University of Florida
College of Public Health & Health Professions Syllabus
PHC 6068: Biostatistical Computing (3 credit hours)
Fall, 2021
Delivery Format: HyFlex
Course Website and E-Learning

Instructor Name: Zhiguang Huo
Classroom Number: HPNP G-301
Online learning option: See canvas website for zoom ID, both synchronous/asynchronous options are
                      available.
Delivery Format: HyFlex: the students can choose either classroom learning or online leaning.
Phone Number: (352)-294-5929
Email Address: zhuo@ufl.edu
Lecture time: Mon 12:50 – 14:45
                      Wed 13:55 – 14:45
Teaching Assistants: Runzhi Zhang runzhi.zhang@ufl.edu
Office Hours: HZ: Monday 3:00-4:30pm, Zoom (https://ufl.zoom.us/j/94451437002)
                      ZR: Wednesday 3:00-4:30pm, Zoom (https://ufl.zoom.us/j/94451437002)
Preferred Course Communications: Lecture notes will be distributed on https://caleb-
huo.github.io/teaching/2021FALL/biostatisticalComputing.html and assignments will be distributed through the
canvas system at http://elearning.ufl.edu/.

Prerequisites
- PHC 6092: Biostatistical Theory,
- PHC 6050c: Statistical Methods for Health Sciences Research I,
- PHC 6051: Biostatistical Methods II,
- Or permission of the instructor.

PURPOSE AND OUTCOME

Course Overview
This course is intended to develop your ability to perform statistical computing. The course will focus primarily
on the R programming language using the RStudio interface, both of which are free and open-source
software programs. The course will cover programming topics (vectorization, data input and output, data
manipulation via tidyverse, GitHub, building R packages, and R Shiny app), statistical and computational
methods (visualization, optimization, simulation, resampling, boostrapping, classification, clustering,
regression and modern statistical methods such as LASSO), and direct integration and dynamic reporting
using LaTeX and R through programs such as knitr. Additionally, this course will include the use of high-
performance computing resources at the University of Florida such as HiPerGator.

Relation to Program Outcomes
Students will develop the knowledge and skills to translate ideas and methods into workable software and
interface with diverse data structures and objects, and write functions to implement statistical methods. These
computational skills are essential for applied biostatistics.

Course Objectives and/or Goals
Upon successfully completing this course, students should be able to:
1. Convert an algorithm into a workable program and write functions that others can use and understand.
2. Data manipulation via Tidyverse.
3. Smooth and visualize data, including ggplot2 functions for multi-panel displays.
4. Construct a simulation study and use it to evaluate the size and power of a statistical test or method.
5. Use resampling techniques such as the bootstrap and cross-validation to assess model fit and
   compare competing models.
6. Implement computational methods for optimization (e.g., Newton-Raphson), classification (e.g., LDA,
   SVM, tree-based methods, random forests), and regression (e.g., LASSO).
7. Build R packages, R Shiny app, and upload to the GitHub.

DESCRIPTION OF COURSE CONTENT

Topical Outline/Course Schedule

Week	Date(s)	Topic(s)	Assignments release	Assignments due
1	8/23/21 – 8/27/21	Basics of R programming Writing functions in R	HW 1 (8/23)	
2	8/30/21 – 9/1/21	Data manipulation (Tidyverse) Vectorized calculations		
3	9/6/21 – 9/8/21	Labor Day! R graphics (basic)	HW 2 (9/6)	HW 1 (9/6)
4	9/13/21 – 9/17/21	R graphics (advanced) Using HiPerGator		
5	9/20/21 – 9/22/21	R Shiny Midterm (Take home)	Midterm (9/20)	HW 2 (9/20)
6	9/27/21 – 9/29/21	R packages Rcpp	Final project (9/27)	Midterm (9/27)
7	10/4/21 – 10/6/21	GitHub (guest lecture) Matrix operation	HW3 (10/4)	
8	10/11/21 – 10/13/21	Dimension reduction Clustering method		
9	10/18/21 – 10/20/21	Linear models Lasso and Ridge regression	HW 4 (10/18)	HW3 (10/18)
10	10/25/21 – 10/27/21	Generalized linear models Mixed models		
11	11/1/21 – 11/3/21	Optimization Simulating random variables Veterans Day!	HW 5 (11/1)	HW 4 (11/1)
12	11/8/21 – 11/10/21	Simulation Bootstrapping		
13	11/15/21 – 11/17/21	Decision tree Cross validation	HW 6 (11/15)	HW 5 (11/15)
14	11/22/21 – 11/26/21	Supervised machine learning (others) Thanksgiving!		
15	11/29/21 – 12/3/21		Final exam (12/1)	HW 6 (12/1)
16	12/6/21 – 12/10/21	Final exam (Take home)		Final project (12/6) Final exam (12/8)

Course Materials and Technology
There is no required text. You are also referred to the following texts as follow-up resources.
1. Google's R Style Guide. https://google.github.io/styleguide/Rguide.xml
2. Hadley Wickham (2014). *Advanced R*. Taylor & Francis. http://adv-r.had.co.nz
3. Hadley Wickham (2016). R for Data Science. http://r4ds.had.co.nz/

The primary mechanism for communication in this course, other than class meetings, is conducted through the course website https://caleb-huo.github.io/teaching/2021FALL/biostatisticalComputing.html to post lecture notes and Canvas system https://ufl.instructure.com/ to deliver in class labs, assignments, final exams and grades. It is imperative that students familiarize themselves with Canvas, check Canvas frequently for possible announcements, and make sure that their e-mail account in Canvas is correct and active.

For technical support for this class, please contact the UF Help Desk at:
- Learning-support@ufl.edu
- (352) 392-HELP - select option 2
- https://lss.at.ufl.edu/help.shtml

Resources for trouble shooting
- You may ask questions during the live zoom class. Note that the class will be video-recorded, and later distributed to online students after editing. So, if you don't feel conformable being recorded, please leave your question in the "Chat" feature. Also see "Online Synchronous Sessions" below.
- You may ask questions during the virtual office hours.
  - Instructor, HZ: Monday 3:00-4:30pm, Zoom (https://ufl.zoom.us/j/94451437002)
  - TA, ZR: Wednesday 3:00-4:30pm, Zoom (https://ufl.zoom.us/j/94451437002)
- You may ask/answer questions in the canvas discussion section. The participation of this discussion section is highly encouraged.

Requirement for attendance
This is no requirement for attendance. The recorded zoom video will be made available on canvas. The instruction on how to find recorded zoom videos can be found here: https://elearning.ufl.edu/zoom/

ACADEMIC REQUIREMENTS AND GRADING

Final project:

The goal of the final project is to develop an R package that will be useful to other statisticians and R users. Students can either form groups (at most 3 people) themselves or work individually. Readable R documentations are necessary. Students will be encouraged to use higher level knowledge from the class to the R package. (E.g. Rcpp, vignette, github). Details instructions about the final project will be released on Mon Sep 27. The final R package and a short report of how to use the R package is due on Mon Dec 6 (11:59 pm).

Exam Policy

Both the midterm exam and the final exam will be "take home exam". You must work alone. You may only ask clarification questions from the instructor/TA; you may not ask for hints to the questions since these are exam, not a homework assignment. Exams will be delivered in R Markdown format and must be submitted in R Markdown format. We will not grade exams in other formats. All the exams must be submitted electronically to the instructor and/or the teaching assistant of the class. **No hard copy is required.** Your responses must be supported by both textual explanations and the code you generate to produce your result.

Homework

All the homework problems will require R programming involving various statistical computational topics outlined before. Students will be required to use their own computers as well as HiPerGator in order to complete the assignments. All homework will be delivered in R Markdown format and must be submitted in R Markdown format. We will not grade homework in other formats. All the homework assignments must be submitted electronically to the instructor and/or the teaching assistant of the class. **No hard copy is required.** Your responses must be supported by both textual explanations and the code you generate to produce your result. You are allowed to discuss with your classmates, but you need to write your own code. The topics and dates of the homework assignments are provided in the previous table and the submission schedules and the credit distributions are provided below.

Late Homework policy:

Full credit will be given for assignments turned in on the due date (by 11:59pm). Assignments turned in the next school day after the due date will have a maximum possible credit of 80%. 50% credit for two days late. Assignment turned in two school days after the due date will have a maximum credit of 50%. NO credit is given after two days late. If you are out sick, no deduction will be taken if you inform me before the homework is due. Please stay home and do not get other people sick. Just turn in your homework as soon as you can. If you are going to miss school on the day the homework is due (going out of town, religious holiday, etc.) please turn your homework in early. Each student is granted for two-day grace periods, which can be applied to any homework (not exam or final project). For all 6 homework, the total grace periods cannot exceed 2 days. Each time at least one day of grace period will be used. The instructor and the TA will check the last submission date and determine if you use the grace periods.

Grading

Requirement	Due date	Points or % of final grade (% must sum to 100%)
Homework 1	09/06/2021	5%
Homework 2	09/20/2021	5%
Mid-term exam	09/27/2021	20%
Homework 3	10/18/2021	5%
Homework 4	11/01/2021	5%
Homework 5	11/15/2021	5%
Homework 6	12/01/2021	5%
Final project	12/06/2021	20%
Final exam	12/08/2021	30%

Point system used (i.e., how do course points translate into letter grades).

Points earned	94-100%	90-93%	87-89%	83-86%	80-82%	77-79%	73-76%	70-72%	67-69%	63-66%	60-62%	< 60%
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E

Please be aware that a C- is not an acceptable grade for graduate students. A grade of C counts toward a graduate degree only if an equal number of credits in courses numbered 5000 or higher have been earned with an A. In addition, the Bachelor of Health Science Program does not use C- grades.

You must include the letter grade to grade point conversion table below. Letter grade to grade point conversions are fixed by UF and cannot be changed.

Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	WF	I	NG	S-U
Grade Points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.33	1.0	0.67	0.0	0.0	0.0	0.0	0.0

For greater detail on the meaning of letter grades and university policies related to them, see the Registrar's Grade Policy regulations at:
http://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Policy Related to Make up Exams or Other Work
Please see the instructor as early as possible regarding a possible absence during an exam. Make-up exams due to an excused absence will be handled on an individual basis.

Please note: Any requests for make-ups due to technical issues MUST be accompanied by the ticket number received from LSS when the problem was reported to them. The ticket number will document the time and date of the problem. You MUST e-mail me within 24 hours of the technical difficulty if you wish to request a make-up.

All faculty are bound by the UF policy for excused absences. For information regarding the UF Attendance Policy see the Registrar website for additional details:
https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

STUDENT EXPECTATIONS, ROLES, AND OPPORTUNITIES FOR INPUT

Expectations Regarding Course Behavior

Students are expected to spend an average at least 3 hours of in-class time per week and 6 hours out of class time per week. This time includes but is not limited to reading, research, preparations for class, team or group meetings (electronic or otherwise), and course deliverables.

Communication Guidelines

The preferred methods of communication for the course are messages in Canvas (see Course Materials above) or e-mail.

Academic Integrity

Students are expected to act in accordance with the University of Florida policy on academic integrity. As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge:

 "**We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity**."

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied:

 "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For additional information regarding Academic Integrity, please see Student Conduct and Honor Code or the Graduate Student Website for additional details:
https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/
http://gradschool.ufl.edu/students/introduction.html

Please remember cheating, lying, misrepresentation, or plagiarism in any form is unacceptable and inexcusable behavior.

Online Faculty Course Evaluation Process
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

On Campus Face-to-Face
We will have face-to-face instructional sessions to accomplish the student learning objectives of this course. In response to COVID-19, the following policies and requirements are in place to maintain your learning environment and to enhance the safety of our in-classroom interactions.

- You are required to wear approved face coverings at all times while in Health Science Center classrooms and within Health Science Center buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email

covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.

- If you are tested positive but being asymptomatic, you could use the online synchronized/asynchronized option to keep up with the class, if you want to.
- Maintain physical distancing (6 feet between individuals) is highly recommended. Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class.
- Follow your instructor's guidance on how to enter and exit the classroom. Practice physical distancing to the extent possible when entering and exiting the classroom.
- Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work (https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/).

Online synchronous sessions:
If you don't want to come to the classroom for any reason, you could take advantage of the online synchronous zoom sessions. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Online asynchronous Sessions:
Our class sessions may be audio visually recorded via zoom for students in the class to refer back and for enrolled students who are unable to attend live. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Policy Related to Guests Attending Class:
Only registered students are permitted to attend class. However, we recognize that students who are caretakers may face occasional unexpected challenges creating attendance barriers. Therefore, by exception, a department chair or his or her designee (e.g., instructors) may grant a student permission to bring a guest(s) for a total of two class sessions per semester. This is two sessions total across all courses. No further extensions will be granted. Please note that guests are not permitted to attend either cadaver or wet labs. Students are responsible for course material regardless of attendance. For additional information, please review the Classroom Guests of Students policy in its entirety. Link to full policy: http://facstaff.phhp.ufl.edu/services/resourceguide/getstarted.htm

SUPPORT SERVICES

Accommodations for Students with Disabilities
If you require classroom accommodation because of a disability, it is strongly recommended you register with the Dean of Students Office http://www.dso.ufl.edu within the first week of class or as soon as you believe you might be eligible for accommodations. The Dean of Students Office will provide documentation of accommodations to you, which you must then give to me as the instructor of the course to receive accommodations. Please do this as soon as possible after you receive the letter. Students with disabilities should follow this procedure as early as possible in the semester. The College is committed to providing reasonable accommodations to assist students in their coursework.

Students in UF Health Sciences programs should be mindful that unique course accommodations may not be applicable in a clinical, fieldwork or practicum setting. Thus, planning a semester in advance with the DRC Health Sciences Learning Specialist, Lisa Diekow ldiekow@ufsa.ufl.edu , is highly encouraged.

Counseling and Student Health
Students sometimes experience stress from academic expectations and/or personal and interpersonal issues that may interfere with their academic performance. If you find yourself facing issues that have the potential to or are already negatively affecting your coursework, you are encouraged to talk with an instructor and/or seek help through University resources available to you.

- The Counseling and Wellness Center 352-392-1575 offers a variety of support services such as psychological assessment and intervention and assistance for math and test anxiety. Visit their web site for more information: http://www.counseling.ufl.edu. On line and in person assistance is available.

- You Matter We Care website: http://www.umatter.ufl.edu/. If you are feeling overwhelmed or stressed, you can reach out for help through the You Matter We Care website, which is staffed by Dean of Students and Counseling Center personnel.

- The Student Health Care Center at Shands is a satellite clinic of the main Student Health Care Center located on Fletcher Drive on campus. Student Health at Shands offers a variety of clinical services. The clinic is located on the second floor of the Dental Tower in the Health Science Center. For more information, contact the clinic at 392-0627 or check out the web site at: https://shcc.ufl.edu/

- Crisis intervention is always available 24/7 from:
  Alachua County Crisis Center:
  (352) 264-6789
  http://www.alachuacounty.us/DEPTS/CSS/CRISISCENTER/Pages/CrisisCenter.aspx

Do not wait until you reach a crisis to come in and talk with us. We have helped many students through stressful situations impacting their academic performance. You are not alone so do not be afraid to ask for assistance.

Inclusive Learning Environment
Public health and health professions are based on the belief in human dignity and on respect for the individual. As we share our personal beliefs inside or outside of the classroom, it is always with the understanding that we value and respect diversity of background, experience, and opinion, where every individual feels valued. We believe in, and promote, openness and tolerance of differences in ethnicity and culture, and we respect differing personal, spiritual, religious and political values. We further believe that celebrating such diversity enriches the quality of the educational experiences we provide our students and enhances our own personal and professional relationships. We embrace The University of Florida's Non-Discrimination Policy, which reads, "The University shall actively promote equal opportunity policies and practices conforming to laws against discrimination. The University is committed to non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information and veteran status as protected under the Vietnam Era Veterans' Readjustment Assistance Act." If you have questions or concerns about your rights and responsibilities for inclusive learning environment, please see your instructor or refer to the Office of Multicultural & Diversity Affairs website: www.multicultural.ufl.edu