

University of Guelph
College of Engineering and Physical Sciences
Department of Mathematics and Statistics

STAT*3240 Applied Regression Analysis

Course Outline
Fall 2022

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LECTURES: 10:00–11:20 Tuesday and Thursday in GFTC 241. This is a face-to-face offering of the course. Some online resources will be provided, but this is first and foremost a face-to-face offering of the course.

OFFICE HOURS: 11:30 – 1:00 Tuesdays and Thursdays. (I have lecture until 11:20, so I may be late to my office hours if I'm speaking with students after class.) I may be available for online meetings at other times; contact me for details.

PREREQUISITES: MATH*1160, STAT*2050, (1 of IPS*1510, MATH*1090, MATH*1210, MATH*2080)

CREDIT WEIGHT: 0.5 credits.

CALENDAR DESCRIPTION: This course reviews simple linear regression and introduces multiple regression with emphasis on theory of least squares estimation, residual analysis, and model interpretation. Within the multiple regression context, transformations of variables, interactions, model selection techniques, ANOVA, influence diagnostics and multicollinearity will be discussed. Topics may also include Box–Cox transformations, weighted regression, and logistic and Poisson regression. This course is supplemented with computer labs involving interactive data analysis using statistical software.

COURSE OBJECTIVES: Upon successful completion of the course, students will be able to:

- Select, implement and interpret appropriate regression models to explain real-world phenomena.
- Demonstrate an understanding of the limitations and uncertainties associated with regression models.
- State the assumptions of regression models, and investigate these assumptions using appropriate plots and statistics.
- Demonstrate a command of the mathematical foundations of regression models.
- Demonstrate competence in using statistical software to implement regression procedures.
- Effectively communicate a proper interpretation of the results of a regression analysis.

COURSE WEBSITE: <http://courselink.uoguelph.ca>.

Notes, announcements, assignments, etc. will be posted here.

REPRESENTATIVE TEXTS:

There is no textbook for the course. I will be supplying notes (and *some* supporting videos) as the semester progresses. I may occasionally point to other online resources. If you're looking for additional reading from a text that is in the spirit of the course, you could try:

Introduction to Linear Regression Analysis by Montgomery, Peck, and Vining (any edition).
Applied Regression Analysis, Draper and Smith (any edition).

TENTATIVE LECTURE SCHEDULE:

The following is a rough outline of the lecture schedule. We will likely cover all of the following topics, but the ordering of topics and timeline may change.

Week 1–Week 3: Simple Linear Regression. (The simple linear regression model, least squares, properties of the least squares estimators, model assumptions, interpretation of model parameters, inference on the slope and intercept, prediction, maximum likelihood estimation, the coefficient of determination, ANOVA for regression.)

Week 3–Week 5: Introduction to Multiple Linear Regression. (The multiple linear regression model, matrix notation, properties of the least squares estimators, inference on model parameters, estimation and prediction, interpretation of output, standardized regression coefficients, multicollinearity.)

Week 6: Model Assumptions and Checking Model Adequacy. (Residual analysis, standardized and studentized residuals, residual plots, partial regression and partial residual plots, outliers, lack of fit tests.)

Week 7: Polynomial Regression Models, Indicator Variables. (Including higher order terms in the linear regression model, the use of indicator variables to represent categorical explanatory variables, one-way ANOVA as a regression.)

Week 8: Transformations and Weighting. (Variance stabilizing transformations, intrinsically linear models, the Box-Cox transformation, weighted least squares.)

Week 9: Leverage and Influence. (Leverage, influence, measures of leverage and influence, treatment of influential observations.)

Week 10: Model Building. (Model building techniques, forward selection, backward selection, stepwise selection, Mallows's Cp.)

Week 11: Nonlinear Regression. (A brief introduction to nonlinear regression models.)

Week 12: Generalized Linear Models. (Brief introduction to generalized linear models, logistic regression, interpretation of parameters, Poisson regression.)

GRADING SCHEME:

- 30% Assignments. There will be 4 equally-weighted assignments, submitted online.
- 30% Midterm exam. During class (10:00 –11:20) Thursday October 27.
- 40% Final exam. 11:30 – 1:30 December 12.

IMPORTANT DATES:

Date	Assessment
Friday September 30	Assignment #1 is due.
Friday October 14	Assignment #2 is due.
Thursday October 27	Midterm examination (10:00 – 11:20)
Friday November 11	Assignment #3 is due.
Friday November 25	Assignment #4 is due.
December 12	Final exam 11:30–1:30

ASSIGNMENT POLICIES:

- There is a harsh late penalty: any assignment not submitted by the deadline will not be marked and will receive a grade of 0. (If you are having trouble making a deadline, you are strongly encouraged to discuss the matter with me as soon as possible.)

- While you are encouraged discuss approaches to assignment questions with other students, your submitted assignment must be your own work. Copying any part of another student's work is considered academic misconduct. (Please read the section on academic misconduct at the end of this document and in the undergraduate calendar.)

University Policies

Email Communication

As per university regulations, all students are required to check their uoguelph.ca email account regularly: email is the official route of communication between the University and its students.

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the academic calendar for information on regulations and procedures for Academic Consideration:

<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-consideration-appeals-petitions/>

Drop date

Courses that are one semester long must be dropped by the end of the last day of classes; two-semester courses must be dropped by the last day of classes in the second semester. The regulations and procedures for Dropping Courses are available in the Undergraduate Calendar: <https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/dropping-courses/>.

Copies of out-of-class assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

More information: <https://www.uoguelph.ca/sas>

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community ? faculty, staff, and students ? to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:

<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-misconduct/>

Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs: <http://www.uoguelph.ca/registrar/calendars>

Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via Courselink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

Safety Protocols

For information on current safety protocols, follow these links:

<https://news.uoguelph.ca/covid-19/safety-practices/>

<https://news.uoguelph.ca/covid-19/spaces-events-services/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.

Mental Health Services

One out of every five students in Canada experiences some sort of mental health issue at some point in their academic career. If you find yourself facing a mental health crisis, or just need to talk to someone, please consider taking advantage of one of the following resources available to University of Guelph students:

Counselling Services: Visit the Counselling Services website (<https://wellness.uoguelph.ca/counselling>) to get information on resources available to you, both online and in-person. You can also visit them at Health Services (J.T. Powell Building, ext 53244) where they offer individual and group counselling sessions by appointment or walk-in.

Student Support Network: is located in the Wellness & Education Promotion Centre in the J.T. Powell Building and offers confidential, peer-based, drop-in support.

Good2Talk: (1-866-925-5454) is a free, 24/7 student hotline that provides professional counselling and referrals for mental health, addictions and well-being.

Here 24/7: (1-844-437-3247) specializes in assessment, referral and appointment booking and is available 24/7 for crisis support.

You are not alone and you will not be judged for asking for help.