



GOSHEN COLLEGE
MATHEMATICS DEPARTMENT
MATH 233 STATISTICAL MODELS – FALL 2023-24

Catalog Description	An introduction to the practice and theory of multivariate statistical modeling. Topics include descriptive statistics, experiment and study design, probability, hypothesis testing, multivariate regression, single and multi-way analysis of variance, logistic regression, and data mining. The R statistical software environment will be used extensively. Examples will be drawn from the social, biological, and physical sciences. Recommended background: three years of high school algebra and geometry or Math 115. Earns 3 credit hours.
Learning Objectives	By the end of the course, the student will be able to do the following: <ol style="list-style-type: none">1. Identify how a data set was acquired, how it is organized, and what it represents.2. Create, fit to data, and interpret statistical models to explore relationships among variables in a population.3. Use standard single and multiple variable statistical techniques and the R statistical software environment adroitly.4. Explain the mathematical justification for and limitations of the statistical techniques used.5. Communicate correctly, clearly, concisely, and completely an analysis of a data set.
Recommended Background	A C or better grade in Math 115 Applied Algebra, or grades of A or B in 3 years of high-school algebra and geometry. . A score of 61% or above on the ALEKS Placement Exam (and enter the class code 4CFL6-DDUVJ) is highly recommended. The exam can be taken multiple times, and modules are available to help you review any gaps in your knowledge. If you have any concerns about your readiness for this course, please converse with the instructor.
Instructor	David Housman, SC 117, dhousman@goshen.edu, 574-535-7405. When he is available in his office is posted on his office door and on Moodle.
Class	TR 8:00 – 9:15 a.m. in SC 107. Attendance and participation are expected. Class activities will complement, not substitute, for the reading, problem solving, and concept discussing students engage in outside of class.
Textbooks	<i>Statistical Inference via Data Science: A ModernDive into R and the Tidyverse!</i> by Chester Ismay and Albert Y. Kim, July 26, 2023. We will refer to this book as the ModernDive text and is available for free at https://moderndive.com/ .
Software	R statistical computing and graphics software and RStudio integrated development environment will be used extensively. These software are available on campus Windows computers and can be downloaded and installed onto your own computer.

Activities

The study of statistics is not a spectator sport! Reading, listening, solving problems, writing explanations, reflecting upon ideas, and receiving feedback are essential to learning the concepts and techniques of statistics. Read with paper and pencil in hand, and take an anticipatory approach: try to obtain solutions, explanations, and proofs before reading what the author provides. Write down specific questions when you do not understand a portion of the reading or a lecture.

An average student can obtain an average grade with an average of nine hours each week devoted to this course—adjust if you are not average or desire a grade that is not average.

Moodle will announce reading recommendations and assignments. Class time will be devoted to activities intended to complement, deepen, and extend your understanding. Reading, class activities, and assignments will be the primary means for learning the content of this course. There will be a take-home final exams to focus attention on synthesizing what has been learned, and students will complete a data collection and analysis project to encourage depth of understanding.

Tentative Schedule

Topic	Chapters	Number of Classes
Introductions	1	2
Data Visualization	2	2
Data Wrangling	3-4	2
Regression	5-6	6
Sampling	7	2
Confidence Intervals	8	4
Hypothesis Testing	9	4
Regression Inferences	10	2
Project Completion	11	2 + Final Exam period

Grading

Course grades will be based on performance on assignments (60%), a comprehensive final exam (20%), and a project (20%). The course grade will be translated into letter grades in the following manner.

Minimum Percentage	93	90	87	83	80	77	73	70	67	60	0
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F

Assignments

Achieve and exhibit understanding by completing the assigned exercises. You are encouraged to collaborate and seek assistance when having difficulties; however, you should eventually write your own solutions. You will have achieved the expected level of understanding when you are able to obtain your own solutions, independently reproduce solutions developed in collaboration or with assistance, and/or explain a solution to others. Assignments will typically be due Wednesdays at 8:00 AM and graded by the start of Thursday's class. Rewrites and late submissions will be assessed a 30% penalty and typically be due one week after the original due date.

Final Exam	Exhibit your ability to solve problems and describe statistical concepts without assistance or collaboration. The exam will be completed over several days with students permitted to make use of any inanimate course resource.
Project	Exhibit your ability to apply your knowledge of statistical models to data sets of interest. Students may complete the project individually or in a group of two or three students. A written report and an oral presentation will be due at the end of the semester. Further details will be provided on Moodle.
Extra Credit	Receive extra credit toward your assignments grade by doing one or more of the following: (1) find content errors in the textbook or posted course materials and describe the error in writing; (2) attend a quantitative presentation (e.g., Science Speakers) or participate in a quantitatively based activity and describe in writing some interesting mathematical aspect of the presentation or activity; or (3) participate in a Career Services event and describe your most important discovery. For any of these activities, the description should be at least one substantive paragraph and be submitted to the instructor on paper or via email.
Accessibility Accommodations	Goshen College is committed to providing all students equitable access to programs and facilities. Students who need accommodations based on disability should contact the Academic Success Center (ASC). Students must register with the ASC before faculty are required to provide reasonable accommodations. For more information or to register, please contact the Director of Academic Success, Michelle Blank, Good Library 112, mblank@goshen.edu or 574-535-7526. To ensure that learning needs are met, contact the ASC the first week of classes. More information at: https://www.goshen.edu/campuslife/asc/disability-services/ .
Learning Assistance	The Academic Success Center offers individual tutoring by appointment at tutorcal.goshen.edu . Unfortunately, there may not be any student available to provide tutoring assistance for this course. So, you are encouraged to visit David in his office with your questions.
Collaboration and Academic Integrity	<p>You are encouraged to use all available resources to learn the concepts and techniques discussed in this course. Conversations with other students and the instructor can be an effective learning method. Reading other books and web pages can be another effective learning method. However, copying someone else's work subverts the learning process.</p> <p>For assignments and the project, you may look at and discuss another person's written work, but you may not directly copy that work when writing your answers. You may collaborate with others, but any written work developed during such a collaboration should be destroyed before writing your own solutions. You should give written acknowledgement to people with whom you have had discussions and to any written materials (other than the official texts) that were helpful. When completion by a group of students is permitted, the above restrictions do not apply to persons within the group.</p> <p>For exams, you may <i>not</i> use any resources unless a specific exception is stated by the instructor.</p> <p>Failure to observe the above rules will result in a zero on the assignment or exam. Any violation of academic integrity will be reported to the Associate Academic Dean.</p>

Observation of the above rules will help you learn the material well and give you the satisfaction of knowing that you have earned your grade.

Due Date Policy Assignments, exams, and the project can only be excused, rescheduled, or made up if (1) there is a serious medical problem, a death in the immediate family, or an irreconcilable conflict with another official Goshen College activity; (2) there is written documentation signed by proper authorities; and (3) the instructor is notified prior to the due date or as soon as possible afterwards.

Course Materials are for Private Use Course materials (videos, assignments, exams, problem sets, etc) are for use in this course only. You may not upload them to external sites, share with any person outside this course, or post for public commentary without written permission from the professor. Sharing recordings outside of the class could lead to a copyright or FERPA violation. Goshen College prohibits any student from duplicating, downloading, or distributing class recordings with anyone outside of this class, for any reason.

Student Life Resources Goshen College is committed to providing a safe, supportive, and equitable learning environment. If you encounter circumstances that impact your learning or personal safety, please contact someone from [Student Services](mailto:studentservices@goshen.edu) (studentservices@goshen.edu or 574.535.7474).

- Any student who has difficulty accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Dean of Students Gilberto Pérez Jr. (gperez@goshen.edu or 574.535.7434) for support.
- Adriana Ortiz, Director of Hispanic Student Recruitment and Family Engagement, is available to help commuter students (aortiz@goshen.edu or 574.535.7291).
- Resident Directors Kevin Schultz (kevints@goshen.edu or 574.535.7286) and Jordan Blank (jblank@goshen.edu or 574.535.7296) are available to assist residential students.
- If you experience safety issues on campus, please contact Chad Coleman, Director of Campus Safety (chadc@goshen.edu or 574.535.7292).

Goshen College does not condone and will not tolerate inappropriate conduct toward any individual based on the individual's sex, sexual orientation, national origin, race, ethnicity, documentation status or gender identity. Issues related to [gender](#) and [racial](#) discrimination or harassment can be reported online. You may also contact Dean of Students Gilberto Pérez Jr. (gperez@goshen.edu or 574.535.7434) or Deputy Title IX Coordinator Liz Andes (landes@goshen.edu or 574.535.7484).