

# Department of Environmental Health

## I. Course Information:

<b>Title:</b>	Advanced Biostatistics
<b>Course #:</b>	26 BE 7023 & 26 PH 7023
<b>Credit Hours:</b>	3
<b>Term:</b>	Fall 2019
<b>Prerequisites:</b>	26 BE 7022, 26 PH 7010, or equivalent

## II. Instructor Information:

<b>Name:</b>	Dr. M B Rao
<b>Title:</b>	Professor
<b>Office Information:</b>	
<b>Office:</b>	247 Kettering Lab (513)558-3602
<b>Fax:</b>	Not used
<b>Email:</b>	marepalli.rao@uc.edu
<b>Office Hours:</b>	Tuesdays and Thursdays 1:00-2:00 PM
<b>Teaching Assistants:</b>	Ziyun Wang (wang5zn@mail.uc.edu)
<b>Communication Policy:</b>	Students are encouraged to contact me anytime via email or phone. A response will be given within 36-48 hours except on weekends.

## III. Course Materials

### Required

- None is required; my notes (posted on the blackboard) is self-sufficient

### Optional

- Julian Faraway (2015) – Linear Models with R, Second Edition, CRC Press, New York
- Julian Faraway (2016) – Extending the Linear Model with R, Second Edition, CRC Press, New York
- John Fox and Sanford Weisberg (2011) – An R Companion to Applied Regression, Second Edition, Sage Publications
- Daniel Wright and Kamala London (2009) – Modern Regression Techniques Using R, Sage Publications
- Christopher Hay-Jahans (2012) – An R Companion to Linear Statistical Models, CRC Press, New York
- Simon Sheather (2009) – A Modern Approach to Regression with R, Springer, New York
- Eugene Demidenko (2013) – Mixed Models Theory and Applications with R, Wiley, New York

## IV. Course Description:

All articles published in the New England Journal of Medicine during 2004-05 were surveyed for statistical content. Simple Linear Regression was used in 6% of the articles, Multiple Regression 51%, Repeated Measures 12%, and Survival Methods 61% (Cox Regression), isolating the regression-themed

methodologies. This class will pay homage to regression in all its glory. This is purely an applied class with examples culled from a variety of sources. The software R will be used for all computational needs.

## V. Student Learning Outcomes:

Upon successful completion of this course, the learner will be able to:	How is this outcome assessed?
1. Comprehend the role of regression in developing cause and effect models	Homework 1
2. Enhance numerical output with graphical presentations	Homework 2
3. Learn the mechanics of multiple regression	Homework 3
4. Pursue Model Selection algorithms and cross-validation methodologies	Homework 4
5. Tame the data via Box-Cox transformations	Homework 5
6. Build robust regression models	Homework 6
7. Carry out lasso and least angle regressions	Homework 7
8. Exercise quantile regressions, principal component regressions, partial least squares regressions and their ilk	Homework 8
9. Plunge into regressions for discrete response variables	Homework 9
10. Handle regressions for counts	Homework 10
11. Rope in mixed models	Homework 11

## VI. Instructional Methods (Including Description about Bb):

The following course has the Blackboard (Bb) Learning Management System to provide student-centered online learning that will enhance the teaching and learning process. If you are not familiar with these tools, please visit [IT@UC's Knowledge Base for Blackboard](#).

## VII. Course Communication:

University policy requires that the email set up in Blackboard is the primary means of communication. It is advisable that you use your UC email for this purpose and that you check it often. If you choose to change your email in Blackboard to a non-UC email it is your responsibility to ensure you check it frequently.

## VIII. Course and Grading Policies:

- Course Structure:** Changes to the syllabus, due dates, course requirements or grading requirements will be made as far in advance as possible.
- Academic Code of Conduct:** Academic misconduct or dishonesty is defined in the University of Cincinnati Student Code of Conduct. Academic misconduct includes, but is not limited to: acts of

cheating, plagiarism, falsification, and misappropriation of credit. The Student Code of Conduct defines behavior expected of all University of Cincinnati students. It is each student's responsibility to know and comply with the University's Student Code of Conduct. Disciplinary procedures are explained in a step-by-step manner, and the procedures for appeal of decisions are stated. (see: [UC's Student Code of Conduct](#))

3. **Disability:** Students with disabilities who need academic accommodations or other specialized services while attending the University of Cincinnati will receive reasonable accommodations to meet their individual needs as well as advocacy assistance on disability-related issues. Students requiring special accommodation must register with the Disability Services Office. [UC's Disability Services Office](#).
4. **Counseling Services, Clifton Campus:** Students have access to counseling and mental health care through the University Health Services (UHS), which can provide both psychotherapy and psychiatric services. In addition, Counseling and Psychological Services (CAPS) can provide professional counseling upon request; students may receive five free counseling sessions through CAPS without insurance. Students are encouraged to seek assistance for anxiety, depression, trauma/assault, adjustment to college life, interpersonal/relational difficulty, sexuality, family conflict, grief and loss, disordered eating and body image, alcohol and substance abuse, anger management, identity development and issues related to diversity, concerns associated with sexual orientation and spirituality concerns, as well as any other issue of concerns. After hours, students may call UHS at 513-556-2564 or CAPS Cares at 513-556-0648. For urgent physician consultation after-hours students may call 513-584-7777.
5. **Title IX:** Title IX is a federal civil rights law that prohibits discrimination on the basis of your actual or perceived sex, gender, gender identity, gender expression, or sexual orientation. Title IX also covers sexual violence, dating or domestic violence, and stalking. If you disclose a Title IX issue to me, I am required forward that information to the Title IX Office. They will follow up with you about how the University can take steps to address the impact on you and the community and make you aware of your rights and resources. Their priority is to make sure you are safe and successful here. You are not required to talk with the Title IX Office. If you would like to make a report of sex or gender-based discrimination, harassment or violence, or if you would like to know more about your rights and resources on campus, you can consult [UC's webpage for Title IX](#) or contact the office at 556-3349.
6. **Missed and/or late examinations and graded exercises:** 1. Projects are assigned in lieu of exams. 2. All homework is due on the date stipulated on the homework sheet. Submission a day late results in a loss of 20% of the points allocated to the homework. Submission two days late results in a loss of 40% of the points. After that homework will not be accepted. You can drop one homework (supposedly one with the lowest score) in the final grade. 3. All homework is submitted on the blackboard.
7. **LCB Weather Related Protocol:** When inclement weather threatens the safety of the University of Cincinnati community, the Senior Vice President for Administration and Finance may invoke University Rule [3361: 10-55-01](#) and declare an emergency closing.  
College of Medicine Students: Graduate Students – follow all University snow policies and procedures. All classes and exams are canceled when the university has closed. On days when the

University delays opening, classes and exams will resume at the hour that the University reopens if this is at or before 3 pm.

**8. Criteria for letter grades:**

Your course grades will be based on your performance on the following:

***Point Allocation:***

*Assignments (11)                      30 points each (50% of the grade)*

*Mid-term Project (mid-October)                      20% of the grade*

*Final Project (mid-November)                      20% of the grade*

*Presentations                                      10% of the grade*

***Grading Scale***

<u>Overall Percentage / Points</u>	<u>Letter Grade</u>
90% and above	A
87%	A-
85%	B+
83%	B
80%	B-
77%	C+
73%	C
70%	C-
Below 70%	F

**IX. Course Schedule:**

Dates	Topic(s):	Readings, Lectures, & Other Materials	Assignments & Assessments	Due Dates
Week 1 (August 27 - 31)	History of Regression and the Least Squares Method	Class notes + Internet		
Week 2 (September 04)	Simple Linear Regression + Multiple Regression + LOWESS + Diagnostics	Class notes	Homework 1	September 11
Week 3 (September 11)	Model Selection	Class notes	Homework 2	September 11
Week 4 (September 18)	Box-Cox Transformations	Class notes	Homework 3	September 18

<b>Dates</b>	<b>Topic(s):</b>	<b>Readings, Lectures, &amp; Other Materials</b>	<b>Assignments &amp; Assessments</b>	<b>Due Dates</b>
Week 5 (September 25)	Influential Observations + Outliers + Robust regression	Class notes	Homework 4	September 25
Week 6 (October 02)	Lasso	Class notes	Homework 5	October 02
Week 7 (October 09) Fall Reading Days	Principal component regression + Partial Least Squares regression	Class notes	Homework 6	October 09
Week 8 (October 16)	No classes – Human Genetic Conference – Mid-Term Project will be Handed Out		Mid-term project assignment	
Week 9 (October 23)	Model Selection + Cross Validation	Class notes	Homework 7	October 30
Week 10 (October 30)	Logistic regression + Multinomial regression + Proportional odds model	Class notes	Homework 8	November 06
Week 11 (November 06)	Classification and regression trees	Class notes	Homework 9	November 13
Week 12 (November 13)	Poisson Regression	Class notes	Homework 10 + Final project assignment	November 20
Week 13 (November 20)	Zero-inflated models	Class notes	Homework 11	November 27
Week 14 (November 27)	Mixed models	Class notes		
Week 15 (December 04)	Bric-a-brac			