Math 150: Freshman Seminar — Data-Driven Decision Making

Spring, 2025

TR 11:00–12:20

Civilization advances by extending the number of important
operations which we can perform without thinking about them.

—Alfred North Whitehead (1861–1947)

Instructor: Larry Leemis
Office: Jones 116
e-mail: leemis@math.wm.edu
Office hours: Tuesday and Thursday: 3:30–4:45 PM, or by appointment

Purpose:

This class considers the use of data (for example, biomedical survival data, financial data) to drive decision making (for example, chemotherapy vs. radiation for a patient diagnosed with a particular type of cancer, stock portfolio optimization) using the open source R software package. A student completing this class will be able to formulate a research question, engage in independent critical thinking, collect data, use the R software to analyze the data set, draw appropriate conclusions, and present the analysis and conclusions in written and oral form.

Prerequisites:

None.

Texts:

Leemis, L.M., *Learning Base R*, Second Edition, 2022, Lightning Source.

Johnson, D.T., Price, J.E., *Will This Be on the Test? What Your Professors Really Want You to Know about Succeeding in College*, 2019, Princeton University Press.

Purdue On-Line Writing Lab (OWL), https://owl.english.purdue.edu/owl/

Grades:

Course grades will be determined by the weights:

Homework	15%
Quizzes	5%
Midterm 1	20%
Midterm 2	20%
Final project	20%
Final exam	20%

with a grading scale (plus and minus grades may be assigned within each range):

90 — 100%	A
80 — 90%	B
70 — 80%	C
60 — 70%	D
0 — 60%	F

Homework:

Weekly homework assignments are due at the beginning of class as a LaTeX document. No late assignments will be accepted without prior approval from the instructor. Legitimate excuses for a late homework assignment include illness and a death in the family. Documenting your work is necessary for grading your homework, but it is also important for the future you as you study for the exams. Your solutions to the homework problems should be polished and complete. Establish a standard of excellence on your homework submissions. Each homework assignment involves writing R code and prose supporting the R code. In terms of collaboration on homework with classmates, you may *discuss* problems with others in the class, but the writeups must be done individually. This "empty hands/empty cell phone/empty laptop" policy encourages you to collaborate with one or more classmates, but you may not take any written notes from these collaborations; you must do your own writeup. Some of the homework assignments will involve an associated quiz.

Course schedule:

	January 23 meet R; calculator mode; simple objects
January 28 vectors; matrices	**January 30** arrays; built-in functions
February 4 user-written functions; utilities	**February 6** complex numbers; character strings
February 11 logicals; relational operators	**February 13** coercion; lists
February 18 data frames	**February 20** midterm 1
February 25 built-in data sets; input/output	**February 27** probability
March 4 high-level graphics	**March 6** custom graphics
March 11 Spring break	**March 13** Spring break
March 18 conditional execution	**March 20** iteration
March 25 recursion	**March 27** simulation
April 1 elementary statistics	**April 3** midterm 2
April 8 advanced statistics	**April 10** linear algebra
April 15 base packages	**April 17** contributed packages
April 22 applications I	**April 24** applications II
April 29 presentations	**May 1** presentations

Exams:

You may use one formula sheet for the first midterm exam. You may use two formula sheets for the second midterm exam. Each formula sheet should be hand-written by you on a single side of an 8.5×11 inch sheet of paper. You may use the midterm formula sheets plus and an additional formula sheet for the final exam. It should also be hand-written by you on a single side of an 8.5×11 inch sheet of paper.

Course outline:

1. Introducing R
2. R as a Calculator
3. Simple Objects
4. Vectors
5. Matrices
6. Arrays
7. Built-In Functions
8. User-Written Functions
9. Utilities
10. Complex Numbers
11. Character Strings
12. Logical Elements
13. Relational Operators
14. Coercion
15. Lists
16. Data Frames
17. Built-In Data Sets
18. Input/Output
19. Probability
20. High-Level Graphics
21. Custom Graphics
22. Conditional Execution
23. Iteration
24. Recursion
25. Simulation
26. Statistics
27. Linear Algebra
28. Packages

Distractions:

Learning the material in this class requires concentration. Please leave your laptop computer and cell phone in a backpack on the floor during class.

Audio and video taping:

No audio taping or video taping of the class without the permission of the instructor.

Project:

The class project will involve selecting a topic that involves the analysis of a data set, developing a thesis that concerns the use of this data set in decision making. The deliverables for the class project are a 6–8 page paper and a presentation to the class during the last week of classes.

Writing format:

Homework assignments and the semester project are to be prepared using the LaTeX text processor. The LaTeX language can be used on a website (two popular sites are Overleaf and ShareLaTeX) or can be used on your laptop (two popular packages are MiKTeX for laptops running Windows and TeXShop for Apple laptops).

Writing requirement:

In order to pass the Freshman Seminar "W" writing requirement, students must receive a $C-$ or higher and produce at least 24 pages of writing (at least half of which must be formal or academic writing). Free assistance with your writing is available at the Writing Resources Center on the first floor of the Swem Library. An appointment can be scheduled at `http://www.wm.edu/as/wrc/`

Accessibility statement:

It is the policy of William & Mary to accommodate students with disabilities and qualifying diagnosed conditions in accordance with federal and state laws. Any student who believes s/he may need an accommodation based on the impact of a learning, psychiatric, physical or chronic health diagnosis should be referred to Student Accessibility Services (SAS) staff at 757-221-2509 or at `sas@wm.edu`. SAS staff will work with you to determine if accommodations are warranted, and if so, to help you obtain an official letter of accommodation.

Success:

I am interested in your success in this course, in your time as a student at William & Mary, and your time beyond William & Mary. The tools that you learn in this class (both computing and critical thinking) can be applied in in the future. If you need to discuss any of the course content, please see me during my office hours.

Attendance:

Attendance is mandatory. You are allowed to miss one class session without penalty. Each subsequent class missed results in a one-letter grade reduction in your final grade in the class. Do not attend the class when you are ill. Simply send me an e-mail indicating that you are ill (no doctor's note is required) *before* the class session that you will miss. All other absences must be cleared by me prior to the class you will be missing. Make sure to get the class notes for any class that you miss from a classmate.

The best thing about being a statistician is that you get to play in everyone's backyard. —John Tukey