your home Faculty within 48 hours of the scheduled exam time.

Remarks: If you miss any homework deadlines, a midterm, or the final due to illness, you need to fill out the self-declaration form at the link https://umanitoba.ca/sites/default/files/2022-09/Self%20Declaration%20Fillable%20Form-%20FINAL%20for%20Website.pdf
The Self-Declaration for Brief and Temporary Absences Procedure and Policy is effective as of September 1, 2022, and therefore students will not be required to present medical or other documentation for absences due to extenuating circumstances of five days (120 hours) or less; however, you must submit the form to your instructor in lieu of any medical or other documentation. Please note that further documentation may be requested from students who claim multiple temporary absences or absences for more than five days. You only need to submit this form if you miss an assessment (i.e., you do not need to inform your instructor if you have to miss a lecture). Note that personal vacations or work obligations are **not** considered valid excuses to miss assessments.

Final Grading: The final grade for the course will be calculated according to the following scheme: Assignments (4): 40% (10% each); Midterm Tests: 30% (15% each); Final Exam: 30%. I normally use the following cutoffs when assigning letter grades:

Letter Grade	Mark out of 100	Letter Grade	Mark out of 100
A+	90-100	C+	65-70
A	80-90	C	60-65
B+	75-80	D	50-60
B	70-75	F	below 50

Expectations and Policies

Attendance: As we are transitioning back to in-person teaching, all the lectures will be delivered synchronously, in a traditional classroom setting. Currently, there are no plans to have any remote lectures or to have any forms of recording. So it is better to be present **in person** in the designated lecture room punctually. There is no alternative way of attendance.

Professional Conduct: It is expected that you conduct yourself professionally and do not distract your fellow students with inappropriate behaviour. Please be familiar with the UM Respectful Work and Learning Environment (RWLE) Section 2.5(c) of the Student Non-Academic Misconduct and Concerning Behaviour Procedure that describes types of inappropriate or disruptive behaviour.

Class Communication: The University requires all students to activate an official University email account. You are required to obtain and use your UM email account for all communication between yourself and the university. Please note that all communication between your instructor and you as a student must comply with the Electronic Communication with Students Policy. When emailing me, please make sure to follow proper email etiquette: emails should start with an opening salutation, be written in complete English sentences and be signed with your name and student number.

Student Accessibility Services: If you are a student with a disability, please contact Student Accessibility Services (SAS) for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation. The contact information for SAS is: Student Accessibility Services, `http://umanitoba.ca/student-supports/accessibility`, 520 University Centre, 204-474-7423, Student_accessibility@umanitoba.ca

Recording of Class Lectures: No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission from your instructor.

Use of Electronics in the Classroom: It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner. A student may use technology in the classroom setting *only for educational purposes* approved by the instructor and/or the University of Manitoba Accessibility Services. Students should not engage in electronic messaging/posting activities (e-mail, texting, video or voice chat, social networking (e.g. Facebook) or electronic gaming during scheduled class time.

Sharing of Course Materials: Course materials (both hardcopy and digital) are for participants' private study and research, and **must not be shared**. They must be used in a responsible, efficient, ethical and legal manner for educational purposes only. Violation of this policy and other Academic Integrity principles, will lead to serious disciplinary action.

Copyrights

Copyrighted Materials: We will use copyrighted content in this course and ensure that the contents are appropriately acknowledged according to copyright laws and university guidelines. The course notes, assignments, tests and exams are the intellectual property of your instructor or the Department of Statistics. Reproduction or distribution of these materials is strictly forbidden without their consent. **You do not have permission to upload any course notes, tests, assignments, practice problems or handouts to a learning management system (such as UM Learn), or any note sharing websites.** All of the course materials, videos and other recordings available to you through UMLearn are meant for your own personal use only.

More details are available online at `www.umanitoba.ca/copyright/`.

Academic Integrity

The value of a degree from the University of Manitoba is dependent on students and faculty strictly upholding values of honesty and academic integrity in all their work. Academic dishonesty devalues the hard work and effort of students who are working honestly to achieve their degrees. Since you are a member of the university community, it is important that you learn and understand the basics of academic integrity, what constitutes academic dishonesty and what are its very serious consequences. I expect students to hold themselves to the highest standards of academic integrity. I expect you to be honest, conduct yourself with integrity, actively encourage your peers to conduct themselves with integrity, and uphold the value of what a degree from the University of Manitoba means. **Impersonation, plagiarism (in written assignments or R codes), and using unauthorized materials are all very serious offences.** When in doubt, please do not hesitate to contact your instructor to discuss what is and what is not allowed. Asking is a sign of integrity, not a signal that you are planning to cheat. I expect you to follow the rules: ignorance is not an acceptable excuse for academic

misconduct. Useful resources can be found at www.umanitoba.ca/student/resource/student_advocacy/academicintegrity/students/a-to-i-what-is-academic-integrity and sci.umanitoba.ca/statement-on-academic-dishonesty/.

ROASS Schedule A

Schedule "A" of the *Responsibilities of Academic Staff with regards to Students* (ROASS) policies of the University of Manitoba lists resources and policies for students. It is important that you familiarize yourself with these resources and policies. This document is available from the Department of Statistics web page at: www.sci.umanitoba.ca/statistics/courses-and-programs/outlines.

University of Manitoba Acknowledgement of Traditional Territories

UM campuses are located on original lands of Anishinaabeg, Cree, Oji-Cree, Dakota and Dene peoples, and on the homeland of the Métis Nation. We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.

COVID-19 Policy

UM is committed to maintaining a safe learning environment for all students, faculty, and staff. Should campus operations change because of health concerns related to the COVID-19 pandemic or other campus-wide emergency, it is possible that this course will move to a fully remote delivery format. Should the instructor be required to stay at home for an extended period and an alternate instructor not be available, the course may move temporarily to a remote delivery format. In that instance, you may be provided with an asynchronous option to minimize the impact the change may have on your schedule.

In a face-to-face environment, our commitment to safety requires students to observe all physical distancing (2m) and personal protective equipment (PPE) guidelines set by the University (umanitoba.ca/coronavirus).

While on campus and in class, you must wear PPE (Personal Protective Equipment) as stipulated in current University policies, procedures, and guidelines. Students who fail to comply are subject to disciplinary action in accordance with the Student Discipline Bylaw and the Non-Academic Misconduct and Concerning Behaviour Procedure.

Medical-grade 3-ply masks are available at many locations on campus, including specific classroom locations, designated by your unit, the Elizabeth Dafoe Library (Fort Garry Campus) and the Brodie Centre main doors (Bannatyne Campus). Additional PPE, if necessary for a specific learning environment, will be provided to you by the teaching unit. If you do not follow masking and other requirements you will be asked to leave the learning space and may only return to the class already in progress when you have complied with these requirements. Repeated issues will result in disciplinary action as previously noted. **Students should not eat or drink during class time.**

Stay home if you have symptoms or are ill. If you become sick or are required to self-isolate you should notify your instructor by email so you can develop a plan to complete the course learning outcomes while you are absent. If you have symptoms, do not come to campus or any UM facilities. Complete the self-assessment on the Manitoba Public Health site and follow the guidelines, which

may include booking a COVID-19 test.

What to do if you become ill while at UM: 1) Leave the classroom, lab or workspace immediately. Continue to wear your mask while leaving the premises and/or while waiting for transportation. 2) Perform hand hygiene (soap and water or hand sanitizer) and avoid contact with others, and minimize contact with the physical environment. 3) Once at home, complete the MB self-assessment and follow the directions that are provided. 4) Inform your supervisor(s), instructor(s) or, if in residence, the appropriate individual. 5) You must remain off campus and all UM facilities until cleared to return in accordance with self-assessment, testing results, or MB Health requirements.

Recommended transportation options (in order): 1) Drive yourself home. 2) Pick-up by family or friend - remember to keep your mask on and to distance as much as possible, and where possible, open a window to improve ventilation. 3) Pickup by taxi/Uber. 4) Winnipeg Transit buses - Winnipeg Transit has indicated that individuals that are ill may not use Transit.