College of Liberal Arts and Sciences
Department of Mathematics, Physics, and Statistics

MATH 250

Data Analysis (3 units)
Fall 2022
Section 01 Class #: 11324
Segerstrom 174 TR 4:20PM – 5:45 PM

Instructor

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APU Mission Statement

Azusa Pacific University is an evangelical Christian community of disciples and scholars who seek to advance the work of God in the world through academic excellence in liberal arts and professional programs of higher education that encourage students to develop a Christian perspective of truth and life.

Course Description

Prerequisite: MATH 130 or MATH 361

APU Credit Hour Policy

Following the APU Credit Hour policy, to meet the identified student learning outcomes of this course, the expectations are that this 3 unit course, delivered over a 15 week term will approximate 3 hours/week classroom or direct faculty instruction. In addition, out-of-class student work will approximate a minimum of 6 hours each week.

Other Important Policies and Information

https://goo.gl/2uDWh7

Course Objectives and Desired Student Learning Outcomes for Probability and Statistics

Student Learning Outcome "By the end of this course, students should be able to…"	IDEA Objective	Assignments Used to Assess
Prepare data for statistical analysis	Developing specific skills needed by professionals in the field	Labs, Homework, Project
Use methods for effectively organizing, interpreting, and presenting quantitative data based on type of data	Learning to Apply Course Materials	Labs, Homework, Project, Exam
Identify appropriate measures of association applied to different data types	Gaining a basic understanding of the subject	Labs, Homework, Project, Exam
Select and use hypothesis tests for different data types and scientific questions	Learning appropriate methods for collecting, analyzing, and interpreting numerical information	Labs, Homework, Project
Apply concepts of power, errors, assumptions, and biases in statistical analyses	Learning to Apply Course Materials	Labs, Homework, Project

Required Course Materials

Books: This course has two textbooks, both of which are freely available online:
- [R for Data Science](#) by Hadley Wickham & Garrett Grolemund
- [Introduction to Modern Statistics](#) by Mine Çetinkaya-Rundel and Johanna Hardin

Software: This course will utilize the statistical software R via the web version RStudio Cloud. Students will receive instructions in the first week of class for how to set up an RStudio Cloud account.

Hardware: Students are expected to bring a laptop to all class sessions. If access to a laptop is an issue, then please contact the course instructor and an accommodation will be made. This requirement will not prevent students from taking this course.

Campuswire account: This term we will be using [Campuswire](#) as our preferred platform for questions about homework, labs, and general course questions. The system is highly catered to getting you help quickly and efficiently from classmates and the instructor. Rather than emailing questions to the instructor, you should post your questions on Campuswire. ***See Canvas for Enrollment Code.***

Course design[1]

Modern data analysis is inherently tied to coding and computational tools, and coding is learned by doing. To facilitate this type of learning, this course utilizes a flipped learning design. Each week, you will watch a series of lecture videos and complete a preparation quiz *before* class. Then class-time will be dedicated to hands-on application exercises and group lab assignments. The activities and assessments follow a *prepare, practice, perform* format and are designed to help you develop the foundational skills of a modern data scientist.

- **Prepare**: Includes lecture videos and optional readings to introduce new concepts and a short quiz ensure a basic comprehension of the material. The goal is to help you prepare for the in-class activities.

- **Practice:** Includes in-class application exercises where you will begin to apply the concepts and methods introduced in the lecture videos. The activities will be graded for completion, as they are designed for you to gain experience with the statistical and computing techniques before working on graded assignments.

- **Perform:** Includes labs, homework, one exam, and the final project. These assignments build upon the prepare and practice assignments and are the opportunity for you to demonstrate your ability to apply course material to analyze real-world data.

Preparation Quizzes (Prepare)

At the beginning of each week, you will watch a series of lecture videos and take a low-stakes preparation quiz in Canvas to check your understanding. Each quiz can be re-taken up to 3 times before the deadline. The quiz is due by class-time on Tuesdays (4:20pm).

Application Exercises (Practice)

The majority of class-time on Tuesdays will be dedicated to working on Application Exercises (AEs) in RStudio Cloud, designed to help you practice the new skills, code, and concepts introduced in that week's lecture videos. AEs are due by class-time on Thursdays the same week they are assigned. AEs are graded on completion; demonstrating that a good faith effort has been made on all parts of the assignment will earn full credit.

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[1] Much of the course design, activities, and assessments are adapted from Mine Çetinkaya-Rundel's *Data Science in a Box* curriculum and Duke University's open source Introduction to Data Science course under the Creative Commons Attribution Share Alike 4.0 International.

Labs (Perform)

The majority of class-time on Thursdays will be dedicated to team lab assignments. The labs are a more in-depth application of the week's material that will have you complete scaffolded analyses of a real dataset using RStudio Cloud. Teams of 3 will be assigned by the instructor and will rotate approximately every two weeks. Labs are due by class-time the following Tuesday. *The lowest lab grade will be dropped at the end of the semester.*

Homework (Perform)

Approximately every other week, an individual homework assignment will be due. Homework will be similar in nature to the labs but are to be completed on your own outside of class. You are still encouraged to work together, but homework will be submitted and graded individually. Homework will be assigned on Thursdays and due by class-time the following Thursday. *The lowest homework grade will be dropped at the end of the semester.*

Exam (Perform)

There will be one take-home mid-term exam for you to demonstrate your individual ability to apply what you have learned. It will consist of an analysis and computational tasks related to the material in the prepare, practice, perform assignments. The exam is take-home and open-notes but must be completed individually, without discussing or seeking assistance from anyone inside or outside the course.

You will be given the opportunity to submit annotated test corrections to earn up to 1/3 of the points back on your exam. Specific instructions and expectations will be provided when the exams are graded and returned.

Statistics Experiences (Practice)

The world of statistics and data science is vast and dynamic! The goal of the statistics experience assignments is to help you engage with the statistics and data science communities outside of the classroom. There are a variety of ways you can participate in "Statistics Experiences", which include but are not limited to listening to a podcast, reading a book, getting coffee with a statistician, joining the American Statistical Association, or participating in #TidyTuesday. Each experience is worth a varying number of points (see course website for details), and you are required to collect at least 5 "Statistics Experience points" throughout the semester. Up to 10 additional points can be collected and added to your lowest homework grade(s).

Project (Perform)

The purpose of the final project is to apply what you've learned throughout the semester to investigate an interesting data-driven research question by analyzing a real-world dataset of your choosing. The project will be completed in self-assigned teams of 2-3. You will be asked to present your findings in a written report and an oral presentation. More details will be provided during the semester.

Late/makeup work

- The coding skills gained in this course build cumulatively week-by-week, so it is important to complete and submit all assignments on time.
- Due dates are there to help you keep up with course material and ensure you receive feedback in a timely manner.
- Late work will not be accepted for preparation quizzes or application exercises, as these are designed to help you prepare for labs and homework.
- Labs and homework may be turned in up to 3 days late, and there will be a 5% reduction for each 24 hour period the assignment is late. Note that the lowest lab and homework grades will be dropped at the end of the semester.
- Labs are intended to be completed in teams, and a majority of each lab will be completed in-class on Thursdays. If you are unable to attend a Thursday lab session, you must submit the assignment individually, and a 15% deduction will apply.
- Life happens, and there are sometimes extenuating circumstances that prevent you from completing an assignment on time. You may email the instructor in advance of the deadline to request a waiver of the late penalty. You may only request the waiver once, so only use it for truly extenuating circumstances. If there are life circumstances that are having a longer-term impact on your academic performance or well-being, come talk to me, and we can work towards a solution and connect you to the support you need.
- There are no makeup exams unless specifically coordinated with the instructor in advance.
- Incompletes are rare and are available only in "special or unusual circumstances" as negotiated with the instructor prior to the end of the term. See the Catalog for policies regarding Withdrawals and grade record permanence.

Grading

Preparation Quizzes	5%
Application Exercises	3%
Engagement & Participation	2%
Statistics Experiences	5%
Homework	25%
Labs	20%
Exam	15%
Project	25%

Grading criteria and scale

- A   Superior knowledge regarding details, principles, terms, and notation; superior skill in computation and application of the material.
- B   More than adequate knowledge regarding the major themes; ability to compute correct answers and apply the material.
- C   Basic knowledge and skill needed to solve problems relating to probability and statistics.
- D   Serious gaps in knowledge, confusion of concepts, inability to recall basic information, inadequate skill in computation or application.
- F   Absence of knowledge, incapable of correct computation, misunderstands most concepts.

Final letter grades will be assigned approximately as indicated in the table below.

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

Tips for success & how to access support for this class

- Dedicate yourself to being an engaged learner and contributing to a thoughtful learning environment for your peers
- Utilize Campuswire to ask questions, respond to your peers, and upvote others' questions and responses.
- Come to my office hours. Even if you don't know what your specific questions or points of confusion are, we can figure that out together. You are welcome to attend in-person (Segerstrom 112) or on Zoom; Zoom details will be provided on Canvas. You can also email me to set up an appointment at an alternative time.
- Collaborate! Get to know your classmates. This is a very hands-on class, and you will be working together extensively.
- Google is a coder's best friend! Answers & discussions on stackoverflow.com are often particularly helpful for R related questions
- Embrace the struggle & don't shy away from confusion or uncertainty. After all, statistics is the "science of uncertainty," and being "good at math" is being good at being stuck…
- Contact me about any concerns. Best way to reach me is via email (kfitzgerald@apu.edu). I do my best to respond within 24 hours.

Important Dates

August 30 (Tue)	First day our class meets
September 7 (Wed)	Add Deadline
September 9 (Fri)	Drop Deadline
September 29 (Thurs)	Exam 1 assigned
October 4 (Tue)	Exam 1 due
November 21 - 27	Thanksgiving break (NO CLASSES)
December 12 - 16	Final Exams

Course Policies

Diversity

Affirming that diversity is an expression of God's image, love, and boundless creativity, it is the University's aim to collectively nurture an environment that respects each individual's uniqueness while celebrating our collective commonalities. It is in this spirit that we collectively strive to create an inclusive environment in which all students, staff, faculty, and administrators thrive.

Azusa Pacific University encourages community members to resolve conflicts directly, when possible. If an APU community member perceives that hostile words or behaviors were directed toward an individual or a group based upon that individual's or group's identity they can submit a Bias Incident Report. Information on the reporting process is available on the website at www.apu.edu/diversity/bias/.

Faith Integration Statement

Academic Faith Integration is recognized as an important feature of courses at Azusa Pacific University. Students can expect to discover how relevant themes from their coursework and themes from the Christian faith meaningfully inform each other. Although faith integration is central to the mission of APU, instructors respectfully recognize that students come from a diversity of faith backgrounds and that they have a variety of perspectives.

Academic Integrity Policy

The mission of Azusa Pacific University includes cultivating in each student not only the academic skills that are required for a university degree, but also the characteristics of academic integrity that are integral to a sound Christian education. It is therefore part of the mission of the university to nurture in each student a sense of moral responsibility consistent with the biblical teachings of honesty and accountability. Furthermore, a breach of academic integrity is viewed not merely as a private matter between the student and an instructor but rather as an act which is fundamentally inconsistent with the purpose and mission of the entire university. A complete copy of the Academic Integrity Policy is available in the Office of Student Life, the Office of the Vice Provost, and online.

Any use of resources that the professor has not explicitly allowed or plagiarism of anyone's words or ideas without proper credit is considered academically dishonest and will result in sanctions up to and including a 0 on the assignment for a first offense and an "F" in the class for a second offense. The student is required to meet with the professor to discuss each offense. All offenses will be reported to the Vice Provost for Undergraduate Programs.

Support Services Policy

Students in this course who have a disability that might prevent them from fully demonstrating their abilities should meet with an advisor in Accessibility and Disability Resources as soon as possible to initiate disability verification and discuss reasonable accommodations that will allow the opportunity for full participation and for successful completion of course requirements. For more information, please contact Accessibility and Disability Resources by phone at 626-815-3849, or email at disabilityservices@apu.edu.

Bibliography

Diez, D., Çetinkaya-Rundel, M., & Barr, C.D. (2019). OpenIntro Statistics (4th ed.) openintro.org/os.

Tipton, E., Kuyper, A.M., Fitzgerald, K.G. – Adapted from Kim, A.Y. & Ismay, C. Introduction to Statistics and Data Science: A moderndive into R and the tidyverse. https://nustat.github.io/intro-stat-ds/index.html

Wickham, H. & Grolemund, G. (2017). R for Data Science. O'Reilly Media. https://r4ds.had.co.nz

Course Calendar (Tentative)

Week	Dates (T-Th)	Prep material/topics	Tuesday	Thursday	Other Assigned
1	Aug 30 – Sept 1	Welcome to MATH 250! Meet the toolkit	AE 01	Lab 01	
2	Sept 6 – 8	Data visualization	AE 02	Lab 02	HW 01
3	Sept 13 – 15	Data wrangling pt. 1	AE 03	Lab 03	SE 01
4	Sept 20 – 22	Data wrangling pt. 2 Spatial data	AE 04	Lab 04	HW 02
5	Sept 27 – 29	Data importing Data cleaning	AE 05	Lab 05	Exam 1
6	Oct 4 – 6	NA (Exam 1)	AE 06	Lab 06	Exam 1 corrections
7	Oct 11 – 13	Scientific Practice Data Science Workflow	AE 07	Lab 07	HW 03
8	Oct 18 – 20	Data Ethics	AE 08	Project Work Session	Project Proposal
9	Oct 25 – 27	Simple & Multiple Linear Regression	AE 09	Lab 08	HW 04
10	Nov 1 – 3	Logistic Regression	AE 10	Lab 09	HW 05
11	Nov 8 – 10	Feature Engineering Cross Validation	AE 11	Lab 10	SE 02
12	Nov 15 – 17	Drawing rigorous conclusions Bootstrapping	AE 12	Lab 11	Project Rough Draft
	Nov 21 - 25	THANKSGIVING BREAK			
13	Nov 29 – Dec 1	Special Topics: Shiny apps	AE 13	Project Peer Review	End of Course Reflection
14	Dec 6 - 8	Special Topics: Text analysis	AE 14	Project Work Session	Project Presentation
15	Dec 13 - 15	Exam Week – Final Project Presentations			

Course schedule, topics, exams and assignments may be changed at the instructor's discretion