STAT 1221/2220: Applied Regression
Fall 2025

Instructor:	Dr. Bryan Nelson
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Office:	1817 Posvar Hall
Office Hours:	Tuesday 11:00 AM - 1:00 PM and Wednesday 12:15 PM - 1:15 PM
Class Time:	Monday and Wednesday: 2:00 PM - 3:15 PM
Classroom:	123 Victoria Building
Prerequisite:	Completion of either STAT 1000, 1060, 1100, or 1152 OR grade of at least B- in STAT 200

General Information

Course Description: This course establishes a foundation in regression modeling and its application in statistical analysis. Models that will be covered include simple linear regression, multiple regression, analysis of covariance, and polynomial regression. Additional emphasis will be placed on variable transformations, interaction terms, residual analysis, collinearity, and model selection. Students will develop proficiency in using R for statistical analysis and will be introduced to LaTeX for typesetting statistical notation relevant to regression.

This course places great emphasis on the accuracy of calculations. While the calculations themselves are not computationally intensive or particularly difficult, there are a lot of them. Attention to detail and double-checking your work will be essential for success in this course.

Attendance Policy: In-person attendance for the lectures is highly encouraged, but is not required. However, attending class will be your only source of extra credit during the semester. Lectures will be recorded and posted after class on Canvas through Panopto but will not be available synchronously via Zoom. You are fully responsible for the content in any classes you miss, and you are responsible for obtaining the lecture notes from either another student or the lecture recording. Remember that technology issues can occur that may prevent the recording from working properly, so attending class is the only guaranteed way to obtain the content from the lecture.

Office Hours: All office hours will be held in my office (1817 Posvar Hall) during the times listed above each week. No appointment is necessary so feel free to drop in at any point during these times. Please come prepared with specific questions so we can make the best possible use of the time.

Grader Information: Your grader will be responsible for grading the homework assignments and holding office hours throughout the semester. Their information is listed below:

Name	Email	Office Hours	Office Hours Location
Jadon Freed	jwf46@pitt.edu	Thursday 9:00 AM - 11:00 PM	

Email Policy: Throughout the semester, your grader and I check our email Monday through Friday between the hours of 9:00 AM and 5:00 PM as our schedules permit. We check our email infrequently outside of this time frame. Emails sent before 5:00 PM will generally receive a response that day. Emails sent after 5:00 PM on weekdays or at any time over the weekend will receive a response on the next business day. If you have a question regarding a homework assignment, make sure you send it before 5:00 PM; failure to receive a response on an email sent late on the due date does not constitute a valid reason for an extension or other accommodation.

If you email either your grader or me with a question about an error regarding R code, **attach the R markdown file** and **include a screenshot of the error message** you are getting. It is often challenging to diagnose the problem without seeing the code and trying to reproduce the error. Similarly, if you are struggling with inputting an answer on a Gradescope problem, include a screenshot of the problem and your attempted solution.

Textbook: There is no required textbook for this course. A PDF file titled *Applied Regression Problems* is posted on the Canvas page. This document was written by the instructor and contains a collection of exam problems that were given in this course over the past five years. Also included in Chapter 0 is a review of topics that are covered in an introductory statistics course and are important for success in this course. Students should review this chapter during the add/drop period of this course to ensure they are prepared for the content in STAT 1221.

Students who would like a textbook as a supplementary resource should consider *Applied Regression Analysis and Other Multivariable Methods*, 5th ed. by Kleinbaum, Kupper, Nizam, and Rosenberg. This book comes the closest to incorporating all the topics in this course. It can be rented from Amazon and is on reserve at the library.

Grading Criteria

1. **Homework (28%) - Broken down into 25% for problem sets and 3% for R code**

   - There will be **nine (9)** homework assignments throughout the semester that are spaced approximately 1 to 2 weeks apart from one another. They are not weighted equally. **All** will count towards the final course grade, and **none** will be dropped.
   - Each assignment requires you to complete a problem set on Gradescope and submit a knitted R markdown file containing your R code. The parts of the assignment that must be completed in R are embedded into the problem set so you will be completing these simultaneously. A template for completing the R code is posted on Canvas for each assignment to help keep your R code organized. To complete each assignment:
     - Download the R markdown template and the data from the assignment link on Canvas
     - Access the problem set on Gradescope
     - Work through the assignment by typing your answers into Gradescope or the R markdown file
     - Once complete, submit the problem set on **Gradescope**, knit your R code to HTML, and upload the knitted R file to the appropriate link on **Canvas** as an HTML file
   - Problem sets will be graded for **accuracy** while the R code will be graded for **completion**.
   - Homework due dates and the lectures they cover are listed in the table below. All assignments are due at **11:59 PM** on the date specified. However, there is a 3-hour grace period built in where the assignment can still be submitted with no penalty.
   - No extensions will be given on any homework assignments except for those with extreme extenuating circumstances. These will be handled on a case-by-case basis and may be subject to a departure from this policy with appropriate documentation. You must reach out before the assignment's due date for me to consider your request.
     - **Last-minute technology or Internet connection problems are not grounds for an extension.** I recommend you begin each assignment well ahead of time so you have time to use one of Pitt's labs to complete the assignment should you encounter a problem with your own computer. **See Page 5 for instructions on how to access Pitt's Virtual Lab as an alternate way of using R and RStudio.**
     - If there is a problem with Canvas or Gradescope that prevents you from submitting or uploading the assignment, it is your responsibility to reach out to Pitt's Technology Help Desk. A response verifying the issue may be grounds for an extension provided the message was sent before the assignment deadline.
     - Disability accommodations that permit extensions on assignments supersede the above policy in accordance with the official notification letter provided by Disability Resources and Services. The request for an extension must be made via email and sent before the assignment's deadline. You may assume that the request is granted provided you have not yet reached the maximum number of extension requests permitted in the notification letter. The instructor will extend the deadline on Canvas and Gradescope upon reading the request.
   - Solutions will be available on Canvas within **two (2)** days of the due date. You can find a PDF of the solutions for each assignment in its entirety under the **Homework Solutions** link in the **Pages** section of Canvas along with the R code.

Assignment	Day	Date	Topic(s)	Lectures
Homework 1	Thursday	September 11	Review of Relevant Topics	1-2
Homework 2	Thursday	September 18	Fundamentals of Simple Linear Regression	3-5
Homework 3	Thursday	September 25	Inference in Simple Linear Regression	6-7
Homework 4	Thursday	October 9	Topics in Multiple Regression	8-10
Homework 5	Thursday	October 16	Regression Diagnostics and Transformations	11-12
Homework 6	Thursday	October 30	Transformations, Confounders, Categorical Pred.	13-15
Homework 7	Thursday	November 13	Interaction Models, ANACOVA, Post-Hoc Testing	16-18
Homework 8*	Friday	November 28	Polynomial Regression and Collinearity	19-20
Homework 9	Friday	December 5	Model Selection and Cross Validation	21-23

* **Homework 8** will earn 5 points of extra credit if turned in before **Friday, November 21** at **11:59 PM**.

2. **Three Midterm Exams (48%, 16% each)**

- The three midterm exams are scheduled for **October 1**, **October 22**, and **November 19** in class.
  - **Midterm 1** will cover Lectures 3-7 (Simple linear regression)
  - **Midterm 2** will cover Lectures 8-12 (Multiple regression and regression diagnostics)
  - **Midterm 3** will cover Lectures 13-18 (Transformations, confounding, categorical predictors, interaction models, ANACOVA, and post-hoc testing)
- Each midterm exam will be scored out of **fifty (50)** points and assigned a weight of **16%** towards the student's final course percentage.
- Exams will consist of a mix of problems and conceptual questions. Old exam problems can be found in the PDF posted on Canvas. Conceptual questions will be derived from content in the lecture slides.
- For each midterm exam, you may use the front and back of **one (1)** sheet of 8.5"x11" paper for any **handwritten** notes. (Your formula sheet may be written on a tablet and printed out.)
- A calculator is required to complete each exam. Any type of scientific or graphing calculator is sufficient. You may not use your phone as a calculator on the exams.
- There are no make-up exams without verifiable, written documentation for a medical emergency, family emergency, or university-sponsored event. Make-up exams may be taken during the instructor's office hours, the grader's office hours, or scheduled at the Testing Center during a mutually agreed upon time.
- Exams missed for any other reason or those missed without an excuse will earn a score of **zero (0)**.
- Students are not permitted to retake exams or earn points back by doing exam corrections.
- Your single lowest midterm exam score will be replaced by your score on the **cumulative** section of the final exam if and only if it improves your grade. If you miss at least one midterm, it will replace a single score of **zero (0)**; otherwise, it will replace the single lowest score of the three exams.

3. **Final Exam (24%)**

- The final exam will be an in-class exam administered in accordance with the University of Pittsburgh's final exam schedule: **Friday, December 12** from **2:00 PM - 3:50 PM**
- The rules stated above for the midterm exams regarding formula sheets and calculators also apply to the final exam. However, for the final exam, you are permitted to use the front and back of **two (2)** sheets of 8.5"x11" paper for any handwritten notes.
- The final exam will be scored out of **100** points and assigned a weight of **24%** towards the student's final course percentage. It will also consist of a mix of problems and conceptual questions.
- The final exam will be cumulative and use the following format:
  - **50** points will test the topics from **Lectures 19-23**
  - The other **50** points will comprise the cumulative portion of the final exam: 40 points on content from **Lectures 3-18** and a 10-point question on all models and tests covered in the course
  - Both sections will consist of problems and conceptual questions
- **There are no alternate times for when you may take the final exam.** The final exam may not be taken early under any circumstances. Students who miss the final exam due to extenuating circumstances may be eligible for a G grade with appropriate documentation and will be permitted to make it up during the spring semester.

4. **Attendance (2% extra credit)**

- Attendance will be taken on **nine (9)** pre-selected days throughout the semester.
- At a random time during class, a QR code will be projected on the screen for you to scan. The link will take you to a Qualtrics survey, where you will fill out your name and PeopleSoft number to register your attendance for the day.
  - Students without the ability to answer the survey (e.g. no smartphone or dead cell phone battery) can register their attendance for the day simply by speaking with the instructor after class.
  - Qualtrics reports location data for where the form was filled out and is set up to identify potential duplicate responses. Do not send the link to anyone outside of class or fill out the form for someone else. Violations of this policy will constitute an academic integrity violation.
- Students who attend at least **eight (8)** of the 9 classes will receive the full 2% in extra credit.
- On days when attendance is taken, 0.5% will be deducted from the extra credit for each missed class after the first until it has reached 0%. (i.e. 4 or fewer classes = 0%, 5 classes = 0.5%, 6 classes = 1%, and 7 classes = 1.5%)

Grading Policies

Assessment Solutions: Solutions to homework assignments will be posted on Canvas no later than **48** hours after the deadline. A PDF of the solutions for each assignment will be posted under the **Homework Solutions** link in the **Pages** section of Canvas along with the R code. Exam solutions will likely be posted on Canvas when the exam scores are released. However, they may be delayed by up to **24** hours if extenuating circumstances arise. A PDF of the solutions will be posted under the **Exam Solutions** link in the **Pages** section of Canvas.

Regrade Requests: Any regrade requests on homework assignments must be made within **one (1)** week of the grades being released. Regrade requests on exams must be made within **one (1)** week of the solutions being posted on Canvas. Requests sent later than these deadlines will not be considered, and your grade on the assessment will be considered final after this point. Regrade requests will only be considered for errors made by the grader of the assessment - not for subjective decisions made regarding the number of points lost.

Exam Feedback Policy: I will not respond to any emails regarding exam performance within the first **24** hours of scores being released. If you are not satisfied with your grade, take some time to review your mistakes, read through the solutions, and make a list of any remaining questions you have. After **24** hours, I will be happy to respond to emails or meet with you during office hours about mistakes that you made and/or how to improve.

Final Course Grade

Final Course Percentage Calculation: Final course percentages will be calculated using the following equation:

$$\frac{\text{Exam 1 Points}}{50} \times 16\% + \frac{\text{Exam 2 Points}}{50} \times 16\% + \frac{\text{Exam 3 Points}}{50} \times 16\% + \frac{\text{Final Exam Points}}{100} \times 24\%$$
$$+ \frac{\text{HW Points Earned}}{\text{Total HW Points}} \times 25\% + \frac{\text{R Points Earned}}{\text{Total R Points}} \times 3\% + \text{Attendance Extra Credit}$$

Assigning of Course Grades: Final course percentages will be rounded to the nearest percent. (Decimals of 0.50 and above will be rounded up; decimals less than 0.50 will be rounded down.) They will then be assigned based on the cutoffs in the table below with one exception, detailed below.

Percent	93-100	90-92	88-89	83-87	80-82	78-79	70-77	68-69	63-67	60-62	0-59
Grade	A	A-	B+	B	B-	C+	C	D+	D	D-	F

Grades are not negotiable and no additional assignments will be offered as extra credit beyond what is specified in the syllabus. Your perceived effort, GPA, financial aid, etc. will not be considerations for your final course grade. It would be unethical for me to assign you a higher course grade than you have earned, and it is unethical for you to attempt to influence the assigning of course grades by asking me to round up your grade or for an additional assessment. These requests will be denied without further discussion.

Exam Performance Requirement: Students must earn at least **175** of the **250** points (or **70%** of the points) available on the four exams to earn a C in the course. This is a raw, unweighted percentage of points earned on exams after the lowest midterm score has been replaced with the score on the cumulative portion of the final exam where applicable. In other words, to earn at least a C in the course the following must be true:

$$\frac{\text{Exam 1 Points} + \text{Exam 2 Points} + \text{Exam 3 Points} + \text{Final Exam Points}}{250} \times 100\% \geq 70\%$$

Students with a final course percentage of at least 70% after including exam scores, homework scores, attendance extra credit, and the appropriate weights, but failing to earn at least 175 points on the exams will earn a C- for the course. Students with a final course percentage less than 70% will earn the grade specified in the table above.

Health and Grading: If extenuating personal circumstances prevent you from completing the course, a G grade may be awarded if and only if you have been making sufficient progress towards completing the course. To be eligible for a G grade, you must have turned in at least 6 of the 9 homework assignments, taken at least 2 of the 3 midterms, and have a grade of at least 70% to have the opportunity for a G grade. If a G grade is awarded, then the student and instructor will complete a contract that details a plan and timeline for completing the course.

Students with grades lower than 70% who are considering a request for a G grade are better off retaking the course in a future semester rather than attempting to complete the coursework independently.

Statistical Software

Software Installation: The statistical software package used in this course is R. R is a relatively easy-to-learn coding language designed specifically for statistical analysis that is used in many occupations. To use R, you will need to download two pieces of software: R, which is the programming language that performs the analyses, and RStudio, which is the IDE that allows you to write organized code. Each of these can be installed as follows:

- **R**: Download from cran.rstudio.com, where there is a link for PC, Mac, and Linux.
  - If you are using Windows, click on **Download R for Windows**. On the following page, click on the link that says **install R for the first time**. This will take you to another page, where you should click **Download R-4.5.1 for Windows**.
  - If you are using a Mac, click on **Download R for macOS**. On the following page, click on either **R-4.5.1-arm64.pkg** or **R-4.5.1-x86_64.pkg** depending on your computer's processor. (Descriptions are on the webpage. If you are unsure, the second link should work for all Macs.)
- **RStudio**: Download from posit.co/download/rstudio-desktop/. Scroll down until you see a box that says either **Download RStudio Desktop for Windows** or **Download RStudio Desktop for MacOS** depending on the type of computer you have. Once you click on this link, the RStudio download will appear in your **Downloads** folder. Open this file and follow the on-screen instructions to install RStudio.

Software Help: If you need additional help R or RStudio or encounter difficulty with the software at any point throughout the semester, the Pitt Technology Help Desk is available for assistance if you are unable to attend office hours. They have two drop-in locations: **G-65 in Hillman Library** and the **University Store on Fifth**. Their working hours and additional information can be found at this link.

Virtual Lab

R and RStudio are installed on university computers as well. Should you run into a problem with your own computer or if your computer does not have the capabilities to run R and RStudio, you can log into Pitt's Virtual Lab. Navigate to this link (technology.pitt.edu/services/virtual-lab) and follow the directions on the screen. This will allow you to control one of Pitt's computers through your browser. Anything you do while on the Virtual Lab will save to your university OneDrive account.

Additional Course Policies

Disabilities: Students who have a disability that requires special accommodations, contact Disability Resources and Services in 140 William Pitt Union (www.drs.pitt.edu). They will verify the disability and determine reasonable accommodations for this course. Accommodations will not be granted retrospectively. If a student takes an exam before being approved for accommodations or chooses not to use the accommodations, they may not retake the exam and the original score will remain.

Students with alternative testing accommodations should schedule their exams to be taken in the Testing Center. The exam should be scheduled on the same day as the rest of the class and should start at approximately the same time. Exams are permitted to start a bit earlier or later than the class time to accommodate the student's schedule. **The Testing Center requires students schedule an exam time at least 3 business days in advance for midterms and at least 7 business days in advance for final exams.**

Academic Integrity: Students are expected to comply with the University of Pittsburgh's Academic Integrity policy (www.as.pitt.edu//fac/policies/academic-integrity). Any student found deliberately copying another student's homework assignment or allowing another student to copy their homework will receive a zero for that assignment. Any student found cheating on an exam or assisting others in cheating on an exam will receive an F for the course. All cases of academic dishonesty may be subject to further disciplinary action than listed above, which may include participation in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity.

Although this syllabus deals with the most common situations that arise, we live in an imperfect world where we must deal with unexpected circumstances. Rules do not exist for every situation. Those that do not fall under the context of the syllabus will be evaluated on a case-by-case basis. Any attempt to exploit loopholes or borderline cases not explicitly covered in the syllabus will be considered a case of academic dishonesty.

Disclaimer: While this syllabus is unlikely to change, the instructor reserves the right to modify the due dates and lectures covered on homework assignments, dates of the midterm exams, remove or add material not otherwise specified, and/or remove lectures to make this course as successful as possible.

Fall 2025 Course Calendar

Class	Day	Date	Topic	Recommended Practice Problems
1	Monday	August 25	Review: Variables and Probability Distributions	Ch. 0 #1, 2, 3, 4
2	Wednesday	August 27	Review: Descriptive Statistics and Inferential Statistics	Ch. 0 #5, 6, 7
	Monday	September 1	*No Class: Labor Day*	
3	Wednesday	September 3	Correlation and the Least Squares Method	Ch. 1 #1a-c, 2a-c, 3a-d, 4a-c, 5a-c, 6a-c, 7a-c, 8a-c
4	Monday	September 8	Variation in Simple Linear Regression	Ch. 1 #1d-e, 2d, 3e-g, i, 4d-g, 5d-f, 6d-e, 7d-f, 8d-e, h
5	Wednesday	September 10	Assessing the Simple Linear Regression Model	Ch. 1 #3h, 6g, 8g
6	Monday	September 15	Inference in SLR: Slope and Intercept	Ch. 1 #4h-i, 5f, 6f, 8g; Ch. 2 #1a-f, 2a-e, h, 3a-f, l, 4a-d, j, 5a-f, 6a-i, 7a-h
7	Wednesday	September 17	Inference in SLR: Correlation, Predictions	Ch. 2 #1g-k, 2f-g, 3g-k, 4e-j, 5g-l, 6j-p, 7i-o
8	Monday	September 22	Foundations of Multiple Regression	Ch. 3 #1a-d, f, 2a-c, h, 3a-b, g, 4a-c, j, 5a-c, h, 6a-c
9	Wednesday	September 24	Partial F-Test	Ch. 3 #1g, i-k, 2d-f, 3c-e, 4d-f, 5d-f, 6d, f
10	Monday	September 29	Multiple Partial F-Test and Additional Inference	Ch. 3 #1h, l-m, 2g, 3f, h-i, 4g-i, k-l, 5g, i, 6e, g-j; Ch. 4 #3c, 4c
	Wednesday	October 1	**Exam #1 (Lectures 3-7)**	
11	Monday	October 6	Regression Diagnostics: Part 1	Ch. 4 #1a-e, 2a-e, 3d-h, 4d-h
12	Wednesday	October 8	Regression Diagnostics: Part 2	Ch. 4 #1f-g, 2f, 3a-b, i-j, 4a-b, i-j
13	Monday	October 13	Transformations	Ch. 4 #5, 6
14	Wednesday	October 15	Confounding Variables and Control Variables	Ch. 8 #1
15	Monday	October 20	Categorical Predictors	Ch. 5 #1, 2
	Wednesday	October 22	**Exam #2 (Lectures 8-12)**	
16	Monday	October 27	Interaction Modeling	Ch. 5 #3, 4, 5, 6, 7
17	Wednesday	October 29	Analysis of Covariance	Ch. 6 #1, 2, 3, 4
18	Monday	November 3	More Complex Models and Post-Hoc Testing	Same as Lectures 16 and 17
19	Wednesday	November 5	Polynomial Regression and Lack of Fit	Ch. 7 #1, 2, 3, 4
20	Monday	November 10	Collinearity	Ch. 8 #2, 3, 4, 5
21	Wednesday	November 12	Model Selection: Part 1	Ch. 9 #1c-d, g-h, 2a-b, e-f, 3a-b, e-f, 4a-b, 3-f
22	Monday	November 17	Model Selection: Part 2	Ch. 9 #1a-b, e-f, 2c-d, g-i, 3c-d, g-i, 4c-d, g-i
	Wednesday	November 19	**Exam #3 (Lectures 13-18)**	
	Monday	November 24	*No Class: Thanksgiving Break*	
	Wednesday	November 26	*No Class: Thanksgiving Break*	
23	Monday	December 1	Cross Validation	Ch. 9 #1i-l, 2j-m, 3j-m, 4j-m
	Wednesday	December 3	*Review for Final Exam*	
	Friday	December 12	**Final Exam (2:00 PM - 3:50 PM)**	

Note: This list of topics is unlikely to change, but may be modified if necessary. Sufficient notification of any changes will be provided. The list of suggested practice problems for each topic may also be updated later in the semester to better reflect the content that will be covered.