Stat 380A2:
Sports Statistics and Analytics II

Spring 2023

Instructor:	Aaron Nielsen, Ph.D.	**Email:**	aaron.nielsen@colostate.edu
Time:	MW 4:30 – 5:45pm	**Location:**	Weber 202
Webpage:	`http://canvas.colostate.edu/`		

Teaching Assistant: TBD

Course format: This semester's course will be held **in-person**. Class attendance is required.

Course credits: 3

Recommended Textbooks: *Analytic Methods in Sports* (Second Edition) by Thomas Severini and *Mathletics* (Second Edition) by Winston, Netstler, Pelechrinis

Required Software: R (It's free and available at `http://www.r-project.org/`) and RStudio (also free and available at `https://rstudio.com/`).

Office Hours: Immediately after class or by appointment

Prerequisite: Sports Statistics I or STAT 341 (or permission from the instructor)

Course Overview: Introduction to data collection, data management, data visualization, statistical and machine learning methods related to exploratory and predictive analysis of sports data. Real world examples from baseball, football, basketball, hockey, soccer, and volleyball are covered.

Course Goals:

1. Acquire sports data using data scraping techniques and R packages.
2. Create graphical and statistical summaries of sports data.
3. Apply linear regression models, as they relate to sports data and assess model diagnostics.
4. Use principal component analysis for exploratory and data reduction applications
5. Implement machine learning algorithms to analyze sports data (e.g., clustering and classification).
6. Learn sport-specific methods in baseball, football, basketball, hockey, and soccer.
7. Write summary and project reports and present research results to an audience.

Attendance and Participation: Attendance will be taken at the beginning of every class period. Students are expected to attend class and participate in group discussions.

Homework: There will be about five homework assignments and they will be due approximately every other week.

Reading Quizzes: There will be weekly readings from sports analytics books and journals. Each Wednesday there will be a short reading quiz covering the reading.

Short Presentation: Each student will give a short 2–5 minute presentation on a topic related to sports statistics of their choosing.

Final Project: Students will complete a final project related to sports statistics either individually or in a small group. Students will be expected to deliver a 5–10 minute in-class presentation during the final week of classes and turn in a 5–10 page report.

Basis for Final Grade: Your final grade will be based on your reading quizzes, weekly homework sets, projects, and participation/attendance. The weightings will be as follows:

- Homework: 30%
- Reading Quizzes: 10%
- Short Presentation: 10%
- Final Project Presentation and Report: 40%
- Class Attendance and Participation: 10%

Grading Scale: Your course grade will be determined from the following grading scale:

A	93% – 100%	C+	75% – 80%
A-	90% – 93%	C	70% – 75%
B+	87% – 90%	D	60% – 70%
B	83% – 87%	F	0% – 60%
B-	80% – 83%		

Course Policies:

- **Academic Integrity and CSU Honor Pledge:** This course will adhere to the CSU Academic Integrity/Misconduct policy as found in the General Catalog and the Student Conduct Code. Academic integrity lies at the core of our common goal: to create an intellectually honest and rigorous community. Because academic integrity, and the personal and social integrity of which academic integrity is an integral part, is so central to our mission as students, teachers, scholars, and citizens, I will ask that you affirm the CSU Honor Pledge as part of completing your work in this course. Further information about Academic Integrity is available at CSU's Academic Integrity - Student Resources.

- **Cheating:** This includes using unauthorized sources of information and providing or receiving unauthorized assistance on any form of academic work or engaging in any behavior specifically prohibited by the faculty member. In particular, students are not allowed to communicate with others during exams and are not allowed to use online solutions from any source.

- **Late Work Policy:** Online homework may be submitted up to one week late for half credit. No late homework can be submitted after the final exam.

- **Grades of "Incompletes":** I will follow university procedures on "incompletes", i.e., they are only given in situations where unexpected emergencies prevent students from completing the course and the remaining work can be easily finished the following semester. Incomplete work must be finished the next semester or the grade automatically turns into an F.

- **Group Work Policy:** Students are welcome to work together on homework, but you must submit your own work. You may not use solutions obtained from previous semesters or from online. This is considered academic dishonesty.

- **Students with Disabilities:** The university is committed to providing support for students with disabilities. If you have an accommodation plan, please see me so we can make any arrangements necessary to facilitate your learning.

- **Need Help?** CSU is a community that cares for you. If you are struggling with drugs or alcohol and/or experiencing depression, anxiety, overwhelming stress or thoughts of hurting yourself or others please know there is help available. Counseling Services has trained professionals who can help. Contact 970-491-6053 or go to `http://health.colostate.edu`. If you are concerned about a friend or peer, tell someone by calling 970-491-1350 to discuss your concerns with a professional who can discreetly connect the distressed individual with the proper resources (`http://safety.colostate.edu/tell-someone.aspx`). Rams take care of Rams. Reach out and ask for help if you or someone you know is having a difficult time.

- **COVID:** For the latest information about the University's COVID resources and information, please visit the CSU COVID-19 site `https://covid.colostate.edu/`.

Course schedule: The following schedule of course materials covered is tentative and subject to change.

Week	Topics
1 – 2	Introduction to sports statistics, data acquisition, data scraping, accessing sports data via R libraries, data wrangling, summarizing multivariate datasets graphically and numerically
3 – 4	Simple and multiple linear regression models for sports data, model assumptions and diagnostics
5	Principal Component Analysis, application in the analysis of baseball career statistics, passing performance in NFL quarterbacks
6	Clustering analysis, PECOTA, player similarity scores
7	Classification methods, win probability models, goal scoring probability models
8	Nonparametric statistics, splines, generalized additive models, analysis of historical sports data
9	Analysis of sports drafts, draft pick valuation, historical trends, analysis of NFL combine data
10	Sabermetics and baseball analytics, player and team valuation, acquisition and analysis of Statcast and Pitch F/X data
11	Football analytics, game theory and its use for in-game strategy, 4th down strategy, play calling, win probability added calculations
12	Basketball analytics, "hot hand" effect, spatial analysis of shot attempts, three point attempt strategy
13	Hockey analytics, puck possession, goal prevention, goal scoring probability models
14	Soccer analytics, estimation of expected goals, assessment of passing ability
15	Project presentations