



## **Statistical Programming in R**

STAT 412/612 - 007

Fall, 2020

Online asynchronous class

American University

### **Course Information**

#### **Instructor Information**

Instructor: Dr. Jane Wall

Email: [janewall@american.edu](mailto:janewall@american.edu)

Office: DMTI 214

Office Hours: Mondays 10:45 – 11:30 am, 4:00 – 4:45 pm and 7:00 – 8:00 pm or by appointment

Preferred Communication Method: email

#### **Course description**

The basics of programming using the open source statistical program R. Imputing data, performing basic analyses, graphing, data types, control structures and functions in R. Most of the course will use the tidyverse packages in R and will use the RStudio IDE

#### **Course Learning Outcomes**

Upon successful completion of this course, you will be able to:

- Produce reproducible research using R Markdown using relative paths
- Write basic R programs using control and data structures
- Use ggplot2 to visualize and understand both categorical and quantitative data
- Perform analysis on datasets using dplyr verbs select, mutate, filter, arrange, group\_by and summarize
- Import data from csv files into R using readr
- Distinguish a tidy dataset from one that is not tidy. Use tidyr to make datasets tidy.
- Combine datasets using dplyr verbs for data joining
- Use regular expressions and stringr to manipulate character strings
- Reset levels of factor variables
- Communicate results of your data analysis

### **Textbooks and Materials**

**Required:** R for Data Science by Wickham and Grolemund (O'Reilly)

<http://r4ds.had.co.nz/>

**Laptop computer**

**Class notes (includes lecture notes, video links and assignments)**

<https://stat412612.netlify.app/>

**Blackboard:** You will use your AU credentials to [log in to Blackboard](#). AU's Blackboard Support team recommends using Chrome or Firefox to optimize your experience and avoid incompatibility issues that can occur when accessing Blackboard with other browsers. Do not use Internet Explorer. Blackboard will be used for announcements and submission of homework and projects. You may use Blackboard Collaborate for meeting with your colleagues and teammates if you want (or use zoom or whatever you want). Please use the discussion section to introduce yourselves to your classmates.

**Zoom:** I will use zoom for office hours. The link is on Blackboard under announcements.

## **Course Expectations, Requirements, and Policies**

**Expectations for Course Participation:** You should plan to spend around 12 – 15 hours per week on the course. Assignments will be due approximately weekly. In addition, there is a final project due that is a considerable part of your grade and should be started early in the semester. Each week you should work through the week's module online and watch the videos as you follow along on your own computer. Scattered through the material are the exercises that compose the week's assignment(s). You should have watched the videos and attempted the assignments prior to office hours. You will be required to attend at least one office hour per week *with your video camera turned on*. I want to connect with you and see how you are doing each week. This is an opportunity for you to ask questions on anything you did not understand from the video lectures, textbook or assignments.

**Assignments:** During the semester I will assign, collect, and grade assignments. There will be approximately 10 formal assignments throughout the semester. I intentionally require you to dig out material past what I have taught you for the assignments. This is what a true data scientist does all the time!

You may receive assistance from other students in the class and me, but your submissions must be composed of your own thoughts, coding and words. I expect you to get ideas from online resources such as stackoverflow or github when you get stuck. Please cite your source when you do so and be specific about what you have added to it. You should be able to redo the code "cold" when you do this. Failure to do so is a violation of AU's Academic Integrity Code.

**Project:** All students will prepare a final project using the tools learned in the class. You will work in a team of 2-3 students on the project. Work with me to get your topic approved. Your project should involve working with a fairly large real-world dataset to answer some question of interest to you. It should be reproducible and include graphical representations of your data. The entire project should be understood by all team members. It is fine for different people to lead different areas of the project, but each member should be comfortable explaining or reproducing the entire project.

**Grading:**

You should be able to explain your work on assignments and project and your rationale. Based on your explanation (or lack thereof), I may modify your grade.

**Late Work Policy:** Late assignments will not be accepted without prior consent of the instructor.

### Final Grade Calculation

| Assessment                              | Number/<br>Frequency | % of course grade for<br>graduate students | % of course grade for<br>undergrad students |
|---|----------------------|--|---|
| Homeworks completed using<br>R Markdown | Weekly               | 50%  | 50%   |
| Project                                 | One                  | 50%  | 40%   |
| Attendance and Participation            | Ongoing              | Can lower grade                            | 10%   |

### Grading Scale

| Final Percent | Grade |
|---------------|-------|
| 93%-100%      | A     |
| 90%-92%       | A-    |
| 88%-89%       | B+    |
| 83%-87%       | B     |
| 80%-82%       | B-    |
| 78%-79%       | C+    |
| 73%-77%       | C     |
| 70%-72%       | C-    |
| 60%-69%       | D     |
| Under 60%     | F     |

### Course Schedule – tentative and subject to change

- Week 1: (August 24-30) R and RStudio Installs (Ch 1-2), R Markdown (Ch 27)
- Week 2: (August 31 – Sep 6) R programming (Ch. 19 + Sect 1-3 of [style.tidyverse.org](https://style.tidyverse.org))
- Week 3: (Sep 7 - 13) Data Visualization using ggplot2 (Ch. 3)
- Week 4: (Sep 14 – 20) Workflow Basics / Scripts, intro to dplyr (Ch. 4, 6, 5)
- Week 5: (Sep 21 – 27) More dplyr and class lab on dplyr (Ch. 5)
- Week 6: (Sep 28 – Oct 4) Expl. Data Analysis, projects in R , readr (Ch 7-11)

- Week 7: (Oct 5 – 11) tidyr (Ch 12)
- Week 8: (Oct 12 – 18) rel data w dplyr (Ch 13)
- Week 9: (Oct 19 – 25) COVID19 data analysis
- Week 10: (Oct 26 – Nov 1) stringr / reg expressions (Ch 14)
- Week 11: (Nov 2 – 8) project work
- Week 12: (Nov 9 – 15) factors w forcats (Ch 15)
- Week 13: (Nov 16 – 22) lubridate (Ch 16)
- Week 14: (Dec 1 - 4) Project presentations

## **University-Wide Policies**

### **Academic Integrity**

Standards of academic conduct are set forth in the university's Academic Integrity Code. By registering for this course, students have acknowledged their awareness of the Academic Integrity Code and they are obliged to become familiar with their rights and responsibilities as defined by the Code. Violations of the Academic Integrity Code will not be treated lightly and disciplinary action will be taken should violations occur. This includes cheating, fabrication, and plagiarism.

### **Defining and Reporting Discrimination and Harassment (Title IX)**

American University expressly prohibits any form of discrimination and discriminatory harassment including sexual harassment, dating and domestic violence, sexual assault, and stalking. The University is an equal opportunity, affirmative action institution that operates in compliance with applicable laws and regulations. AU does not discriminate on the basis of race, color, national origin, religion, sex (including pregnancy), age, sexual orientation, disability, marital status, personal appearance, gender identity and expression, family responsibilities, political affiliation, source of income, veteran status, an individual's genetic information, or any other bases under federal or local laws in its programs and activities.

As a faculty member, I am required to report discriminatory or harassing conduct to the university if I witness it or become aware of it – regardless of the location of the incident. There are four confidential resource on campus if you wish to speak to someone who is not required to report: Counseling Center, victim advocates in OASIS, medical providers in the Student Health Center, and ordained clergy in the Kay Spiritual Life Center. If you experience any of the above, you have the option of filing a report with [University Police](tel:202-885-2527) (202-885-2527), the [Office of the Dean of Students](mailto:dos@american.edu) (dos@american.edu or 202-885-3300), or the [Title IX Office](mailto:TitleIX@american.edu) (202-885-3373 or TitleIX@american.edu). For more information, including a list of supportive resources on and off-campus, contact OASIS (oasis@american.edu or 202-885-7070) or check out the [Support Guide on the Title IX webpage](#).

### **Emergency Preparedness**

In the event of an emergency, American University will implement a plan for meeting the needs of all members of the university community. Should the University be required to close for a period of time, we are committed to ensuring that all aspects of our educational programs will be delivered to our students. These may include altering and extending the duration of the traditional term schedule to complete essential instruction in the traditional format and/or the use of distance instructional methods. Specific strategies will vary from class to class, depending on the format of the course and the timing of the emergency. Faculty will communicate class-specific information to students via AU email and Blackboard, while students must inform their faculty immediately of any emergency-related absence. Students are responsible for checking their AU email regularly and keeping themselves informed of emergencies. In the event of an emergency, students should refer to the AU Student Portal, the [AU website](#), and the AU information line at (202) 885-1100 for general university-wide information, as well as contact their faculty and/or respective dean's office for course and school/college specific information.

### **Incomplete Policy**

At the discretion of the faculty member and before the end of the semester, the grade of I (Incomplete) may be given to a student who, because of extenuating circumstances, is unable to complete the course during the semester. The grade of Incomplete may be given only if the student is receiving a passing grade for the coursework completed. Students on academic probation may not receive an Incomplete. The instructor must provide in writing to the student the conditions, which are described below, for satisfying the Incomplete and must enter those same conditions when posting the grades for the course. The student is responsible for verifying that the conditions were entered correctly.

Conditions for satisfying the Incomplete must include what work needs to be completed, by when the work must be completed, and what the course grade will be if the student fails to complete that work. At the latest, any outstanding coursework must be completed before the end of the following semester, absent an agreement to the contrary. Instructors will submit the grade of I and the aforementioned conditions to the Office of the University Registrar when submitting all other final grades for the course. If the student does not meet the conditions, the Office of the University Registrar will assign the default grade automatically.

The Associate Dean of the Academic Unit, with the concurrence of the instructor, may grant an extension beyond the agreed deadline, but only in extraordinary circumstances. Incomplete courses may not be retroactively dropped. An Incomplete may not stand as a permanent grade and must be resolved before a degree can be awarded.

[More information on AU Regulations and Policies.](#)

### **Student Code of Conduct**

The central commitment of American University is the development of thoughtful, responsible human beings in the context of a challenging yet supportive academic community. The [Student Code of Conduct](#) is designed to benefit the American University community and to assist in forming the highest standards of ethics and morals among its members. By registering for this

course, students have acknowledged their awareness of the Student Code of Conduct and they are obliged to become familiar with their rights and responsibilities as defined by the Code.

### **Religious Observances**

Students will be provided the opportunity to make up any examination, study, or work requirements that may be missed due to a religious observance, provided they notify their instructors before the end of the second week of classes. Please send this notification through email to the professor. For additional information, see American University's [religious observances policy](#).

### **Use of Student Work**

The professor will use academic work that you complete for educational purposes in this course during this semester. Your registration and continued enrollment constitute your consent.

## **Academic Support Services**

### **Tutoring Center**

The Math/Stat Tutoring Lab, as well as Computer Science and Physics Tutoring, have moved online. Students are able to schedule online tutoring sessions starting Monday, August 31. All tutoring will take place online via Zoom.

The Math & Stats Lab will be open Monday to Thursday from 11:00am-9:00pm and on Sundays from 3:00pm-9:00pm, offering both one-on-one and drop-in tutoring. The schedule is below:

- Mondays
  - 11:00am-4:00pm (ONE-ON-ONE)
  - 4:00pm-9:00pm (DROP-IN)
- Tuesdays
  - 11:00am-4:00pm (DROP-IN)
  - 4:00pm-9:00pm (ONE-ON-ONE)
- Wednesdays
  - 11:00am-4:00pm (ONE-ON-ONE)
  - 4:00pm-9:00pm (DROP-IN)
- Thursdays
  - 11:00am-4:00pm (DROP-IN)
  - 4:00pm-9:00pm (ONE-ON-ONE)
- Sunday
  - 3:00-6:00pm (ONE-ON-ONE)
  - 6:00-9:00pm (DROP-IN)

For Computer Science, Physics, and Statistical Software support, drop-in tutoring is available Mondays and Wednesdays from 2:00pm-6:00pm and on Thursdays from 5:00-9:00pm. The schedule is below:

- Mondays
  - 2:00pm-6:00pm (DROP-IN)
- Wednesdays
  - 2:00pm-6:00pm (DROP-IN)

- Thursdays
  - 5:00-9:00pm (DROP-IN)

To schedule a one-on-one tutoring session:

1. Visit [american.mywconline.net](http://american.mywconline.net) , select the ONLINE Quant Support Schedule, and login
2. Search for your class (choose STAT 412) using the drop down menu at the top of the page
3. Select a starting time with any tutor available and enter all the information in the pop-up window
4. Create the appointment and look out for emails from your tutor

### **Academic Support**

All students may take advantage of the [Academic Support and Access Center \(ASAC\)](#) for individual academic skills counseling, workshops, Tutoring and Writing Lab appointments, peer tutor referrals, and Supplemental Instruction. The ASAC is located in Mary Graydon Center 243. Additional academic support resources available at AU include the Bender Library, the Department of Literature's Writing Center (located in the Library), the Math Lab in the Department of Mathematics & Statistics, and the Center for Language Exploration, Acquisition, & Research (CLEAR) in Anderson Hal, Room B-101. A more complete list of campus-wide resources is available in the ASAC.

### **International Student & Scholar Services**

[International Student & Scholar Services](#) has resources to support academic success and participation in campus life including academic counseling, support for second language learners, response to questions about visas, immigration status and employment and intercultural programs, clubs and other campus resources. (202-885-3350, Butler Pavilion 410).

### **Writing Center**

The [Writing Center](#) offers free, individual coaching sessions to all AU students. In your 45-minute session, a student writing consultant can help you address your assignments, understand the conventions of academic writing, and learn how to revise and edit your own work. (202-885-2991, Bender Library – 1<sup>st</sup> Floor Commons).

## **Student Support Services**

### **Center for Diversity & Inclusion (CDI)**

[CDI](#) is dedicated to enhancing LGBTQ, multicultural, first-generation, and women's experiences on campus and to advancing AU's commitment to respecting and valuing diversity by serving as a resource and liaison to students, staff, and faculty on issues of equity through education, outreach, and advocacy. It is located on the 2nd floor of Mary Graydon Center (202-885-3651, MGC 201 & 202).

### **Counseling Center**

The [Counseling Center](#) offers counseling and consultations regarding personal concerns, self-

help information, and connections to off-campus mental health resources. (202-885-3500, MGC 214).

### **Dean of Students Office**

The [Dean of Students Office](#) offers individual meetings to discuss issues that impact the student experience, including academic, social, and personal matters; making referrals to appropriate campus resources for resolution. Additionally, while academic regulations state that medical absences are to be excused, if faculty require documentation to verify the student's explanation, such documentation should be submitted to the Dean of Students. The office will then receive the documentation and verify the medical excuse. Faculty have the discretion to approve absences and do not need permission from the Dean of Students to excuse absences. Students should be sent to the Dean of Students only if faculty require further proof or if they have concerns about the impact of absences on the student's ability to succeed (202-885-3300, Butler Pavilion 408).

### **Food and Housing Insecurity Statement**

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the [Dean of Students](#) ([dos@american.edu](mailto:dos@american.edu)) for support. Furthermore, please notify the professor if you are comfortable in doing so. This will enable them to provide any resources that they may possess.

### **Office of Advocacy Services for Interpersonal and Sexual Violence**

[OASIS](#) provides free and confidential advocacy services for students who have experienced sexual assault, dating or domestic violence, sexual harassment, and/or stalking. Please email or call to schedule an appointment with a victim advocate in OASIS. ([oasis@american.edu](mailto:oasis@american.edu), 202-885-7070, Health Promotion and Advocacy Center – Hughes Hall 105). Students can also book an appointment with one of our two confidential victim advocates.

### **Respect for Diversity**

As stated in the [American University Discrimination and Sexual Harassment Policy](#):

"American University is an equal opportunity, affirmative action institution that operates in compliance with applicable laws and regulations. The University does not discriminate on the basis of race, color, national origin, religion, sex, pregnancy or parenting, age, sexual orientation, disability, marital status, personal appearance, gender identity and expression, family responsibilities, political affiliation, source of income, veteran status, an individual's genetic information or any other bases under applicable federal and local laws and regulations (collectively "Protected Bases") in its programs and activities. The University expressly prohibits any form of discriminatory harassment including sexual harassment, dating and domestic violence, rape, sexual assault, sexual exploitation and stalking."

The above website includes further details, including how to report instances of discrimination and your responsibilities as a member of the campus community in relation to the policy; you are strongly encouraged to familiarize yourself further with this policy.



Class rosters and University data systems are provided to faculty with the student's legal name and legal gender marker. As a student, you are able to change how your preferred/proper name shows up through email, Blackboard, and on your AU ID Card. This option is helpful for various student populations, including but not limited to: students who abbreviate their first name; students who use their middle name; international students; and transgender students. As a faculty member, I am committed to using your proper name and pronouns. We will take time during our first class together to do introductions, at which point you can share with all members of our learning community what name and pronouns you use, as you are comfortable. Additionally, if these change at any point during the semester, please let me know and we can develop a plan to share this information with others in a way that is safe for you. Should you want to update your preferred/proper name, you can do so by looking at the [guidelines and frequently asked questions](#) from the Center for Diversity and Inclusion.

### **Students with Disabilities**

If you wish to receive accommodations for a disability, please notify me with a letter from the Academic Support and Access Center. As accommodations are not retroactive, timely notification at the beginning of the semester, if possible, is strongly recommended. To register with a disability or for questions about disability accommodations, contact the Academic Support and Access Center at 202-885-3360 or [asac@american.edu](mailto:asac@american.edu), or drop by MGC 243. For more information, visit AU's [Disability Accommodations web page](#).