MTWTh, 9:00am to 11:45am, synchronous online (via Zoom)
In Person, June 10th through June 13th, in Ross 3275
Student Hours: MTWTh 1:00pm to 5:00pm in Ross 2250D

Instructor: Neil Hatfield
Email: neil.hatfield@unco.edu
Office Number: Ross 2250D
Course Website: Canvas https://unco.instructure.com
All Course Materials, homework assignments, and tests will be posted to the course website.

Catalog Description: Methods related to descriptive and inferential statistics and the concept of probability are investigated in depth.

Course Description: This course addresses the statistical processes of formulating questions, collecting and analyzing data, and interpreting results. Methods related to descriptive and inferential statistics and the concept of probability are investigated in depth. This course will act as a first course in the concepts and methods of statistics, with emphasis on data visualizations, the distribution conception, descriptive statistics, and statistical inference. Inference topics include parametric and non-parametric point and interval estimation, hypothesis testing, and measures of effect size.

Prerequisites and Placement: Graduates only.

Textbook and Reading Materials:
• Required Textbook: None.
• Required Readings: There will be several required readings; PDFs of these readings will be made available to you at no cost through the course website. These readings fall under Educational Fair Use guidelines.
• Recommended Readings: A list of additional readings, sometimes including PDFS, will be posted to the course website. These readings will be optional (strongly recommended) and are meant to help enrich your experience in the course. These readings fall under Educational Fair Use guidelines. If you have a suggestion for the list, please share the details with the instructor.
• Course slides, handouts, and other materials will be posted to the course site. You are responsible for downloading these materials. You will be expected to download and read any additional reading materials made available to students on the course website.

Technology: This course will make use of different forms of technology including but not limited to: a scientific/graphic calculator, spreadsheet software, and statistical analysis software.
• Required Technology
  o You will need access to a computer for this course. The computer should run either Windows or Mac OS X.
  o You will need Internet access. Many of your course assignments will be done through the course website. Additionally, course materials (handouts, slides, videos) will be accessible via the Internet.
You will need access to an Office Suite for this course. Some of your assignments (and possible tests) will be available in Word format for you to fill in. You will need to either have Microsoft Word (at least Office 2007 for Windows, Office 2011 for Mac) or use LibreOffice. You will be told the appropriate file extension (e.g., *.docx or *.xlsx) to use for submissions. You are responsible to ensure you submit files on time and with the correct extension. You are responsible to ensure that I can read the responses as you intended. WARNING: Google Docs tends to cause problems such as deleted sentences, graphics appearing in unintended locations, and invisible tables when converting to the DOCX format.

You will need to purchase JMP Student Edition. The cost to you is ~$19.99 for a two-year license. To do so you will need to go to https://www.jmp.com/getse and click the “Access JMP Student Edition”. You’ll be directed to a new page where you’ll need to Register an account to get the discounted pricing; use your UNCO email address. (If asked, enter NA for Textbook Author and Title; Neil Hatfield for instructor.)

Optional Technology
- A scientific/graphing calculator may be used for this class. You do not need to purchase a calculator if you don’t already have one. Examples of highly recommended models are the TI 83/84 or Casio 9850 GB Plus. Instruction on how to use your calculator is beyond the scope of this course. Should you want assistance, please your instructor during office hours/or make an appointment.
- Should you feel inclined, you may wish to use R (and R Studio), SPSS, Minitab, Tableau or another statistical software package that you have. However, you must be aware that each of these packages use slightly different internal calculational processes than JMP (and each other) and may be able to build the data visualizations that JMP can. Instruction in these other software packages is beyond the scope of this course and will not be covered in class. The same is true for Excel, Numbers, and other spreadsheet applications.

In addition, please examine the Cell Phone and Technology Policies listed below.

Course Goals:
1. To support students in developing ways of thinking about data that will guide them as critical consumers of Statistics in today’s age and society.
2. To support students in developing coherent meanings for specific statistical concepts (and mathematical concepts) so that the use of the statistics becomes useful in their academic, professional, and personal lives.
3. To support students in improving their problem-solving abilities.
4. To support student in learning how to make logical and verbal arguments.

Course Structure: The class will be a mix of discussion and group work. While I will screen/audio record and post a video for each class, class attendance is essential for your success. Discussion is an important part of your learning. During class, you are expected to be prepared and will be called on to explain your thinking.

Concepts Covered: This course aims to prepare you to have a solid working knowledge of statistical concepts for some common situations. Further, this course seeks to provide a solid foundation for you to build new statistical knowledge on in future courses and to tackle novel problems as that might arise in real life. The following page provides the overall organization of concepts that this course will cover. Additional information appears on the course site under the heading “Extended Course Information”.

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Course Outline:

- **Unit 1: What is Statistics?**
  - The Discipline/Field
  - Philosophical Approaches to Data Analysis: Exploratory vs. Confirmatory

- **Unit 2: What are Data? And What is Variation?**
  - Attributes and Values
    - Data Types
    - Modeling Types
  - Variation—The Role and Types

- **Unit 3: Where do Data Come From? And How do we Describe Long-run Behavior?**
  - First-order Stochastic Process
  - Randomness
  - Sampling Methods
  - Stochastic Variables and their Conventions
  - Accumulation
  - Probability, Chance, Likelihood
  - Distributions and Distribution Functions
  - Notation: Probability, Distribution, and Distribution Functions
  - Named Distributions I
  - Attributes of Distributions

- **Unit 4: What Do Our Data Tell Us?**
  - Data Visualizations
  - Quantitative Reasoning
  - Attributes of Collections
  - What is a statistic?
    - Function and Statistics Notations
    - Statistics Notation
  - Sample Statistics

- **Unit 5: How Do We Make Decisions Based on Our Data?**
  - Second-order Stochastic Processes
  - Sampling Distributions
  - Named Distributions II
  - Replication
    - Simulation (Permutation and Bootstrapping, Monte Carlo)
    - Shortcuts (Monte Carlo, Parametric, Nonparametric Methods)
  - Estimators—Point and Interval
  - Null Hypothesis Testing
  - Statistical Significance
    - \( p \)-values
    - Inference Errors—Types I (Error Rates), II (Power), III, and IV
  - Practical Significance—Effect Size
    - Distance Family
    - Proportion of Variance Explained
    - Probability of Superiority
    - Measures of Association Strength
  - Problems
    - The \( k \) Sample Problem/Oneway Layout
    - The Two Sample [Location] Problem
    - The One Sample [Location] Problem
    - The Independence Problem
Rules of Engagement: Your success in STEAM and STEAM teaching requires that you:

1. **Speak with Meaning**
   What you say should carry meaning to others. Reference attributes (quantities and qualities)—NO pronouns. Explain and justify your approach.

2. **Exhibit Intellectual Integrity**
   Base your conjecture on a logical foundation; don’t pretend to understand when you don’t.

3. **Strive to Make Sense**
   Persist in making sense of your peer’s thinking.

4. **Respect the Learning Process of Others**
   Allow others the opportunity to think, reflect and construct. When assisting your peers, pose questions to help them construct meaning rather than show them how to get the answer.

Grading Policy—Types of Assessments:

1. **Tests.** There will be two (2) take-home tests given during the semester. The first test will be after the completion of Unit 3 (covering Units 1-3) and the second will be after the completion of Unit 4 (covering Units 1-4, focusing on 4). You will work alone to complete each take-home test to show your understanding of the course material. The best possible preparation for the tests is regular attendance and completion of assigned homework. Making up a missed test will be set up on a case-by-case basis. Requests should include legitimate reasons with sufficient/appropriate written documents (e.g., a doctor’s note).

2. **Final Exam.** There will be one (1) take-home comprehensive final exam for you to complete at the end of the semester. You will work along to complete the tasks to demonstrate your understanding and mastery of the course material.

3. **Homework (General Assignments).** Throughout the semester, you will have homework assignments, which you need to complete as assigned. These assignments will involve problem solving and will require you to reveal your reasoning, justification, and reflection on your thinking. You are responsible for completing the homework assignments prior to the announced deadline. Your instructor will review your homework and your grade is based on completion, accuracy, neatness, and work shown.

To ensure that I can get feedback to you in as timely a fashion as possible, I ask that you turn your homework in on time. While I typically do not accept late work, students may contact me about getting a limited extension. You must provide all of the following:

- Contact me a minimum of two (2) days (48 hours) before the posted due date of the assignment.
- Show that you have made some progress on the assignment already.
- Explain why you need the additional time.
- Propose a new due date

I will review each request on a student-by-student basis and get back to you with the extended due date that I grant you, which might not be the date you propose. Until you hear back from me, please do not assume that you have the extension. You may only ask for one extension per assignment.

If you find yourself asking for multiple extensions, please reach out to me to discuss what’s going on. I’ll do the same if I feel that you’ve made a large number of extension requests.

4. **Quizzes.** There may be announced and un-announced (“pop”) quizzes held during the class sessions during the semester. Making up quizzes will be permitted under the instructor’s discretion in line with
the attendance and university policy. Additionally, some quizzes may be take-home and completed via Canvas.

5. **Data Analysis Project.** Statistics (and mathematics) is an interactive field where you must engage with data to help you develop ways of thinking that will serve you well in your future endeavors. Thus, there will be an on-going data analysis project this semester. Over the course of the semester you will prepare a paper focused on the exploratory data analysis for an adopted data set. Further details about this project will be given in class.

6. **Attendance and Participation.** Your success in this class is dependent upon your attendance and participation. You are required to attend class at each class meeting. If you must miss class, please contact your instructor via email prior to the class. Your instructor reserves the right to decide whether an absence is excused. Participation is defined as contributing to statistical discussions relative to your assignments, completing assignments, and presenting your statistical thinking to the class. Active participants continue participating outside of scheduled class hours by forming study groups, asking questions outside of class. Failure to participate during class will result in a loss of participation points allotted for each class session. Examples of non-participation include, but are not limited to, working on non-statistical content or assignments from other courses, texting during class, or engaging in discussions with students on topics outside of statistics.

You are required to attend the first class session; I am required to withdraw students who do not attend the first class session. It is your responsibility to attend all classes. You will not be able to make-up class activities if you are absent.

If you will be absent from class due to a religious observance or practice as well as participating in a university sanctioned event/activity, you are responsible for informing the instructor during the first week of class. Your instructor will work with you on alternative and reasonable arrangements for any time missed.

7. **Extra Credit.** Extra credit is not a student right, but a privilege granted at the instructor’s discretion. Please do not ask me to give you extra credit. I will let everyone about extra credit opportunities throughout the semester. Extra credit opportunities will only be made to the class as a whole and never to individual students.

8. **Academic Integrity.** UNC’s policies and recommendations for academic misconduct will be followed. For additional information, please see the Dean of Students website, Student Handbook link (http://www.unco.edu/dos/handbook/index.html). You are expected to attend class and take responsibility for your own learning.

**Grading Policy—Final Grade Procedure:** Your grade is dependent upon how well you demonstrate your comprehension of the subject through application and completion of the items listed above in this syllabus.
1. **Weighted Course Total**

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<th>Assessment Category</th>
<th>Weighting</th>
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| 2 Tests:            | Total: 40%  
Test 1 focuses on Units 1–3  
Test 2 focuses on Unit 4, but will include elements from Units 1–3  
|                      | (Each test is 20%) |
| Final Exam:         | 25%        |
| Focuses on Unit 5, but will include elements from Units 1–4  |
| Data Analysis Project | 15%    |
| Homework and Quizzes | 15%   |
| Attendance/Participation | 5%    |

2. **Dropped Assessments:** No test or exam grade will be dropped from the calculation of your weighted total. The lowest grade from the Homework and Quizzes category will be dropped.

3. **Extra Credit:** If and when extra credit opportunities are made available that are not part of any assessment, the points for the opportunity will be included in the Homework and Quizzes category.

Each test and the final exam will have an extra credit section; the points earned here will be applied to the Tests category (or the final exam category).

4. **Calculation of Final Course Grades:** Final course grades will be determined in a data-driven approach based upon five items, listed in order of importance:

1) Number of Learning Outcomes at the Advanced Level  
2) Number of Learning Outcomes at the Proficient Level  
3) Number of Learning Outcome Categories at the Advanced Level  
4) Number of Learning Outcome Categories at the Proficient Level  
5) Weighted Course Total

Throughout the semester, your work from all homework, quizzes, tests, and the data analysis project is tied to the various learning outcomes associated with this course. The learning outcomes allow for you to demonstrate your skills and understanding over the whole semester rather than a “high stakes” exams. For each learning outcome, your scores on associated questions helps determine your status on that learning outcome. There are five statuses:

- Advanced: your score on that learning outcome is 85% or higher.  
- Proficient: your score on that learning outcome is 70% or higher.  
- Progressing: your score on that learning outcome is 50% to 70%.  
- Beginning: your score on that learning outcome is less than 70%.  
- Not Shown: your score on that learning outcome is 0%.

A listing of learning outcomes is posted on the course website. If you wish to see where you are at in terms of learning outcomes, please come see me during office hours/contact me.

**Cell Phone Policy:** If there is a call you are expecting (e.g., you have a sick family member) let me know before class. Furthermore, texting during class time will not be tolerated.
**Technology Policy:** I recognize that in today’s age some students prefer to take notes via their laptop computers, iPads, or other tablet devices. I am not opposed to you doing this. Additionally, we will be using statistical software all semester. However, you should not let the use of your computing device become a distraction to your participation in class. Further, your use of the computing device should not impede your learning or the learning of others around you. To this end, I will ask that you not be on any websites that do not directly pertain to our class. This means that the use of Facebook (or other social networking sites), Reddit, Tumblr, YouTube, Pinterest and other such websites are not allowed during class time. In addition, working on projects/homework (including emails) for other classes will not be allowed.

**Disabilities:** It is the policy and practice of the University of Northern Colorado to create inclusive learning environments. If there are aspects of the instruction or design of this course that present barriers to your inclusion or to an accurate assessment of your achievement (e.g. time-limited exams, inaccessible web content, use of videos without captions), please communicate this with your professor and contact Disability Support Services (DSS) to request accommodations. Office: (970) 351-2289, Michener Library L-80. Students can learn more about the accommodation process at [https://www.unco.edu/disability-support-services/](https://www.unco.edu/disability-support-services/).

**Honor Code:** All members of the University of Northern Colorado community are entrusted with the responsibility to uphold and promote five fundamental values: Honesty, Trust, Respect, Fairness, and Responsibility. These core elements foster an atmosphere, inside and outside of the classroom, which serves as a foundation and guides the UNC community's academic, professional, and personal growth. Endorsement of these core elements by students, faculty, staff, administration, and trustees strengthens the integrity and value of our academic climate.

Consult your student handbook for university policies on student conduct in the classroom, cheating, plagiarism, and other academic expectations. You are expected to complete your own homework and exams without assistance. UNC's policies and recommendations for academic misconduct will be followed. For additional information; [https://mcb.unco.edu/students/student-code-of-conduct.aspx](https://mcb.unco.edu/students/student-code-of-conduct.aspx) or [https://www.unco.edu/dos/assets/pdf/StudentCodeofConduct.pdf](https://www.unco.edu/dos/assets/pdf/StudentCodeofConduct.pdf).

**Disclaimer:** The student is responsible for knowing all of the information contained in this syllabus. Any changes to the syllabus and course calendar will be announced in class. Students are responsible for these changes whether in attendance or not. Additionally, the student should review the college policies included in the college catalog and the student handbook.

**Inclusivity:** If you go by a different name than what appears on the roster, please let me know so I can adjust my records. Additionally, please let me know what your preferred pronouns are.

**Important Dates:**
- Add Deadline for full semester courses: TBA
- Drop Deadline for full semester courses: TBA
- Individual Course Withdrawal Deadline for full semester courses: TBA
- Complete Schedule Withdrawal Deadline: TBA