2020

STAT 250 Statistics for Life Sciences syllabus

Nancy Geisendorfer
University of Northern Colorado

STAT 250 Statistics for Life Sciences

Course: STAT 250-005 CRN 14716 Fall 2020
Tues/Thurs at 11:00-12:15 synchronous online

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Office Hours: Tues/Thurs 9:00 – 10:30 Zoom Drop-in or by Virtual Zoom with appointment.

Prerequisites: A satisfactory score on the math placement index (ALEKS $\geq$ 40) and a full year of high school modern second year algebra with a grade of "C" or better; or credit in Math 124 or higher; or consent of the instructor.

Description: This course is an introduction to statistical methods in biological sciences. Topics include study designs, data visualization and exploration, basic probability with applications, and statistical inferences using R for confidence intervals, hypotheses tests, and regression. Course is worth 3 credits.

Materials:

- OER Textbook: *Statistics Using Technology* (2nd Ed.) by Kathryn Kozak, 2015.
- OER Textbook: *Open Intro Statistics* (4th Ed) by David Dietz, Mine Cetinkaya-Rundel, and Christopher Barr, 2019.
- Scientific calculator, preferably TI-83 Plus or TI-84 or equivalent.
- Access to Canvas http://canvas.unco.edu/
- Statistical analysis tool called StatKey at http://www.lock5stat.com/StatKey/
- Statistical software R and/or R Studio at https://cran.r-project.org/
- Access R through the Jupyter Hub at https://jupyter.unco.edu

Course Evaluation

Attendance Policy: Attendance and participation are expected. We are a mathematical community of learners where community support and active participation are expected. Attendance will be taken daily if on campus. The weights of each course component are given below.

Your weighted grade will be calculated as:

20% Assignments/Homework
20% Labs & Projects
40% Exams
20% Final Exam

Grading Scale

A	90 – 100%
B	80 – 89%
C	70 – 79%
D	60 – 69%
F	< 60%

Summary of Assessments:

- Assignments/Homework: Homework will be assigned and assessed weekly through Canvas. The goal of the online homework is to master the concepts; thus you will have 3 chances to achieve the correct solutions for each homework set. The number of problems may vary by week so the point value will change, and partial credit can be earned on multipart problems. The online homework assignments are generally due by 11:59 pm each Saturday night. You can complete the work anytime during the week, but I suggest working on the assignments throughout the week. Do NOT procrastinate until the due date to start the homework!
- Labs and Projects: We will have both inside and outside of class activities, which may consist of conducting an experiment, completing a worksheet, or you will explore analyzing data using technology. Throughout the semester there will be opportunities for you to analyze real data using *StatKey* and/or *R Studio* and writing an associated statistical report. Some of these will be individual and some can be completed in pairs. More details to come.
- Exams: There will be two examinations given over material discussed during the semester plus the final exam. Exams will consist of problems that require knowledge of the techniques covered in class and the homework. No makeup examinations will be given without appropriate documentation. Each exam will be worth 100 points. Tentative exam dates are: Exam 1 is October 1 covering descriptive statistics and probability (Ch 1 - 6.3); and Exam 2 is November 5 covering inferential statistics (Ch 6.4 – 9). There will be a several day window in which to complete the exams when online format.
- Final Exam: The final examination will be comprehensive on Ch 1-11. The final exam is scheduled for Wednesday December 9 at 10:45-1:15**.** You are allowed a graphing calculator. You will need StatKey and/or RStudio to complete the take-home portion of the final exam. Smartphones will NOT be allowed during exams and the final exam will not be given early.

Please note: During examinations, no cell phones, tablets or other electronic devices can be turned on or seen visually. Anyone found with an electronic device that is active during an in-class examination will be given a zero on that examination. So, you will need to bring a calculator to the examination (e.g. TI-83) as you will not be allowed to use your electronic devices for calculations.

Presentation of Material:

Please make sure you understand the material as it is presented. As the course progresses, we will build upon the concepts covered earlier. If you fall behind, it will be nearly impossible to catch up. *It is valuable to read the material to be covered before attending class*. Having an idea of the material to be covered will facilitate a more thorough knowledge of the material when it is presented. In class we will review important vocabulary and its application through a variety of activities including investigating with technology. Some weeks we will have computer-based *projects* where you can implement the concepts learned to the data we collected from the class, these will be submitted under Assignments for a grade. If you have questions, please ask them as they occur to you. If you don't understand, most likely there are others who do not understand also. You should have a thorough knowledge of high school algebra.

Important Dates

Important Dates:

- Last day to add classes: Friday, August 28, 2020
- Last day to drop classes: September 4, 2020.
- Labor Day: University closed: September 7, 2020
- Last day to withdraw from classes and receive a ‘W’: October 15, 2020
- Thanksgiving Break is November 25-29, 2020
- Final Exam is Wednesday, December 9 at 10:45-1:15

Course Learning Objectives -

As a result of this course, students should be able to . . .

- understand different statistical methods and its importance in public health and environment.
- apply analytical skills to provide meaningful graphical and numerical summary of data.
- interpret key statistical measures and association.
- distinguish between observational and experimental studies.
- identify different study designs - including designed experiment, prospective and retrospective studies.
- identify potential sources of bias and variability and explain concepts of confounding.
- explain significance tests and interpret results from confidence intervals and p-values.
- use appropriate statistical test (e.g. t-test, z-test, chi-square test) for comparing between two groups.
- use ANOVA (parametric and non-parametric) for multiple group comparisons.
- use regression models to make predictions.
- critique the use of statistical methods in biological studies.
- confidently use R for data analysis.

University Policy & Resources

Disability Resources

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 Resource Center (DRC) 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-resource-center/

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.

UNC's Policies

UNC's policies and recommendations for academic misconduct will be followed. For additional information, please see the Student Code of Conduct at the Dean of Student's website https://www.unco.edu/dean-of-students/pdf/Student-Code-of-Conduct.pdf.

Food Insecurity and Basic Needs

Research shows that college students experience food insecurity at higher rates than the American household rate, and that food insecurity can negatively impact academic performance and persistence. In recognition of this problem, UNC offers assistance to students facing food insecurity through an on- campus food pantry. The Bear Pantry is located in University Center 2166A, and is open for regular hours throughout the semester. Please visit www.unco.edu/bear-pantry for more information.

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is also urged to contact Student Outreach and Support (SOS) for assistance. SOS can assist students during difficult circumstances which may include medical, mental health, personal or family crisis, illness or injury. SOS can be reached at sos@unco.edu or via phone at 970-351-2796.

Academic Integrity

You are expected to practice academic honesty in every aspect of this course. Students who engage in academic misconduct are subject to grading consequences with regard to this course and/or university disciplinary procedures through the Community Standards and Conflict Resolution at . https://www.unco.edu/community-standards/

Title IX
The University of Northern Colorado is committed to providing a safe learning environment for all students that is free of all forms of discrimination and sexual harassment, including sexual assault, domestic violence, dating violence, and stalking. If you (or someone you know) has experienced or experiences any of these incidents, know that you are not alone. UNC has staff members trained to support you in navigating campus life, accessing health and counseling services, providing academic and housing accommodations, helping with legal protective orders, and more.

Please be aware all UNC faculty and most staff members are "responsible employees," which means that if you tell a faculty member about a situation involving sexual harassment, sexual assault, dating violence, domestic violence, or stalking, they must share that information with the Title IX Coordinator, Larry Loften. Larry or a trained staff member in the Office of Institutional Equity and Compliance (OIEC) will contact you to let you know about accommodations and support services at UNC as well as your options for pursuing a process to hold accountable the person who harmed you. You are not required to speak with OIEC staff regarding the incident; your participation in OIEC processes are entirely voluntary.

If you do not want the Title IX Coordinator notified, instead of disclosing this information to your instructor, you can speak confidentially with the following people on campus and in the community. They can connect you with support services and help explore your options now, or in the future.

- UNC's Assault Survivors Advocacy Program (ASAP): 24 Hr. Hotline 970-35-4040 or www.unco.edu/asap
- UNC Counseling Center: 970-351-2496 or www.unco.edu/counseling
- UNC Psychological Services: 970-351-1645 or www.unco.edu/cebs/psych_clinic
- If you are a survivor or someone concerned about a survivor, or if you would like to learn more about sexual misconduct or report an incident, please visit www.unco.edu/sexual-misconduct or contact the Office of Institutional Equity and Compliance (970-351-4899). OIEC is located on the third floor of the University Center in room 3060.

Equity and Inclusion Statement
The University of Northern Colorado embraces the diversity of students, faculty, and staff, honors the inherent dignity of each individual, and welcomes their unique perspectives, behaviors, and world views. In this course, people of all races, religions, national origins, sexual orientations, ethnicities, genders and gender identities, cognitive, physical, and behavioral abilities, socioeconomic backgrounds, regions, immigrant statuses, military or veteran statuses, size and/or shapes are strongly encouraged to share their rich array of perspectives and experiences. Course content and campus discussions will heighten your awareness to each other's individual and intersecting identities. If you would like to report an incident or learn more about identity-based discrimination/harassment, please visit www.unco.edu/institutional-equity-compliance.

Portable Electronic Devices
Please extend courtesy to your instructor and fellow students by turning off your portable electronic devices such as: cell phones, pagers, and iPods. Although not an audio issue, text- messaging is a distraction to other students and prevents you from full participation in class. You should keep your portable electronic devices in your backpack or purse during class. Your personal electronic devices should not be on your desks. If you know that you may need to accept an emergency phone call during class or if you have children in childcare or school, please let the instructor know. If you need to take a phone call during class, please step out of the classroom while you complete your call. Thank you for your cooperation.

Course Outline

- Statistical Basics
  - Types of Data
  - Study Design
  - Sampling Methods
  - Experimental and Observational Studies
- Descriptive Statistics
  - Graphical summaries
  - Numerical summaries
- Probability
- Distributions
  - Probability
  - Binomial
  - Normal
- Statistical Inference
  - Interval estimation for means and proportions
  - Hypothesis Tests (Z, t, chi-square tests)
  - Significance Test for comparing means, proportions, variances
  - Inferences for categorical data
  - ANOVA
  - Regression
- Statistical Modelling in R

Tentative Schedule

Weeks	Content	Due Date
1	Statistics Data and Study Design	Aug 29
2	Graphing Data with StatKey	Sept 5
3	Descriptive Statistics & Correlation	Sept 12
4	Probability	Sept 19
5	Discrete Distributions	Sept 26
6	Distributions & Exam	Oct 1
7	Sampling Distributions	Oct 10
8	Confidence Intervals	Oct 17
9	Hypothesis Testing	Oct 24
10	Comparing Means	Oct 31
11	Comparing Proportions & Exam	Nov 5
12	More Comparisons Tests	Nov 14
13	Analyzing Associations	Nov 21
14	ANOVA & Regression	Nov 28
15	Review for Final	Dec 5