

**STAT 360**  
Linear Models  
**Summer 2021**

- Preface:** Due to exceptional circumstances, this course will be taught, and all assessments will be done completely ONLINE. Given the subject matter and nature of this course, exams, including the class tests and/or the final exam will be given online through the Concordia Online Exams (COLE) platform with online proctoring. For more details read the ADDENDUM at the end of this course outline.
- Instructor:** Dr. D. Sen  
Email: [debaraj.sen@concordia.ca](mailto:debaraj.sen@concordia.ca)
- Office Hours:** Tuesdays, 9:30-11:00, Online via Zoom link (refer to the course's Moodle page).
- Textbook:** *Applied Linear Regression Models*, 4th Edition, by Kutner, Nachtsheim and Neter, McGraw Hill-Irwin, 2004.  
The print version of the textbook will be available at:  
<https://www.bkstr.com/concordiastore/home>  
**Note:** Students should order textbooks as early as possible, especially for print versions in case books are backordered or there are any shipping delays.
- Calculators:** Only calculators approved by the Department such as **Sharp EL 531** or the **Casio FX 300MS** are permitted for the class test and final examination. See <http://www.concordia.ca/artsci/math-stats/services.html#calculators> for details.
- Software:** **R** (a software environment and language for statistical computing and graphics, <https://www.r-project.org/>).
- Assignments:** Assignments are compulsory. There will be 4 assignments. Most of the assignments will involve use of the software **R** that will be demonstrated during online lecture. **R** can be freely downloaded and installed from <http://www.r-project.org>. Students are expected to submit electronic assignments as PDF files through **Moodle**. **Late assignments will not be accepted.**
- Midterm Test:** There will be one midterm test, based on the material of Weeks 1-7, which will contribute up to 30% to your final grade (see the Grading Scheme below). Missed tests cannot be made up. The midterm test will be held on **Wednesday, June 2, 2021** proctored by COLE and/or Moodle platform (See Addendum). This test will be held during online lecture time. This exam and the final will be closed book exams.

**NOTE:** It is the Department’s policy that tests missed for any reason, **including illness**, cannot be made up. If you miss the midterm test because of illness (*medical note required*) the final exam will count for 85% of your final grade, and the assignments will count for the remaining 15%.

**Final Exam:** The final examination will be two hours long, given online through the COLE platform. The exam will cover all the material in the course.

**NOTE:** Students are responsible for finding out the date and time of the final exams once the schedule is posted by the Examinations Office. Conflicts or problems with the scheduling of the final exam must be reported directly to **the Examinations Office, not to your instructor**. It is the Department’s policy and the Examination Office’s policy that students must be available to take the final exam on the selected date and time. Conflicts due to travel plans will not be accommodated.

**Final Grade:**

- a) Assignments (15%)
- b) Midterm test (30%)
- c) Final examination (55%)

If the grading scheme for this course includes graded assignments, a reasonable and representative subset of each assignment may be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore attempt all assigned problems.

**IMPORTANT:** **PLEASE NOTE THAT THERE IS NO “100% FINAL EXAM” OPTION IN THIS COURSE.**

Lecture	Sections	Topics to be covered
1	1.3, 1.6, 1.7, 1.8	Simple linear regression models; estimation of regression function; estimation of error term variance; normal error regression model.
2	2.1, 2.2, 2.4	Estimation of $\beta_0$ and $\beta_1$ ; interval estimation of $E(Y_h)$ . <b>Introduction to R program.</b>
3	2.5, 2.6, 2.7	Prediction of new observation; confidence band of regression line; ANOVA approach to regression analysis.
4	2.8, 2.9, 3.1, 3.2	General linear test approach; coefficient of correlation; Diagnostics for Predictor Variable; Residuals.
5	3.3, 3.4, 3.7, 4.1	Diagnostics for residuals; Overview of Tests involving Residuals; F-test for lack of fit; Joint estimation of $\beta_0$ and $\beta_1$ .
6	4.2, 4.3, 4.4, 5.1, 5.2	Simultaneous estimation of mean responses; Simultaneous prediction intervals for new observations; Regression through origin; Matrices, Matrix Addition & Subtraction.
7	5.3, 5.4, 5.5 <b>Class Test</b>	Matrix Multiplication; Special Types of Matrices; Linear Dependences & Rank. <b>Class Test will cover material from Section 1.3 to section 4.4.</b>
8	5.6, 5.8, 5.9, 5.10	Inverse of a matrix Random vectors and matrices; differentiation of a vector and scalar function of $n \times n$ matrix; Simple linear regression model in the matrix form. Least square estimation of regression parameters.

9	5.11, 5.12, 5.13	Fitted values and residuals; ANOVA results; inferences in regression models.
10	6.1, 6.2, 6.3	Multiple linear regression models; general linear regression model in matrix terms; estimation of regression coefficients.
11	6.4, 6.5, 6.6, 6.7	Fitted values and residuals; ANOVA results; inferences about regression parameters; inferences about mean response and prediction of new observation.
12	6.8, 6.9, 7.1, 7.2	Diagnostics and remedial Measures; An Example-Multiple Regression with Two Predictor Variables; Extra sum of squares; application of extra sum of squares.
13	7.3, 7.4, 7.5, 7.6. <b>Review</b>	Tests concerning regression coefficients; Coefficient of partial determination; standardized multiple regression models; multicollinearity and its effects.

#### Academic Integrity and the Academic Code of Conduct

This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: [concordia.ca/students/academic-integrity](http://concordia.ca/students/academic-integrity)." [Undergraduate Calendar, Sec 17.10.2].

#### Addendum:

This course will be taught, and all assessments will be completely online. A midterm and/or a final online exam will be provided through the Concordia Online Exams (COLE) platform with online proctoring (also known as auto-proctoring). More information about the COLE system may be found at the [COLE website](#).

Please note the following respect to online proctored exams:

- That the exam will take place during the exam period at the designated date and time set by the professor (midterm) or the Exams office (final). All exam times will be set to Eastern Standard/Daylight Time.
- That your image, voice and screen activity will be recorded throughout the duration of the exam.
- That you must show your Concordia University Identification card to validate your identity. Alternative government issued photo identification will be accepted, though it is not recommended. Only identification in English or French will be accepted.
- That any recording made will only be viewed by authorized university personnel (no external entity has authorization to review the recording).
- That you will be responsible for ensuring appropriate, properly functioning technology (webcam, a microphone, appropriate browser and an ability to download any necessary software, as well as a reliable internet connection with a minimum of a 3G connection).
- That you are very **strongly recommended** to enter the virtual test site found at the [COLE website](#) and become familiar with the software that will be used for your exam before starting the exam.

- That you will need a quiet place within which to take the exam. Earplugs or noise-cancelling headphones that are not connected to a device may also be used to allow you to focus for the duration of the exam.

Students who are unable to write an exam because they are unable to meet the above conditions and requirements are advised that they will need to drop the course. More information can be provided on the next offering of this course by consulting the Department. Students are advised that the drop deadline (DNE) for this course is **May 17, 2021**.

Students who require additional accommodations for their exams due to a documented disability should contact the Access Centre for Students with Disabilities as soon as possible ([acsinfo@concordia.ca](mailto:acsinfo@concordia.ca)).

If you face issues during the exam, you should inform your professor of those issues immediately. Please note that there are in-exam supports you should spend time getting to know. Visit the [COLE website](#) for more information.

Note: Zoom is included as an institutionally approved technology. This means we have been assured of the privacy protections needed to use freely within the classroom.

Zoom will be used in this course to facilitate learning at a distance. It may be used to record some or all of the lecture and/or other activities in this course. If you wish to ensure that your image is not recorded, speak to your instructor as soon as possible.

Also, please note that you may not share recordings of your classes and that the instructor will only share class recordings for the purpose of course delivery and development. Any other sharing may be in violation of the law and applicable University policies, and may be subject to penalties.

### **Behaviour**

All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the [Code of Rights and Responsibilities](#) which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

### **Intellectual Property**

Content belonging to instructors shared in online courses, including, but not limited to, online lectures, course notes, and video recordings of classes remain the intellectual property of the faculty member. It may not be distributed, published or broadcast, in whole or in part, without the express permission of the faculty member. Students are also forbidden to use their own means of recording any elements of an online class or lecture without express permission of the instructor. Any unauthorized sharing of course content may constitute a breach of the [Academic Code of Conduct](#) and/or the [Code of Rights and Responsibilities](#). As specified in the [Policy on Intellectual Property](#), the University does not claim any ownership of or interest in any student IP. All university members retain copyright over their work.

### **Extraordinary circumstances**

In the event of extraordinary circumstances and pursuant to the [Academic Regulations](#) the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the changes.