1 Course Information

1.1 Course Introduction

This course introduces biostatistical methods and applications, covering descriptive statistics, probability, and inferential techniques necessary for appropriate analysis and interpretation of data relevant to health sciences. Students will use the statistical software package R and R Studio.

1.2 Course Prerequisites

- MATH 112 or higher; pre-health or health education students
- It is assumed that you have a grasp of algebra and basic mathematical notation and skills (e.g., using proper order or operations, solving for \( x \), ability to use a simple calculator).

1.3 Course Learning Objectives

At the end of the course, you should be able to:

- Recognize improvements in your statistical literacy
- Explain basic statistical terminology and concepts
- Conduct basic statistical tests by hand
• Determine the proper method to be used in analyzing data sets
• Carry out basic statistical analyses using R
• Review journal articles that present basic statistical summaries and inferences

1.4 Biostatistics Competencies

• Use basic biostatistical approaches and other modern methodological frameworks to design and test hypotheses.

1.5 Locations and Times

Lecture Time: T/R 4 PM - 5:15 PM
Lecture Place: Physics and Atmospheric Sciences, Rm 201

1.6 Course Materials

Textbook: Understandable Statistics (12th edition), by Brase and Brase

• It is advisable to pick up a copy of the text as soon as possible. This text serves as the foundation for the course. Lectures, examples, and assignments will follow the framework and notation of the text.

• You can pick up a copy at the Health Sciences Center bookstore. You might consider purchasing a hard copy or electronic version from an online retailer (e.g., amazon.com) or sharing one with a fellow classmate and splitting the cost.

• A hard copy is available on reserve at the College of Public Health, Division of Epidemiology and Biostatistics. You can check out the text for only a limited amount of time, however. Check with Laura Shriver on the 2nd oor Drachman (southeast corner) for additional information.

• The 11th edition of the text is similar enough, however, you should realize that the page numbers for the assigned readings and sample problems might not match.
• I will assume you have access to a copy of the text and are actively reading. Questions from the assigned reading may appear on homework and exam, regardless of whether they are on the lecture slides. Please read the chapters in the book before you come to lectures so that any questions you have may be solved during class.

R statistical programming software and RStudio

• RStudio is a user interface extension for R programming language. Both are free to download. You need both to complete the assignments from this class.

• A detailed step-by-step installation guide will be posted on D2L.

• There are NO mobile versions of either R or RStudio. You need a computer (laptop or desktop) to run them.

• A successful and timely installation of R and RStudio on your computer is crucial to maintaining a good grade in this course. Refer to Grading section for more details.
Handheld calculator

- Your calculator should include the square root and power functions ($x^y$). Other useful features may include parentheses and inverse functions ($x^{-1}$).
- You do not need a graphing or programmable calculator.
- Note that cell phones, laptops, tablets, and other web-enabled devices will not be permitted during exams, so do not rely on these as your sole source for computing.

1.7 Course Notes and Communication

- Course notes and other general resources will be available on D2L (d2l.arizona.edu) for review. PowerPoint slides may (intentionally) be incomplete and may not work out all problems in detail. Taking notes in class and using the text will ensure you have a complete set of slides.
- Solutions to problems worked in class will often be posted by the end of the week.
- I reserve the right to discontinue D2L posts (both lecture slides and problem solutions) if I feel not enough students are attending or participating in class. This is not an online class.
- Students will be expected to check the D2L website on a regular basis. All course communication, including announcements and emails, will be conducted via D2L.
- Please make sure you are linked to D2L to receive emails.

1.8 Instructor Information

Dr. Shikhar Kumar
Department of Epidemiology and Biostatistics
Mel and Enid Zuckerman College of Public Health
Office: Drachman Hall A218
Email: shikhark@email.arizona.edu
Office Hours: Tuesdays and Thursdays, 11 AM - 12 AM, or by appointment
1.9 Teaching Assistants

• Jose Rueben Bautista
  Office: Drachman Hall
  Email: jrueben13@email.arizona.edu
  Hours: T/R, 2:30 PM - 3:30 PM

• Yuliang Chen
  Office: Drachman Hall
  Email: yuliangchen@email.arizona.edu
  Hours: M, 3:30 PM - 5:30 PM

• Innocent Twesigye
  Office: Drachman Hall 206 BB
  Email: it2@email.arizona.edu
  Hours: F, 10 AM - 12 PM

• Miao Zhang
  Office: Math 717
  Email: miaozhang@email.arizona.edu
  Hours: T/R, 10 AM - 11 AM

2 Class policies and Grading/Student Evaluation

Your final grades will be determined as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Homework</td>
<td>15%</td>
</tr>
<tr>
<td>In-class Quizzes/Activities/Participation</td>
<td>10%</td>
</tr>
<tr>
<td>Exam 1</td>
<td>20%</td>
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<tr>
<td>Exam 2</td>
<td>25%</td>
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<tr>
<td>Final</td>
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<tr>
<td>Extra credit</td>
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<table>
<thead>
<tr>
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<th>Point Range</th>
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<td>B</td>
<td>80%-89%</td>
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<tr>
<td>C</td>
<td>70%-79%</td>
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<tr>
<td>D</td>
<td>60%-69%</td>
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<tr>
<td>E</td>
<td>&lt;60%</td>
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</tbody>
</table>

Grade Disputes
Disputes about grades on a particular assignment or exam will be entertained for one week from the day the assignment is returned, or 1 day before nal grades are due, whichever is sooner. These will be resolved by re-grading the entire assignment or exam. Note that it is possible that this could result in a lower grade in the event that new mistakes are discovered. This should not discourage you from seeking a correction in the event that I or the TA genuinely make a mistake in grading, as we will always do our best to be as fair as possible, and will apply the same standard during a regrade that was applied originally.

The nal exam will be graded and made available for review by students within 48 hours of its completion, to allow time for any requested regrades.

No negotiations about individual students’ letter grades will be entertained once nal grades are assigned, except as permitted by the policy stated above.

Mandatory R/RStudio installation policy: A mandatory check for successful installation of R and RStudio on your computer will be performed by the TAs at the end of the second and third lecture. A failed check will result in 5 points taken away from your nal grade. You have nearly one week to install R/RStudio, which should leave you ample time to clear any technical difficulties that you have encountered during installation with the TAs. If you have successfully installed R/RStudio before third lecture, you can come to o ce hours and let the TA/instructor check your installation and you will not be checked again during the lecture.

Extra credit: There will be a few short quizzes o ered on D2L that exclusively test your knowledge about R. They will be mainly comprised of multiple choices and true/false questions. You are encouraged to take this opportunity to improve your R skills. There might be some other kind of extra credit as well, like participating in an experiment or doing a challenging problem, etc.

Grades are not necessarily curved: Assignments are thoughtfully constructed with intentional scope and sequencing to aid your learning. As a bonus, your two lowest homework grades will be dropped. Your two lowest in-class exercises will also be dropped. D2L may automatically provide another calculation of your grade that you should ignore. If you believe that a mistake has been made on grading your homework or exams, please email or ask in person the TA who graded your work to discuss the issue.
2.1 In-Class Exercises (Participation)

This component includes:

- Relevant, positive contributions to class and involvement in group exercises (there will be few)
- Completion of any self-assessments, quizzes, or surveys
- If you miss class for any reason, you cannot make up any in-class exercises. It is unnecessary to let me know (in person or via e-mail) the reason why you cannot attend class. The policy of dropping two of these exercises is meant to account for any illness, emergencies or other events that force you out of class.
- Students are encouraged to honestly assess their understanding of material and performance in the course, and to then ask for help, if necessary. To facilitate this there may be quizzes (some of which may be online) throughout the semester that will cover fundamental concepts.

2.1.1 Student Engagement in Class

Students are encouraged to participate in the class during lectures. Participation enhances interaction between the instructor and the students.

2.2 Homework

- There will be approximately 10 to 12 homework assignments.
- Assignments are due on the D2L Dropbox before class begins, typically 1 week from the date they are assigned. The Dropbox will close at 4 PM, every Thursday. After that no submission will be accepted.
- Expect that by the time you have access to an assignment you can complete the majority of it if you have completed the reading assignment. Expect that we would have covered 50% of the assignment through the lectures.
- Some problems will explicitly require that they be solved using R. You must submit your R output for nal submission along with the R code that generated the output (in form of an R script). Do not include warning or error messages from R
due to incorrect code. Hand written R code or output will not be accepted. Solutions using Excel or any other software packages will not be accepted, either.

- For problems that do not require R, the answers should be accurately typed on a Word document.

- Submissions should be in form of a Word document along with an R script file (if problems required R).

- If you do not submit homework in time, you will receive a grade of 0 for that assignment. No make-up homework assignments will be offered. The policy of dropping your two lowest homework assignments is meant to compensate for emergency events that prevent you from turning in your homework before deadline.

- Homework will not be accepted in parts (e.g., turning in half early and half late).

- Drafts of your homework do not count as placeholders for final versions to be submitted later.

- The best way to excel on the exams is to make sure you have mastered the homework.

- To receive full credit, submissions should describe assumptions, provide general equations, and show intermediate steps. No partial credit can be awarded if you do not show your work. For this course the procedure is often more important than the final response.

- Students are expected to review all returned work and ask for help, if necessary.

- Each homework grade will be converted to a percentage. The two lowest percentages will be dropped and the remaining grades will be averaged and then weighted to obtain this portion of your final grade. D2L may automatically provide an alternative calculation of your grade that you should ignore.

2.3 Exams

- There are two exams that will take place in class, plus the final exam. Please clear your schedule for these exam days. Do not schedule plans that will interfere with your final exam.
• Only basic and scientific calculators are allowed for exams. Graphing calculators are not allowed for exams. Laptops, cell phones, and other similar devices with calculators will not be permitted and should not be in sight during exams.

• You may not have your phone out during the exam period without permission. Doing so will result in an automatic test grade of zero.

• You must present your CatCard when handing in your exam.

• Exams cover material in class, lectures, readings (the text), homework, and any material on self-assessments or quizzes. The format of the exams mimics the format of the homework. They are cumulative in the sense that the material builds upon itself. There will be no R related programming questions on exams, only questions involving interpretation R output.

• All exams will be closed-book with the exception of a formula sheet that we will provide and/or statistical tables, again which we will provide. Make-up exams will only be made available to students that have a legitimate (e.g., medical) excused absence, however they are highly discouraged as these exams will likely differ from the original exam in length (length will increase proportional to the date since the original exam) and by including additional theoretical content.

• Points earned from each exam will be converted into a percentage. These percentages will be weighted according to the grading scheme above.

2.4 General Student Responsibilities

• Read the syllabus thoroughly and learn the course policies. Prior to asking administrative questions, please consult the syllabus.

• Respect other students, the course staff (using proper language and behavior), and the course methods.

• Take responsibility for your learning
  
  Attend all class sessions to avoid getting behind
  Evaluate your skills and establish learning goals
  Honestly assess your understanding of concepts and ask relevant questions
  Consult notes, examples, and the textbook prior to attempting assignments
Be prepared for class by keeping up with course material and readings, and adhering to deadlines for assignments

Participate by contributing to in-class exercises and completing online components

Realize that it is natural to struggle with some concepts, but understand that the course provides guidance and tools to aid your understanding

Honestly assess the work you are doing in the class (Are you doing everything that is asked of you? What areas do you need to work on?)

Basic Guidance

- Read
- Listen
- Practice
- Ask
- Keep up

Office Hours
The purpose of office hours is to help you clarify concepts discussed in class or to get answers to informed questions. This means you have read the material, reviewed your notes, and made a solid attempt on an assignment prior to asking questions. Assignments will not be pre-graded" prior to submission. This is all in an effort to help you independently master the concepts in the homework.

Students often nd office hours useful because they allow for specific individualized discussions that may not take place in a classroom setting especially for those less likely to speak up in class or those with mathematical deficits. It is not uncommon for students to set up recurring weekly meetings during office hours to make sure they are keeping up with the material.

Class Attendance
You are responsible for learning all content covered in class, including the in-class exercises, written notes, and any alterations to the syllabus.
All holidays or special events observed by organized religions will be honored for those students who show a liation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean’s designee will be honored.)

2.5 A Note on Reading and Lectures

The word lecture has its roots in the word reading, and comes from a historical period when books had to be hand-copied and it was more e cient for professors to read to rooms full of people than for the students to have their own copies of the text. As such is a bit of a misnomer to call class meetings lectures in an age when students have access to reading materials outside of class. Class meetings should not be a mechanism for the one-way delivery of information that’s what the reading is for. Instead, students are expected to do the relevant reading before each class and have the basics, if not mastered, then at least familiar, so that class time can be spent interactively: reinforcing the reading, clarifying di cult concepts, and discussing subtleties. As an external incentive, there will be frequent quizzes on the basic concepts.

Collaboration Policy

Students are encouraged to work together, both in class / o ce hours and otherwise, to understand problems and general approaches for solutions. However, nal writeups of solutions must be done individually. Any collaboration that takes place outside section or o ce hours must be identi ed in writing, along with the nature of the collaboration (e.g., X and I worked together, Y helped me, I helped Z). Copying another person’s answers, work or code is not permitted, regardless of collaboration status. Clear violations of this policy will result in a grade penalty for the rst o ense, and an academic dishonesty report led for any o ense after that. Borderline violations will result in a written warning for the rst o ense, and the above sequence of consequences enacted after that.

3 University Policies

Classroom Behavior
Students are expected to behave respectfully toward each other and to the instructor and TAs. Disrespectful behavior includes the use of cell phones or other electronic devices in the classroom during class hours.

The Arizona Board of Regents Student Code of Conduct is here: http://dos.web.arizona.edu/uapolicies/scc5308abcd.html#sccphilosophy

ABOR Policy 5-308, prohibits threats of physical harm to any member of the University community, including to oneself. See: http://policy.web.arizona.edu/~policy/threaten.shtml.

Special Needs and Accommodations

Students who need special accommodation or services should contact the Disability Resources Center
1224 East Lowell Street, Tucson, AZ 85721
(520) 621-3268 FAX (520) 621-9423
email: uadrc@email.arizona.edu
web: http://drc.arizona.edu/.

You must register and request that the Center or DRC send official notification of your accommodations needs as soon as possible. Please plan to meet with the instructor by appointment or during office hours to discuss accommodations and how the course requirements and activities may impact your ability to fully participate. The need for accommodations must be documented by the appropriate office.

Student Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://dos.web.arizona.edu/uapolicies/.

Confidentiality of Student Records
See http://www.registrar.arizona.edu/ferpa/default.htm

Subject to Change Statement

Information contained in this syllabus, other than the grade and absence policy, may be subject to change by the instructor, with advance notice.
4 Schedule

4.1 Lecture Topics and Readings

Here is a tentative list of lecture topics and their associated dates.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (8/22)</td>
<td>Course Policies, Introduction, Definitions</td>
<td>Ch. 1</td>
</tr>
<tr>
<td>1 (8/24)</td>
<td>Frequency Tables, Histograms (R/SStudio installation mandatory check)</td>
<td>Ch. 2</td>
</tr>
<tr>
<td>2 (8/29-8/31)</td>
<td>Frequency Tables, Histograms; Statistics, Measures of Center (R/SStudio installation mandatory check)</td>
<td>Ch. 2, 3</td>
</tr>
<tr>
<td>3 (9/5-9/7)</td>
<td>Measures of Center; Measures of Variation</td>
<td>Ch. 2, 3</td>
</tr>
<tr>
<td>4 (9/12-9/14)</td>
<td>Probability and Normal Curves; Normal Distributions</td>
<td>Ch. 3, 4, 5</td>
</tr>
<tr>
<td>5 (9/19)</td>
<td>Z-Scores</td>
<td>Ch. 5, 6</td>
</tr>
<tr>
<td>5 (9/21)</td>
<td>Review</td>
<td>Ch. 1-6</td>
</tr>
<tr>
<td>6 (9/26)</td>
<td>EXAM 1</td>
<td>Ch. 1-6</td>
</tr>
<tr>
<td>6 (9/28)</td>
<td>Sampling Distribution of Mean</td>
<td>Ch. 7</td>
</tr>
<tr>
<td>7 (10/3-10/5)</td>
<td>Sampling Distribution of Mean; Estimation</td>
<td>Ch. 7</td>
</tr>
<tr>
<td>8 (10/10-10/12)</td>
<td>Confidence Intervals &amp; Hypothesis testing</td>
<td>Ch. 7</td>
</tr>
<tr>
<td>9 (10/17-10/19)</td>
<td>Hypothesis Testing; Hypothesis Testing (1 sample, 2 sample)</td>
<td>Ch. 8</td>
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<tr>
<td>10 (10/24)</td>
<td>Hypothesis Testing (1 sample, 2 sample)</td>
<td>Ch. 8</td>
</tr>
<tr>
<td>10 (10/26)</td>
<td>Review</td>
<td>Ch. 7-9</td>
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<tr>
<td>11 (10/31)</td>
<td>EXAM 2</td>
<td>Ch. 9</td>
</tr>
<tr>
<td>11 (11/2)</td>
<td>Correlation</td>
<td>Ch. 9</td>
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<tr>
<td>12 (11/7-11/9)</td>
<td>Correlation &amp; Regression</td>
<td>Ch. 9</td>
</tr>
<tr>
<td>13 (11/14-11/16)</td>
<td>Regression &amp; Inference from Regression</td>
<td>Ch. 9</td>
</tr>
<tr>
<td>14 (11/21)</td>
<td>Inference from Regression</td>
<td>Ch. 9</td>
</tr>
</tbody>
</table>
4.2 Homework Release and Due Dates

Here is a tentative list of the homework assignments and their associated release and due dates.

Please note, homework assignments will be released just after the class (at 5:15 PM), usually on Thursdays. Assignments will be due 1 week after their release date, just before class (at 4 PM) on Thursdays.

<table>
<thead>
<tr>
<th>Homework #</th>
<th>Release Date</th>
<th>Due Date</th>
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