BISC 504: Biometry (4 credits, Remote) **Fall 2020**

Instructor: Dr. Jason Hoeksema (318 Shoemaker, 662-202-4992, hoeksema@olemiss.edu)

Lecture/Lab: Tuesday & Thursday, 9:30 a.m. – 12:00 (live on Zoom)

Office hours: By appointment (via Zoom)

Recommended course materials:

- *Discovering Statistics Using R*, by Andy Field, Jeremy Miles, and Zoe Field. 2012, Sage.

Course grading: Grades will be based on participation in and completion of lab exercises/homework (20%), a midterm exam (25%), a data analysis project (20%), and a final exam (35%).
Grading scale: >90% = A/A-, 80-89% = B+/-, 70-79% = C+/-, 60-69% = D, <60% = F

Learning objectives:
By the end of the course, students will be able to:

- Design efficient sampling schemes and experiments for biological research
- Describe and summarize data using descriptive statistics and graphics
- Conduct inferential statistical tests on a wide variety of data types
- Interpret, explain, and present the results of statistical tests

Course format:
Lectures introduce statistical concepts and approaches to data analysis. Lab exercises and associated homework assignments allow students to practice applying concepts and approaches to analysis of real data on computers, using the open-source statistical software R.

Schedule of lecture topics (relevant chapters from Field et al. in parentheses)

25 Aug Course overview; Intro to Statistics (Ch. 1) and Introduction to R (Ch. 3)
27 Aug Intro to Statistics continued (Ch. 2)
1 Sep Exploring Data with Graphs (Ch. 4)
3 Sep Probability and Hypothesis Testing
8 Sep Correlation (Ch. 6)
10 Sep Linear Regression (Ch. 7, pp. 245-260)
15 Sep Exploring assumptions and handling violations of assumptions
17 Sep Intro to Power Analysis & its application to correlation & regression
22 Sep Comparing two means: t-test, etc. (Ch. 9)
24 Sep t-test (continued, including power & sample size estimation)
29 Sep Introduction to the take-home Midterm Exam (**due Friday, October 2** at 11:59 p.m.)
1 Oct Comparing several means: ANOVA (GLM1) (Ch. 10)
6 Oct Comparing several means: ANOVA (GLM 1) (Ch. 10) continued
8 Oct Analysis of covariance: ANCOVA (GLM 2) (Ch. 11)
13 Oct Analysis of covariance: ANCOVA (GLM 2) (Ch. 11) continued
15 Oct Factorial ANOVA (GLM 3) (Ch. 12)
20 Oct Multiple regression (GLM 4) (Ch. 7, pp. 261-end)
22 Oct GLM overview, review, practice and power analysis

27 Oct Analysis of categorical response variables I: Chi-squared and related (Ch. 18)
29 Oct Analysis of categorical response variables II: Logistic regression (Ch. 8)
3 Nov Mixed models and repeated-measures designs
5 Nov Brief intro to some advanced topics: Meta-analysis, multivariate, and alternatives to null hypothesis testing
10 Nov Work on projects. Come with data and having attempted analysis.
12 Nov Writing workshop: Bring drafts of Written Components of project: Data Analysis Methods, and Results
17 Nov Presentations at 9:30 a.m., written component of project due at 10:00 p.m.
19 Nov Provision of the final exam (take-home, open-book, due at 10:00 p.m. on Monday, November 23)
23 Nov Take-home final exam due at 10:00pm

Academic misconduct: Students are responsible for abiding by the university's policies on Academic Conduct and Discipline, which are available on the university website.
**Collaboration with your peers is encouraged on lab exercises and homework, but all writing and R code must be your own, with no exceptions. On the take-home midterm exam and final exam, no discussion with other students is allowed, and all answers must be strictly your own work. Violation of this policy or any others will not be tolerated in this course, and possible sanctions for academic misconduct include: failure on the work in question, course grade reduction or failure of the course, disciplinary probation, or suspension or expulsion from the University.

Cell phones, texting, e-mail, and web-browsing in class and meetings: Turn off your phones and other electronic devices before entering class or a meeting with an instructor. Computers are encouraged in class, but may only be used for course work. Texting, e-mailing, internet browsing, and making phone calls are all **strictly prohibited** during class and meetings with the instructor.

COVID-19 policies and information

- Students and faculty must quarantine for 14 days if they have a positive COVID-19 test, possible virus exposure, or display any symptoms related to COVID-19.
- Students with COVID-19 should seek medical attention at the Student Health Center and contact their instructor to let them know that they are sick, quarantined, or have some other health-related absence.
- If students test positive for COVID-19 at any health care facility, they must contact the Student Health Center at 662-915-7274. (Faculty and staff should contact the Employees Health Service at 662-915-6550.) University Health Services will coordinate contact tracing to lessen the likelihood of spread.
- Students attending the virtual component of hybrid, remote, or online courses are subject to the same attendance policy and procedures as traditional students. However, participation is defined in a different manner. The University's "Attendance Policy for Online Education" states: "Student attendance in online courses is defined as active participation in the course as

described in the individual course syllabus." If students fail to meet online attendance requirements as stated in the syllabus, they will be given an absence.

- Students are encouraged to visit the University's Keep Learning site (https://olemiss.edu/keeplearning/) to access information and resources related to COVID-19 support. The site provides links to University student services to facilitate and support learning
- Students with diagnosed health concerns that may affect their compliance with COVID-19 health requirements should contact UM's Student Disability Services (SDS) Office (https://sds.olemiss.edu) to see if they are eligible for an SDS accommodation as soon as possible.
- The University must have accurate contact information, including cell phone numbers, to facilitate student communications and contact tracing. Students should check and update their University contact information (https://olemiss.edu/mystudentprofile).

Guidelines for data analysis project: You must conduct an analysis of some data related to your graduate research project or your research interests. The main goal is for you to conduct a data analysis similar to what you will need to conduct during your graduate research, or to analyze some data that you already have collected, but have not yet analyzed. The data can be your own, can be borrowed from someone, found on the internet, or made up (e.g., resembling data that would support one of your hypotheses). The analysis can be anything we are learning in class, but it must answer a question related to your research interests. There are two components to the project: a Written Component and a Presentation.

Written component: The written component can be written in one of two styles: *journal article* (past tense) or *grant proposal/prospectus* (future tense)—you should choose the style that best matches the current state of your research (completed, or being planned). It should should have two sections: a *Data Analysis Methods* section, and a *Results* (for journal article) or *Potential Results* (for proposal/prospectus) section. In addition, there should be a short *Literature Cited* section. The instructor will provide examples of how these two sections should be written. The final version should be uploaded as a Word document on Blackboard, with both sections included in the same document. Due date is the same as the day of presentations (by 10pm that night). Please also upload a copy of your .R code in a separate .R file, when you upload your written assignment n Blackboard.

The Data Analysis Methods section should describe the type of analyses conducted, which predictor and response variables were used, whether any transformations were conducted to meet assumptions, what the alpha/significance level was for the tests, and what software (and any extra packages) were used to conduct the analysis (including R and package version numbers, plus any appropriate citations; use the command *citation*() in R to obtain the appropriate citation for R, and *citation*("packagename") to obtain the appropriate citation for any particular package. Version numbers can be seen on the right in the *Packages* tab in RStudio. Citations for R and R packages should follow standard citation format, with authors and year in parentheses (R Core Team 2019, Williams & Hoeksema 2017) and full citations listed in the *Literature Cited* section at the end.

The Results or Potential Results section should be written in the style of a journal article (Results, past tense) or grant proposal (Potential Results, future tense). This section should include clear

conclusion statements, as practiced during the semester, and graphs to illustrate significant results. These same graphs should be used in your presentation. Make sure to provide statistical support in parentheses, including test statistic (t, F, etc.), degrees of freedom, and P-value). Make sure to describe the result, including the direction of the effect (e.g., positive or negative correlation or slope, or which groups had larger means than others), and refer to a numbered figure to illustrate significant results. Each figure needs a figure legend. If you have a complicated model with more than 2-3 predictors, consider including a nicely formatted ANOVA table to summarize statistical results. If you have only 1-3 predictors, it is probably fine to just put the statistics in parentheses at the end of sentences.

Presentation component: Time limit is **5 minutes, maximum**, and will be strictly enforced, so please practice, and shorten if necessary to meet the time limit. Format for presentation (1 slide each unless otherwise noted): Title slide (including your name), brief background (big picture of the scientific problem, bullet points and/or graphics), research question(s), hypotheses (in the style of research hypotheses, not null vs. alternative), data collection methods (how did you get your data?; bullet points and/or graphics), type of analysis (very briefly describe/justify it), Results (1 or 2 slides with figures, no text), Conclusions/Summary (bullet points giving main result(s)), Acknowledgements (people who helped with the research, and any funding sources). Do not include "Literature Cited" as a slide at the end. Any papers cited during the presentation should be cited at the bottom of the slide using fine print. Stylistic requirements: **No slides should have large blocks of text on them (brief bullet points at most). **Use large enough fonts to be read from the back of the classroom. **Don't put anything on the bottom 20% of your slides (too difficult to see from back of room). Please upload a Powerpoint presentation to Blackboard, at least 10 minutes before class starts on the day of presentations.