INQ 240-E1: Statistical Reasoning

Statistics and Social Justice – Spring 2018

Instructor:	Alexander S. Moore	**Time:**	T, R 6:15 – 7:45
Email:	alsmoore@roanoke.edu	**Place:**	Trexler 374
Office:	Trexler 161-C	**Office Hours:**	T, R 5:15 – 6:15

1   Course Information

This is a course in learning how to obtain and interpret results obtained from sets of data by using techniques of statistics. This class will introduce to you the methods of collecting, organizing, and presenting data. You will also study various quantitative measures for data and will study how to draw conclusions and make inferences from that data. Some probability will also be discussed as a precursor to "inferential" statistics.

2   Accessibility for All Students

Accessible Education Services (AES) is located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Dr. Sue Brown, AES Director, at 540-375-2247 or by e-mail at sbrown@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Dr. Brown at your earliest convenience to schedule an appointment.

3   Intended Learning Outcomes

By the end of this course, successful students will be able to:

- use the methodologies of statistics to investigate a topic of interest and make decisions based on the results;

- use the methodologies of statistics to design and carry out a simple statistical experiment;

- use the methodologies of statistics to critique news stories and journal articles that include statistical information. In the critique, students will recognize variability and its consequences, identify potential sources of bias and both proper and improper cause and effect inference;

- articulate the importance and limitations of using data and statistical methods in decision making;

- write about course topics clearly and effectively; and

- interpret quantitative information related to the course topic.

4   Required Materials

Textbook: *Essential Statistics* by David S. Moore, published by W. H. Freeman

Reference Book: *A Writer's Reference* by D. Hacker, RC Ed. **or** *Easy Writer* by A. A. Lunsford, 6th Ed.

Calculators: Any scientific calculator to perform arithmetic calculations (and square roots)

Other readings will be provided as needed to support the learning outcomes and the specific "flavor" of this class: social justice. Please make sure you have a computer with Internet service, so that you can access the class Inquire site. If you need help with Inquire, please contact the RC HelpDesk.

5   Course Grades

Grades will be recorded using the Inquire Gradebook, which is accessible in the course Inquire website. The table below lists the weights for the various forms of assessment for this class.

A	A	93–100
	A-	90–92
B	B+	87–89
	B	83–86
	B-	80–82
C	C+	77–79
	C	73–76
	C-	70–72
D	D+	67–69
	D	63–66
	D-	60–62
F		0–59

Grade Weights

Quizzes (7+1)	15%
Projects (3)	20%
Tests (4)	44%
Final Exam	21%

Midterm grades will be submitted through Inquire and are informative only, but, in the best interest of the student, will represent a "worst case" scenario based on the student's performance at that time, so no plusses or minuses will be assigned. A grade scale will be determined after final grades are computed, but will be no worse than this.

6   Homework Notebook

Homework, assigned regularly in this class, will be routine problems from the main textbook that serve as examples that reinforce the lecture topics. Homework will not be collected, but rather, you will be required to keep your homework solutions in a **dedicated** binder for this class. One day roughly each week will be dedicated to a wrap-up of the week's topics along with a discussion of homework problems. Bring questions you have! You are, of course, always welcome to come to office hours or email me with questions you have throughout the week. Completing the homework and doing extra problems is by far the best way to become familiar with the material.

As a "reward" for completing the homework, you will be allowed to use your homework notebook during most quizzes—unless announced by the instructor the class period before, using your homework notebook is fair game for a quiz. In addition, you will be allowed to reference and use your homework notebook during the **last 20 minutes** of each test and for a 40 minute period during the final exam. Here's a table to summarize this:

During...	You may use your homework notebook...
Quizzes	All of the time (unless otherwise announced the class period before)

| Tests | During the last 20 minutes of the test |
| Final Exam | During a 40 minute period that will be announced during the exam itself |

Your homework notebook must not have any materials other than the homework that you have worked on, and the contents of your homework notebook should be in your own handwriting (and original, not photocopied)! They are subject to inspection at any time.

7   Quizzes

There will be, roughly speaking, weekly quizzes in this course, given at the end of class on the "wrap-up" day. Generally these quizzes should take you about 30–45 minutes to complete and will have 2–3 problems, one each from the roughly 2–3 chapters that we have discussed during the previous couple of class days. Remember that, unless I say otherwise on the class day before a quiz, you will be able to use your homework notebook during these quizzes.

8   Tests

There will be four tests this semester; the tests will focus primarily on the statistics content of this course, but will emphasize critical thinking and writing. Homework and class notes are absolutely the best sources of review. The tests will not be designed to be cumulative, but as with any course involving mathematics, material from previous tests can be automatically thought of as a prerequisite for future tests, because the material builds. Remember, you will be allowed to use your homework notebook during the final 20 minutes of each test!

9   Major Projects

A colleague of mine runs a blog called *What the Data Say?*. I love this imagery because that is, in one turn of phrase, exactly what the art of statistics is seeking. To build on this idea of figuring out "what the data are saying," there will be three major projects in this class that are designed to allow some freedom for you to explore the connection between statistics and issues of social justice and equity. A grading rubric and explanation of the assignment for each of the three projects will be given out at the appropriate times. Any written papers for me should be in either APA or AMS style, and this will be indicated as such on the rubrics.

Project 1. The first of these assignments will be early in the semester. The form will be a paper (roughly 4 pages) focusing on critiquing the use of descriptive statistics in published articles and reports about a social justice topic of your choice, such as the intersectionality of race and education. Search online and on the College's libguides to find articles to analyze. You are looking for ways to read the article through a critical lens.

Project 2. The second of these assignments will culminate after spring break, but will involve some of your time for a month during the semester. You will assume the role of a statistician hired by a syndicated news outlet for online media, e.g., Vox, Slate, Breitbart, Huffington Post, etc. Your job is to formally write a report regarding the accuracy of a publication by your employer, based on the National Longitudinal Survey of Youth–1979/1997, or NLSY79/97 for short. We will have an orientation session in class when I introduce the project, because you need to create an account to access the data set. There has been tons of analysis done on this data set over the years. Search for existing articles from publications across the country; you can even look for academic journals or other organization-published reports. Using this data and the methods of *inferential* statistics, you will formally test the accuracy and interpretation of the claims of the article, and write a formal

report (about 3 pages, excluding appendices) for your employer, the news outlet. My advice here is to be creative and critical! Even though we are studying social justice in this class, we have to be statisticians first, and must be able to critique the validity of the news we are consuming. That being said, there is also a humanistic aspect to the statistical interpretation of some of these issues; try to separate them from the "hard" analysis of the mathematics. Include the humanistic component at the end of the report as part of the Discussion section, i.e., real implications for humanity and social equity. Come talk to me or email me once you have some specific articles to pull from, and I can help you understand this better. It's more natural to discuss these with real situations instead of theoretical ones.

Project 3. The third assignment will be due towards the end of the semester. We will use police data from the Commonwealth of Virginia and other methods of inferential statistics (such as confidence intervals, correlation and regression) to statistically analyze some issues. You will be given several readings to look at and use as a basis for writing a paper (roughly 3 pages) on the proper use of statistics in drawing conclusions from data based on several questions posed to you. Your focus should be on synthesizing an interpretation of the analysis and really explaining "what the data is saying."

10   Reading

Daily reading of assigned sections from our textbook is expected. You should come to class prepared to discuss the material that you have read. You can find an approximate list of sections assigned in the calendar provided in this syllabus. We will mostly adhere to this schedule, but because we may have to deviate for weather or other situations, the definite sections will be announced in class and posted on Inquire in time for you to do the readings. Readings from other sources will be assigned as appropriate. I expect my students to be *well-read* in the language of applied statistics.

11   Workload

You are expected to spend at least 12 hours per week, inside and outside of class, for this course; 3 hours will be taken up by our Tuesday and Thursday classes, and the remaining 9+ will be a combination of reading the textbook, doing homework problems, working on projects, and studying for upcoming tests or quizzes.

12   Final Exam

The final exam will be comprehensive and given on Tuesday, May 1 from 6:30 PM – 9:30 PM. As with the tests, it will also emphasize critical thinking and writing. The best way to review for the final is to review your performance on the four tests; focus on material that you did not master the first time around, and review the topics that you did master. Remember that you will be able to use your homework notebook during 40 minutes to be announced sometime in the middle of the final exam.

13   MCSP Conversation Series

The Department of Mathematics, Computer Science and Physics offers a series of discussions that appeal to a broad range of interests related to these fields of study. These co-curricular sessions will engage the community to think about ongoing research, novel applications, and other issues that face our discipline. Members of this class are invited be involved with all of these meetings, however participation in **at least one (1)** of these sessions is mandatory. After attending, students will submit a one page paper reflecting on the discussion. This should **not** simply be a regurgitation of the content, but rather a personal contemplation of the experience. This reaction paper will be counted as a quiz.

14   Attendance & Make-Up Work

Attendance at every class session is critical to the understanding of the material in the course; it is both required and expected. Missing one class could easily lead to a disastrous domino effect. Any absence that is not discussed with the instructor prior to the missed class is considered unexcused. When absent—excused or unexcused—you are still responsible for all material covered in class and adhering to the stated due dates for assignments. *You will not be allowed to make up any work missed due to an unexcused absence.* After two (2) unexcused absences, a warning will be sent to you, the registrar, and your advisor warning you that after another absence you will be dropped from the class with a DP (dropped/passing) or DF (dropped/failing) grade.

15   Academic Integrity

Students are expected to adhere to the Academic Integrity policies of Roanoke College. All work submitted for a grade is to be your own work! No electronic devices other than calculators can be taken out during any class or testing period (this includes cell phones; please turn them **off** before class). Note: Looking at or using your cell phone during a test or quiz is considered a violation of Academic Integrity regardless of your purpose or intent in doing so.

16   Class Etiquette

Being inattentive such as doing other work or activities in class that are not related to what is going on in class (i.e. reading the newspaper, completing homework, correcting papers, sleeping, sending/reading messages, etc.) will not be tolerated. There are NO LAPTOPS, CELL PHONES, iPads, iPods or other electronic devices allowed in class. If you have specific documented accommodations that necessitate technology or have a young child or elder person in your care and need your mobile phone with you, please contact me directly regarding arrangements. Additionally, we may encounter some polarizing topics in this class. Remember that everyone is coming from his or her own background and unique perspective. You are required to respect your classmates' opinions, even if they are different than your own. Disrespectful behavior of any kind will not be tolerated. Please note the following class rules regarding etiquette.

Laptops and iPads. Dr. Diane Sieber, University of Colorado at Boulder, compared students who used laptops in class with those who did not. Sieber found students with laptops scored 11% lower than their counterparts without laptops. Dr. Carrie B. Fried, Winona State University, studied the effects of laptops on learning and found that computers are a significant distraction in class and laptops negatively affected students (they learned less and performed more poorly). The University of Chicago Law School has turned off Internet access in their classrooms. Furthermore, here are some of the professors who have banned laptops since 2009: David Cole, Georgetown University; June Entman, University of Memphis; and Michael Krauss, George Mason University. Why? Dr. Krauss states that laptops have "become a substitute for thinking."

Cell Phones. Cell phones should never be a disturbance during class sessions. Turn them *off* before class; if you *must* take a call, only do so on the rare emergency occasion, and excuse yourself quickly and quietly from class. There is only one exception to this rule: We will be using the Classroom Stats app periodically to generate our own data sets for in-class activities. You will need to download and use the app from either the iOS or Android app stores. More information will be provided about this. When we will be using the app in class, I will announce that phones may be brought out and turned on for the duration of the activity. However, the rest of the restrictions regarding messaging and other e-distractions will still apply while we are using the app.

Texting or email. Texting and emailing, just like cell phones, are inappropriate in class. Just as taking calls in the middle of class would be rude to all of us, so too is texting or tweeting during class sessions. I find that it says to us all, "You are not important enough for me to give my full attention." I understand that sometimes an emergency may be brewing or you may be on call, and you need to text someone, but, just as with cell phone calls, if you find you *must* text, call or email during class time, excuse yourself from class and quickly send the message so you can return. Note: I may not say anything about professionalism and decorum throughout the

semester. However, this does not mean that I am not noticing distractions or disrespectful behaviors. *You are expected to maintain professional behavior and portray yourself as a professional at all times!*

Communication. Email is always the best way to reach me. I will send you important information updates concerning this class via your RC email account. If you do not regularly check your RC email, it is your responsibility to redirect your RC email to your preferred account. If you need an immediate response, I prefer that you call me on the phone; my number is 540-353-3987. This will be the best way to receive a prompt response from me if I'm away from my email temporarily. During the week, you will get a response to every email within 18 hours, and within 36 hours on the weekend (usually less).

17   Calendar

Last updated: January 14, 2018. The following schedule is approximate and subject to change, but we will try our best to stick to it. This mainly lists the topics to be covered, project time lines, tests, and quizzes. Other readings will be assigned when appropriate, and will more or less be tied to specific projects. Homework problems to work on for your homework binder are listed with each section.

Question 1: How do we properly convey sociological-statistical information and data in an unbiased and informative way?

Tue	Jan 16	Chapter 1	Picturing Distributions with Graphs
			Homework: Ch1 #19, 20, 25, 26, 27, 28
		Chapter 2	Describing Distributions with Numbers
			Homework: Ch2 #20, 29, 31, 34, 35

Question 2: How can we use data and statistical techniques to analyze issues of social justice?

Thu	Jan 18	Chapter 3	
			The Normal Distributions; **Project 1 Begins**
			Homework: Ch3 #22, 26, 27, 29, 31, 32, 36
		Chapter 4	Scatterplots and Correlation
			Homework: Ch4 #19, 29, 31, 32
Tue	Jan 23		Wrap-Up, **Quiz 1**

Thu	Jan 25	Chapter 5	Regression; **Project 1 Due**
			Homework: C5 #23ab, 24, 25, 28, 38, 39, 41
		Chapters 7, 8	Producing Data: Sampling and Experiments
			Homework: C7 #20, 28, 38; C8 #25, 33, 38a
Tue	Jan 30		Wrap-Up, **Quiz 2**
Thu	Feb 1		Review for Test 1

Tue	Feb 6		**Test 1:** Chapters 1-5, 7, 8

Question 3: How accurate are the statistical results you get when analyzing issues of social justice?

Thu	Feb 8	Chapter 9	
			Introducing Probability
			Homework: C9 #25, 29, 31, 32, 35, 37, 41, 42, 44, 47
		Chapter 10	Sampling Distributions
			Homework: C10 #17, 19, 20, 21, 24, 28, 31, 32
Tue	Feb 13	Chapter 11	General Rules of Probability; **Project 2A Begins**
			Homework: C11 #23, 24, 25a, 27, 34, 35, 39, 41, 42
Thu	Feb 15		Wrap-Up, **Quiz 3**

Tue	Feb 20	Chapter 12	
			Binomial Distributions
			Homework: C12 #20, 21, 27, 32, 33, 38
			Review for Test 2

Thu	Feb 22		**Test 2:** Chapters 9-12

Tue	Feb 27	Chapter 13	
			Introduction to Inference
			Homework: C13 #27, 29, 31, 33, 35
		Chapter 14	Thinking about Inference
			Homework: C14 #23, 26, 33

Thu	Mar 1		Wrap-Up, **Quiz 4**; **Project 2A Due**

Spring Break

Tue	Mar 13	Chapter 16	Inference about a Population Mean; **Project 2B Begins**
			Homework: C16 #25, 27bc (use $\overline{x} = 1.1182$, $s = 0.0438$),
			#28b (use $\overline{x} = 12.83$, $s = 4.65$)
		Chapter 17	Two-Sample Problems
			Homework: C17 #20 (use $s = 21$), 21 (use $s = 33.2$), 22, 25

Thu	Mar 15		Wrap-Up, **Quiz 5**

Question 4: What aspects of social justice issues are independent of other aspects?

Tue	Mar 20	Chapter 18	
			Inference about a Population Proportion
			Homework: C18 #20, 21b, 27, 29a, 32, 34, 36, 37
		Chapter 19	Comparing Two Proportions
			Homework: C19 #14b, 15a, 19, 27

Thu	Mar 22		Wrap-Up, **Quiz 6**
Tue	Mar 27		Review for Test 3; **Project 2B Due**
Thu	Mar 29		**Test 3:** Chapters 13, 14, 16, 17
Tue	Apr 3	Chapter 21	Two Categorical Variables: Chi-Square Test; **Project 3 Begins**
			Homework: C21 #1ab, 2a, 4, 5, 6bc, 9, 29b, 12, 13, 15, 16
Thu	Apr 5	Chapter 23	One-Way Analysis of Variance (ANOVA)
			Homework: C23 #25, 26
Tue	Apr 10		Wrap-Up, **Quiz 7**
Thu	Apr 12		Review for Test 4
Tue	Apr 17		**Test 4:** Chapters 18, 19, 21, 23
Thu	Apr 19		Review for Final Exam; **Project 3 Due**
Tue	May 1		**Final Exam: 6:30 PM – 9:30 PM**

18   Final Thoughts

I am very excited about this class and working with all of you this semester. I find statistics to be an interesting and applicable field of study, and I hope I can impart some of that excitement to you this semester. I will do everything in my ability to empower you to be excited and engaged with the material so you can have a positive experience this semester. The material can seem difficult at times, so please stay on top of your assignments and readings, and, most importantly, come to class prepared to think!