Introduction to programming with R

FOR 6934, Sections: 4326 / 4825 / 4956

Online (asynchronous) course, 2 credits

Summer B 2022

1 Overview

This is an online course that will help students to gain a basic understanding of scientific programming. The course will be taught using R language, so you will learn to use R. However, the programming techniques learned in this course will be easily transferable to other programming languages. The focus will be on programming for scientific analyses. This course will cover basic concepts and techniques in programming such as recognizing and changing data types, reading in and writing out data, indexing, loops, creating functions, iterations, manipulating data and creating plots. You will learn base R and a few selected packages.

This course will use a combination of lectures, programming demonstrations, and assignments to teach introductory programming skills at the graduate level and senior undergraduate level.

This course is open for both on-campus and off-campus students, and targets people who have no experience in programming. Students will become familiar with R and achieve the ability to use R to solve their particular data analysis needs after finishing the course. This course is online and asynchronous, but not a "go at your own pace" course. Each module must be completed in a specific week (see weekly schedule below)

Instructor

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352-273-0792
Office hours: Tuesday 1-2 pm, and Friday 10-11 am
Individual appointment: https://calendly.com/gklarenberg/introduction-to-programming-with-r
Email policy: emails and/or Canvas messages will be answered in 24 hours, during work hours.

1.1 Course Pre-Requisites / Co-Requisites

NA

1.2 Learning Outcomes

At the end of this course, your will be able to:

- Explain the advantage of using a script vs point-and-click methods
- Understand basic programming concepts such as data types, data structures and indexing, and use them in your work
- Apply basic functions
- Conceptualize and create if-else statements and loops to solve different types of problems
- Create your own customized functions
- Create plots
- Perform basic exploratory data analysis with summary statistics and plots
- Demonstrate the use of selected libraries
- Understand new data sets and functions by yourself using R

1.3 Time commitment

The Southern Association of Colleges and Schools Commission on Colleges provides the federal definition of one credit hour as three hours of work (lectures, assignments, etc) per week in a 15 week semester (at a minimum). This means that this 2-credit course has a total workload of 90 hours, which, divided over 6 weeks, translates to approximately 15 hours of work a week. This means that, aside from the videos with explanations and programming demos (2 to 3 hrs/wk), you are expected to spend a decent amount of time on assignments, a quiz and participation each week.

1.4 Materials and Supply Fees

NA

1.5 Required Textbooks and Software

Online (free) text books:

1. Peng, R.D. (2020). R Programming for Data Science. https://bookdown.org/rdpeng/rprogdatascience/
2. Phillips, N.D. (2018). YaRrr, The Pirate's Guide to R. https://bookdown.org/ndphillips/YaRrr/

3. Mahoney, M. (2019). Introduction to Data Exploration and Analysis with R. https://bookdown.org/mikemahoney218/IDEAR/
4. Grolemund, G. and Wickham, H. (2019). R for Data Science. https://r4ds.had.co.nz/
5. Wickham, H. (2018). The tidyverse styleguide. https://style.tidyverse.org/

Required software:

Primarily RStudio Cloud: online tool, available at no cost, no installation required.

If desired R and RStudio: open source, available at no cost.

1.6 Recommended Materials

N/A

1.7 Course Logistics

Modules include pre-recorded videos with built-in quizzes. These quizzes are short and ungraded but are a way to assess your understanding of the topic and allow you to move on to the next topic. Weekly graded quizzes on vocabulary and basic concepts will be conducted through Canvas. One to two assignments are due every week; submission will be through RStudio Cloud and/or Canvas. See section 2.1.

All materials will be made available through Canvas. Other online tools that will be used are RStudio Cloud (practice and assignments), Zoom (office hours) and Piazza (troubleshooting and discussions).

1.8 Technology Requirements

- A computer or mobile device with high-speed internet connection. This course will work best on a laptop or a desktop computer. It is possible to use the tools we employ in this course on a tablet or smartphone, but it is not recommended.
- A headset and/or microphone and speakers; a web cam is suggested.
- Latest version of web browser. Canvas supports only the two most recent versions of any given browser. What browser am I using?

Synchronous online sessions may be recorded. By sharing your video, screen, or audio during any synchronous online class sessions, you are consenting to being recorded for the benefit of students who cannot attend live as well as for class review during the current semester. If you have special circumstances or concerns about privacy, it is your responsibility to discuss it with your instructor.

2 Course Schedule

Week	Topics and video lectures	Reading**	Assignment
Week 1 27 June	1. Introduction, expectations and tools 2. What is programming; about computers and stuff 3. What is scientific programming? And why use scripting? Introducing R, RStudio and RStudioCloud 4. First forays: R for calculations, variables and objects, assignments, vectors, built-in functions 5. Vector calculations, reading in data, more built-in functions 6. What is a working directory, RProjects, libraries 7. How to get help	Phillips (2018), ch 1, 2, 3.1, 3.3, 4, 9 Peng (2020), ch 1, 2, 4.1, 4.2, 18	Introductions #1 Built-in functions, finding help and reading in data
Week 2 4 July	1. The nature of the beast: data types in R 2. Understanding and manipulating data structures 3. Things that can help or hurt you: factors 4. Visualization: making plots 5. Saving your hard work: writing out data and plots 6. What is data acumen and why should I care?	Phillips (2018), ch 5, 6, 8.1-8.4, 11 Peng (2020), ch 4.3 – 4.15, 5 Grolemund & Wickham (2019): 3.2-3.6	#2 Vectors and dataframes #3 Understanding scripts
Week 3 11 July	1. More about lists because they are special 2. How to find stuff: indexing 3. Making choices: conditional statements 4. Do one thing or another thing: if-else statements 5. Naming things and coding style matter	Phillips (2018), ch 7, 8.5, 8.6 Peng (2020), ch 9, 13.1 Wickham (2018), ch 1-2	#4 Indexing #5 If-else statements
Week 4 18 July	1. When you're searching for words: working with strings 2. Dealing with dates and times 3. Doing things over and over 4. Making your own functions 5. Vectorization: what's the big deal?	Mahoney (2019), ch 11, 12 Peng (2020), ch 11, 13.2 – 13.7, 14, 17 Phillips (2018), ch 16, 17	#6 String and date manipulation #7 Making functions
Week 5 25 July	1. More fancy things with loops 2. More ways to iterate 3. Data exploration: descriptive statistics 4. So what do I know about programming now?	Phillips (2018), 13, 14, 15 Peng (2020), ch 16 Mahoney (2019), ch 14	#8 Loops #9 Iterate and summary statistics
Week 6 1 Aug	1. Data science principles: tidy data 2. A trip into the tidyverse 3. Putting it all together (an example) 4. Final remarks on scientific programming, using scripts, and other languages	Peng (2020), ch 12, 21 Grolemund & Wickham (2019), ch 5, 12, 13, 18	#10 tidyverse

** Additional/optional reading will be made available on Canvas

2.1 Assignments and quizzes

Quizzes are to be completed by Sunday, and will evaluate your understanding of concepts covered in the week before, and programming (R) vocabulary. You have 2 (two) attempts for each quiz, with a 30-minute time limit for each. The highest score will be kept.

One to two assignments are due every week. The first assignment will be due on Wednesday, the second on Sunday. The assignments follow the video lectures. It will be indicated which questions accompany which video. A document and a video outlining the format of assignment submissions will be available on Canvas. This format is *not* optional, and worth 10 points on each assignment.

During office hours on Tuesday (1-2 pm) I will go over (i.e. demonstrate) the assignment that was due on Sunday; on Friday (10-11 am) the assignment that was due on Wednesday. These sessions will be recorded and made available on Canvas (attendance is *not* mandatory). See section 3.1 for late submission policies.

For the assignments you are allowed to discuss on the discussion board, or ask for advice through other avenues, *but* you are expected to write your own code. Do not copy someone else's code; this amounts to plagiarism and violates UF's Academic Honesty Policy (see section 3.7).

Each assignment and quiz with the lowest score/points will be dropped from the final grade calculation.

2.2 Participation

We will use an online platform (Piazza) to engage and interact with each other. Asking questions and answering others' questions is an important part of learning. You will receive points for participating, to ensure interaction (though, you will soon realize how beneficial this interaction is for your learning!)

2.3 Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Assignments (9)	100 each	75%
Quiz (5)	50 each	15%
Participation (6)	20 each	10%
		100%

2.4 Grading Policy

A	90.0-100				
B+	86.7-89.9	B	83.7-86.6	B-	80.0-83.6
C+	76.7-79.9	C	73.7-76.6	C-	70.0-73.6
D+	66.7-69.9	D	63.7-66.6	D-	60.0-63.6
E	< 60.0				

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

3 Policies and Requirements

This syllabus represents current plans and objectives for this course. As the semester progresses, changes may need to be made to accommodate timing, logistics, or to enhance learning. Such changes, communicated clearly, are not unusual and should be expected.

3.1 Late Submissions & Make-up Requests

It is the responsibility of the student to access on-line lectures, readings, quizzes, and exams and to maintain satisfactory progress in the course. Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Late submissions of assignments (but before office hours in which the assignment is discussed) will result in a 10% deduction of total points earned. Submission after the assignment has been discussed and demonstrated will result in 20% deduction of total points earned. Quizzes are open until 24 hours after the due date (-10%) and will then be closed.

Computer or other hardware failures, except failure of the UF e-Learning system, will not excuse students for missing assignments. Any late submissions due to technical issues MUST be accompanied by the ticket number received from the Helpdesk when the problem was reported to them. The ticket number will document the time and date of the problem. You MUST e-mail your instructor within 24 hours of the technical difficulty if you wish to request consideration. For computer, software compatibility, or access problems, call the HELP DESK phone number: 352-392- HELP / 352-392-4357 (option 2).

3.2 Semester Evaluation Process

Student assessment of instruction is an important part of efforts to improve teaching and learning. **At approximately the mid-point of the semester**, the School of Forest, Fisheries and Geomatics Sciences will request anonymous feedback on student satisfaction on various aspects of this course. These surveys will be sent out through Canvas and are not required, but encouraged. This is not the UF Faculty Evaluation! **At the end of the semester**, 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/

3.3 Netiquette: Communication Courtesy and Professionalism

Just as in any professional environment, meaningful and constructive dialogue is expected in this class and requires a degree of mutual respect, willingness to listen, and tolerance of opposing points of view. **Respect for individual differences and alternative viewpoints will be maintained in this class at all times.** All members of the class are expected to follow rules of common courtesy, decency, and civility in all interactions. Failure to do so will not be tolerated and may result in loss of participation points and/or referral to the Dean of Students' Office.

3.4 Inclusive Learning Environment

This course embraces 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 the instructor or refer to the Office of Multicultural & Diversity Affairs website: http://multicultural.ufl.edu.

3.5 Services for Students with Disabilities

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation. 0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/.

3.6 Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html

3.7 Academic Honesty Policy

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 assumed that you will complete all work independently in each course unless them instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct or appropriate personnel. 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 more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code.

3.8 Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

4 Campus Helping Resources

For issues with technical difficulties for e-learning in Canvas, please post your question to the Technical Help Discussion in your course, or contact the UF Help Desk at:

- Learning-support@ufl.edu | (352) 392-HELP - select option 2 | http://elearning.ufl.edu
- Library Help Desk support http://cms.uflib.ufl.edu/ask
- SFRC Academic Hub https://ufl.instructure.com/courses/303721

4.1 Student Life, Wellness, and Counseling Help

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- Counseling and Wellness resources http://www.counseling.ufl.edu/cwc/
- U Matter, We Care http://www.umatter.ufl.edu/
- Career Connections Center http://career.ufl.edu/
- Other resources are available at http://www.distance.ufl.edu/getting-help for online students.

4.2 Student Complaint Process

The School of Forest, Fisheries and Geomatics Sciences cares about your experience and we will make every effort to address course concerns. We request that all of our

online students complete a course satisfaction survey each semester, which is a time for you to voice your thoughts on how your course is being delivered. You can also submit feedback anytime.

If you have a more urgent concern, your first point of contact should be the FFGS Academic Coordinator or the Graduate/Undergraduate Coordinator for the program offering the course. You may also submit a complaint directly to UF administration:

- Students in online courses: http://www.distance.ufl.edu/student-complaint-process
- Students in face-to-face courses: https://sccr.dso.ufl.edu/policies/student-honor-code-studentconduct-code/

4.3 Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/