STAT 1341: Sports Analytics
Fall 2025

Instructor:	Dr. Bryan Nelson
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Office:	1817 Posvar Hall
Office Hours:	Tuesday 11:00 AM - 1:00 PM and Wednesday 12:15 PM - 1:15 PM
Class Time:	Thursday and Tuesday, 9:30 AM - 10:45 AM
Classroom:	106 Lawrence Hall
Prerequisite:	STAT 1221 or STAT 1261 or another equivalent course

Course Description

This course will explore various techniques for analyzing and assessing players and teams across the five major sports. Students will learn about advanced metrics in baseball, basketball, football, hockey, and soccer through lecture and scholarly journal articles and statistical analyses. The course will also cover scoring distributions, methods of rating sports teams, Monte Carlo simulations, in-game event probabilities, and the statistics behind sports betting. The statistical software package R will be used throughout the course.

General Information

Attendance Policy: In-person attendance for the lectures is highly encouraged, but is not required. However, attending class will be your only source of extra credit during the semester. Lectures will be recorded and posted after class on Canvas through Panopto but will not be available synchronously via Zoom. You are fully responsible for the content in any classes you miss, and you are responsible for obtaining the lecture notes from either another student or the lecture recording. Remember that technology issues can occur that may prevent the recording from working properly, so attending class is the only guaranteed way to obtain the content from the lecture.

Office Hours: All office hours will be held in my office (1817 Posvar Hall) during the times listed above each week. No appointment is necessary so feel free to drop in at any point during these times. Please come prepared with specific questions so we can make the best possible use of the time.

Grader Information: Your grader will be responsible for grading the homework assignments and holding office hours throughout the semester. Their information is listed below:

Name	Email	Office Hours	Office Hours Location
Oscar Fawcett	osf8@pitt.edu	Thursday 10:00 AM - 12:00 PM	1826A Posvar Hall

Statistical Software: R and RStudio will be needed to complete several of the homework assignments as well as both projects. R and RStudio can be downloaded using the following instructions:

- **R**: Download from cran.rstudio.com, where you can click the link to download the correct version for your computer (PC, Mac, or Linux)

- **RStudio**: Download from posit.co/download/rstudio-desktop/. Navigate to **Products** > **RStudio** in the left column. On the new page, scroll down and click on **Download RStudio Desktop** to install.

Email Policy: Throughout the semester, your grader and I check our email Monday through Friday between the hours of 9:00 AM and 5:00 PM as our schedules permit. We check our email infrequently outside of this time frame. Emails sent before 5:00 PM will generally receive a response that day. Emails sent after 5:00 PM on weekdays or at any time over the weekend will receive a response on the next business day. If you have a question regarding a homework assignment, make sure you send it before 5:00 PM on Friday; failure to receive a response on an email sent late or over the weekend does not constitute a valid reason for an extension or other accommodation.

GRADING AND ASSESSMENTS

1. **Nine Homework Assignments (50%)**

   - There will be **nine (9)** homework assignments throughout the semester worth a total of **340** points. All assignments will count towards the final course grade.
   - Assignments are **not** weighted equally. Your total points earned on the homework will be divided by 340 and multiplied by 50% to determine the homework portion of your grade.
     - **Assignment 1** will consist of a review of topics from the prerequisite courses.
     - **Assignments 2-4** will require you to read **one (1)** journal article, answer a set of questions about the content in the article, and complete a short problem set that is related to the content from class and the article. These assignments will be on basketball, baseball, and football respectively.
     - **Assignment 5** will require you to answer questions about **two (2)** journal articles: one on hockey and one on soccer.
     - **Assignments 6-9** will focus more on statistical modeling and analysis using the techniques covered in class (scoring distributions, rating systems, Monte Carlo simulation, and in-game events).
   - Problem sets, journal articles, an R markdown template, and necessary data will be posted on Canvas.
   - All assignments will be completed using R and RStudio exclusively. When complete, upload the knitted HTML file of your R code and written responses to non-coding questions to Canvas.
   - All assignments, except for Homework 9, are due on Sundays at 11:59 PM. See the table of course due dates on the following page for each assignment's due date.
   - A **1%** penalty will be applied to all assignments for every hour it is late up to **four (4)** days.
   - With regards to grading:
     - Solutions will be posted on Canvas within **four (4)** days following the original due date.
     - The class grader will grade each assignment. Scores will typically be available within **one (1)** week of the due date.
     - Once graded, check the Canvas rubric to see where you earned or lost points.
   - Extended excused absences due to illness, family emergencies, etc. will be handled on a case-by-case basis with appropriate documentation and may be subject to a departure from the above policies.

2. **Midterm Project (25%)**

   - The midterm project for the course will be an individual research project on a topic of the student's choosing. The project is not limited to only the sports discussed in class, but must be sports-related.
   - The selected topic must differ substantially from any examples done in class or any homework assignments. Students who submitted a sports-related project in STAT 1223 may not reuse that project.
   - A detailed description of the midterm project, requirements, and the rubric will be available on Canvas.

3. **Final Project (25%)**

   - The final project for the course will be an individual project that will primarily focus on topics in the second half of the course (rating systems, Monte Carlo simulation, and in-game events), but will also incorporate portions of content from the first half of the course.
   - A detailed description of the final project, requirements, and the rubric will be available on Canvas.

4. **Attendance (2% extra credit)**

   - Attendance will be taken on **eight (8)** pre-selected days throughout the semester.
   - At a random time during class, a QR code will be projected on the screen for you to scan. The link will take you to a Qualtrics survey, where you will fill out your name and PeopleSoft number to register your attendance for the day.
     - Students without the ability to answer the survey (e.g. no smartphone or dead cell phone battery) can register their attendance for the day simply by speaking with the instructor after class.
     - Qualtrics reports location data for where the form was filled out and is set up to identify potential duplicate responses. Do not send the link to anyone outside of class or fill out the form for someone else. Violations of this policy will constitute an academic integrity violation.
   - Students who attend all **eight (8)** classes will receive the full 2% in extra credit.
   - On days when attendance is taken, 0.5% will be deducted from the extra credit until it has reached 0%. (i.e. 4 or fewer classes = 0%, 5 classes = 0.5%, 6 classes = 1%, and 7 classes = 1.5%)

Course Schedule

Class	Day	Date	Unit	Topic
1	Tuesday	August 26		History of Sports Analytics
2	Thursday	August 28	Basketball	Scoring and Possession Metrics
3	Tuesday	September 2	Basketball	Four Factors
4	Thursday	September 4	Basketball	Assessing Individual Player Performance
5	Tuesday	September 9	Baseball	Basic Baseball Statistics
6	Thursday	September 11	Baseball	Advanced Batting Metrics
7	Tuesday	September 16	Baseball	Advanced Pitching Metrics
8	Thursday	September 18	Baseball	Wins Above Replacement
9	Tuesday	September 23	Football	NFL Offensive Revolution
10	Thursday	September 25	Football	Point Expectation
11	Tuesday	September 30	Football	Impact of Special Teams
12	Thursday	October 2	Hockey	Scoring, Goaltending, and Special Teams
13	Tuesday	October 7	Hockey	Possession Metrics and Puck Location
14	Thursday	October 9	Soccer	Club Soccer Analytics
15	Tuesday	October 14	Soccer	Soccer Visualizations and Advanced Analytics
16	Thursday	October 16	Season Analysis	Scoring Distributions
17	Tuesday	October 21	Season Analysis	Pythagorean Win Percentage
18	Thursday	October 23	Rating Systems	Bradley-Terry Model
19	Tuesday	October 28	Rating Systems	Poisson Scoring Models
20	Thursday	October 30	Rating Systems	Elo Ratings
21	Tuesday	November 4	Monte Carlo	Introduction to Monte Carlo Simulation
22	Thursday	November 6	Monte Carlo	Simulating Seasons Using Monte Carlo
23	Tuesday	November 11	Monte Carlo	Additional Topics in Monte Carlo Simulation
24	Thursday	November 13	In-Game Analysis	Expected Goals Models
25	Tuesday	November 18	In-Game Analysis	In-Game Win Probability and Leverage
26	Thursday	November 20	Additional Topics	Predicting Future Performance
	Tuesday	November 25		*No Class: Thanksgiving Break*
	Thursday	November 27		*No Class: Thanksgiving Break*
27	Tuesday	December 2	Additional Topics	Sports Betting: Part 1
28	Thursday	December 4	Additional Topics	Sports Betting: Part 2

Course Due Dates

Assignment	Day	Date	Topic	Lectures	Points
Homework 1	Sunday	September 7	Review of Relevant Topics		34
Homework 2	Sunday	September 14	Basketball	2-4	36
Homework 3	Sunday	September 28	Baseball	5-8	36
Homework 4	Sunday	October 5	Football	9-11	36
Homework 5	Sunday	October 19	Hockey and Soccer	12-15	28
Midterm Project	**Sunday**	**October 26**			
Homework 6	Sunday	November 2	Season Analysis	16-17	38
Homework 7	Sunday	November 9	Rating Systems	18-20	49
Homework 8	Sunday	November 23	Monte Carlo Simulation	21-23	51
Homework 9	Wednesday	December 3	In-Game Analysis	24-25	32
Final Project	**Wednesday**	**December 10**			

Virtual Lab: R and RStudio are installed on university computers as well. Should you run into a problem with your own computer or if your computer does not have the capabilities to run R and RStudio, you can log into Pitt's Virtual Lab. Navigate to this link (technology.pitt.edu/services/virtual-lab) and follow the directions on the screen. This will allow you to control one of Pitt's computers through your browser. Anything you do while on the Virtual Lab will save to your university OneDrive account.

Software Help: If you need additional help installing either of these programs or encounter difficulty with the software at any point throughout the semester, the Pitt Technology Help Desk is available for assistance if you are unable to attend office hours. They have two drop-in locations: **G-65 in Hillman Library** and the **University Store on Fifth**. Their working hours and additional information can be found at this link.

ADDITIONAL COURSE POLICIES

Final Course Grade: Final course grades will be rounded to the nearest percent and assigned based on the cutoffs in the table below. (Decimals of 0.50 and above will be rounded up; decimals less than 0.50 will be rounded down.) Grades are not negotiable and no additional extra credit beyond what is specified in the syllabus will be offered.

Percent	93-100	90-92	88-89	83-87	80-82	78-79	73-77	70-72	68-69	63-67	60-62	0-59
Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F

Statement on Classroom Recording: To ensure the free and open discussion of ideas, students may not record classroom lectures, discussions, and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.

Copyright Notice: These materials may be protected by copyright. United States copyright law, 17 USC section 101, et seq., in addition to University policy and procedures, prohibit unauthorized duplication or retransmission of course materials. See Library of Congress Copyright Office and the University Copyright Policy.

Disabilities: If you have a disability that requires special accommodations, contact Disability Resources and Services in 140 William Pitt Union (www.drs.pitt.edu). They will verify your disability and determine reasonable accommodations for this course. Accommodations will not be granted retrospectively.

Academic Integrity: Students are expected to comply with the University of Pittsburgh's Academic Integrity policy (www.as.pitt.edu//fac/policies/academic-integrity). As this is an upper-level course and there are no in-class assessments, this course has a zero-tolerance policy with respect to cheating. Any student found copying any part of another student's homework assignment or project will receive an F for the course. Similarly, any student who allows another student to copy any part their homework or project will also receive an F for the course. All cases of academic dishonesty will be reported to the Academic Integrity Officer for the Dietrich School of Arts and Sciences, which may include participation in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity.

Although this syllabus deals with the most common situations that arise, we live in an imperfect world where we must deal with unexpected circumstances. Rules do not exist for every situation. Those that do not fall under the context of the syllabus will be evaluated on a case-by-case basis. Any attempt to exploit loopholes or borderline cases not explicitly covered in the syllabus will be considered a case of academic dishonesty.

Health and Grading: If extenuating personal circumstances prevent you from completing the course, a G grade may be awarded if and only if you have been making sufficient progress towards completing the course. To be eligible for a G grade, you must have turned in at least 6 of the 9 homework assignments, completed the midterm project, and have a grade of at least 70% to have the opportunity for a G grade. If a G grade is awarded, then the student and instructor will complete a contract that details a plan and timeline for completing the course.

Students with grades lower than 70% who are considering a request for a G grade are better off retaking the course in a future semester rather than attempting to complete the coursework on their own.

Disclaimer: While this syllabus is unlikely to change, the instructor reserves the right to modify the due dates and lectures covered on homework assignments, due dates of the midterm and final projects, remove or add material not otherwise specified, and/or remove lectures so as to make this course as successful as possible.