

# Math 150: Freshman Seminar — Data-Driven Decision Making

Spring, 2017

TR 11:00–12:20      Morton 2

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

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**Office hours:** Tuesday and Thursday: 3:30 - 5:00 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 use the R software to analyze a data set, draw appropriate conclusions, and present the analysis and conclusions in written and oral form.

**Prerequisites:**

None.

**Text:**

Leemis, L.M., *Learning Base R*, 2016, Lightning Source.

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

**Grades:**

Course grades will be determined by the weights:

Homework/Quizzes	30%
Midterm 1	15%
Midterm 2	15%
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 me to grade 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” 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:

<b>January 17</b>	<b>January 19</b> meet R; calculator mode; simple objects
<b>January 24</b> vectors; matrices	<b>January 26</b> arrays; built-in functions
<b>January 31</b> user-written functions; utilities	<b>February 2</b> complex numbers; character strings
<b>February 7</b> logicals; relational operators	<b>February 9</b> coercion; lists
<b>February 14</b> data frames	<b>February 16</b> midterm 1
<b>February 21</b> built-in data sets; i/o	<b>February 23</b> probability
<b>February 28</b> high-level graphics	<b>March 2</b> custom graphics
<b>March 7</b> Spring break	<b>March 9</b> Spring break
<b>March 14</b> conditional execution	<b>March 16</b> iteration
<b>March 21</b> recursion	<b>March 23</b> simulation
<b>March 28</b> elementary statistics	<b>March 30</b> midterm 2
<b>April 4</b> advanced statistics	<b>April 6</b> linear algebra
<b>April 11</b> base packages	<b>April 13</b> contributed packages
<b>April 18</b> biostatistical applications	<b>April 20</b> financial applications
<b>April 25</b> presentations	<b>April 27</b> presentations

**Exams:**

You may use one formula sheet for each midterm exam. The formula sheet should be hand-written on a single side of an  $8.5 \times 11$  inch sheet of paper. You may use the midterm formula sheets plus and a second additional formula sheet for the final exam. It should also be hand-written on a single side of an  $8.5 \times 11$  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. Elementary Statistics
27. Advanced Statistics
28. Linear Algebra
29. Base Packages
30. Contributed Packages

**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 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). 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/>

**Writing format:**

Homework assignments and the semester project are to be prepared using the L<sup>A</sup>T<sub>E</sub>X text processor. The L<sup>A</sup>T<sub>E</sub>X 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).

**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](mailto: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.

**Writing Center:**

The Writing Resources Center, located on the first floor of Swem Library, is a free service provided to William & Mary students. Trained consultants offer individual assistance with writing, presentation, and other communication assignments at any stage, from generating ideas to polishing a final product, and across disciplines. To make an appointment, visit the WRC webpage [www.wm.edu/wrc](http://www.wm.edu/wrc).