**Syllabus STA 108**

**Lecture:** MWF 3:10 - 4:00 p.m., REMOTE.

**Teachers**

* Prof. Jairo Fúquene-Patiño: jafuquenepatino@gmail.com, Office Hours: Monday 3:00 pm - 5:00 pm or by appointment, Remote Instruction.
* T.A. Yidong Zhou: [ydzhou@ucdavis.edu.](mailto:ydzhou@ucdavis.ed)Laboratory. Thursday 10:00 am - 10:50 am & 11:00 am -11:50 am. Office Hours: Friday 12:00 pm - 2:00 pm. Remote Instruction.

**Rules**

* All communications should be done on canvas and you should email me at jafuquenepatino@gmail.com
* There will be weekly homework assignments. The assignments are due Wednesdays, 5:00 p.m. and for some assignments you need to use R. Each submitted output must be accompanied by a narrative providing the interpretation of your results, even if this is not explicitly mentioned in the assignment.
* Grading: assignments (20%), two midterms (20% each), final exam (20%) on canvas and a final project (20%).
* You should do the assignments on your own, but you can get advice from others in the class. You must never copy code from someone else in the course on the homework, midterm, final exam and project.

**Lectures**

* Course material will be released through canvas

**Main References**

* Kutner, M.H., C.J. Nachtsheim, J. Neter and W. Li (2005). Applied Linear Statistical Models, 5th ed. McGraw-Hill, New York (main book).
* Faraway, J. J. (2014). *Linear models with R*. CRC press (homeworks and some applications during the lectures).

**Course description**

Course goals are to develop facility in the construction of multiple regression models and their application to the analysis of experimental data.

**Summary of course contents:**

* Standard regression model
* General linear model
  + Review of matrix arithmetic
  + Estimates of *β* and *σ*2
  + Confidence and prediction intervals
  + Decomposition of sum of squares, and lack of fit tests
* Analysis of residuals to check on validity of assumptions
* Multiple and polynomial regression-selecting correct variables
* Regression diagnostics
* Analysis of covariance
* Use of R base and/or R studio to analyze real data sets

**Software:**

R (https://www.r-project.org) and/or R studio (https://rstudio.com). The R and R studio packages are open access, therefore free of charge, and it will allow you to implement state-of-the art regression analysis. The book of Faraway, J. J. (2014) has many applications for linear models with R.

**Course Policies**

Due to the COVID-19 pandemic, all class meetings and office hours will be held online using Zoom.

**Schedule and Homework assignments**

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| **Lecture** | **Date Assigned** | **Date Due (Homework)** | **Homework** | **Topics covered and skipped** |
| 1 | Mon March 29 | Wed. April 7 | Ch. 1: #2, 8, 12, 30 | Sections 1.1 to 1.5 (Read 1.4 on your own) |
| 2 | Wed March 31 | Wed. April 7 | Ch. 1: #27; use computer, show work | Sections 1.6, 1.7; Skip 1.8 |
| 3 | Fri April 2 | Wed. April 7 | Ch. 2: #27 | Section 2.1, briefly 2.2, Skip 2.3 |
| 4 | Mon April 5 | Wed. April 7 | Ch. 2: #9, 10, 12 | Sections 2.4, 2.5; Skip 2.6 |
| 5 | Wed. April 7 | Wed. April 14 | Ch. 2: #28ab, 29bde | Sections 2.7 (except pgs 68-71) and 2.9; Do 2.8 later; Read 2.10; Skip 2.11 |
| 6 | Fri. April 9 | Wed. April 14 | Ch. 3: #2, 9 (draw plot by hand or computer) | Sections 3.1 to 3.3; Skip 3.4 to 3.6 |
| 7 | Mon. April 12 | Wed. April 14 | Ch. 3: #19,20 | Section 3.9; Read 3.8 |
| 8 | Mon. April 12 | Wed. April 21 | Ch. 3: #18 | Already noted above |
| 9 | Wed. April 14 | Wed. April 21 | Ch. 3: #23 and Data set. Use R or/and R Studio. | Sections 2.8 and 3.7; Skip Chapter 4 |
| 10 | Fri. April 16 | Wed. April 21 | Ch. 5: #1, 3, 8ab (Do these by hand, not computer) | Sections 5.1 to 5.6; Read 5.7 |
| 11 | Mon. April 19 | Wed. April 21 | Ch. 5: #5 (by hand or computer), 17ab, and Use matrix algebra to show that the hat matrix H is idempotent. | Sections 5.8 to part of 5.11 |
| 12 | Wed. April 21 | Wed. April 28 | Ch. 5: #24ab | Sections 5.11 and 5.13; read 5.12 |
| 13 | Fri. April 23 | Wed. April 28 | Ch. 6: #1, 22ab and Interpret in your own words the coefficients (b0, b1, b2) for the Example in Section 6.9 (see pg 240 for coefficients). | Section 6.1 |
| 14 | Mon. April 26 | Wed. April 28 | Ch. 6: No new homework today. | Sections 6.2 to 6.5 |
| 15 | Wed. April 28 | Wed. May 12 | Ch. 6: #15bc, 16a, 17 | Sections 6.6, 6.7 |
| 16 | **Fri. April 30** | **Midterm** | **Midterm** | **Midterm** |
| 17 | Mon. May 3 | Wed. May 12 | Ch. 7: #5, 26 | Sections 7.1 to 7.3; Skip 7.4, 7.5 |
| 18 | Wed. May 5 | Wed. May 12 | Ch. 7: #22 | Finish Section 7.3 (HW is from Sect. 7.6, will cover Fri.) |
| 19 | Fri. May 7 | Wed. May 19 | Ch. 8: #4abeg (parts a, b, e, g only) | Section 7.6; Section 8.1 |
| 20 | Mon. May 10 | Wed. May 19 | Ch. 8: #16abc | Section 8.3 |
| 21 | Wed. May 12 | Wed. May 19 | Ch. 8: # 21 | Section 8.4 |
| 22 | Fri. May 14 | Wed. May 19 | Ch. 8: #17, 18, 20 | Sections 8.2, 8.5 (Read 8.6, 8.7) |
| 23 | Mon. May 17 | Wed. May 26 | Ch. 9: #25b | Sections 9.1 (partial), 9.3 |
| 24 | Wed. May 19 | Wed. May 26 | Ch. 9: #25c AND Fit the best model from part c and create an appropriate residual plot. Write down the fitted model, show the plot, and comment on whether you think it's a good model. | Section 9.4 (Read 9.1, 9.2) |
| 25 | **Fri. May 21** | **Midterm** | **Midterm** | **Midterm** |
| 26 | Mon. May 24 | Wed. May 26 | Ch. 9: #4, 5, 7 | Finish Sections 9.3, 9.4 (Skip 9.5, 9.6 or read if interested) |
| 27 | Wed. May 26 | Wed, June 2 | Chapter 10 homework is in this file. There will be no further assignments. | Sections 10.2, 10.3, 10.4 |
| 28 | Fri. May 28 |  |
| 29 | **Wed. June 2** |  |  | **Discussion final Project** |
| 30 | **Mon. June 7** |  |  | **Final Exam** |
| 31 | **Wed. June 2** |  |  | **Deadline final project** |