Introduction to Data Analytics

TAC 249 - 4 Units - 2025 Spring
Section 31832R - Tuesday 3:30-6:50pm

**USC
Viterbi**
School of Engineering

Course Description

Data is now an integral part of our lives and to be successful in today's business landscape, we need to be able to leverage data to make critical business decisions. This course will teach students how to use data to make those decisions confidently.

Objectives

After completing this course, students will be able to:
- Use Excel, SQL, NoSQL and leading industry tools
- Collect, clean, and analyze data from multiple sources
- Pose questions, collect relevant data, analyze data, interpret data and provide insights
- Present data-driven insights using data visualization and dashboards

Prerequisites

None

Lectures and Lab

Tuesday 3:30PM to 6:50PM in-person in classroom GFS 118.

Zoom?

There will be no remote attendance option, nor will there be any recordings of the lecture. **Students are expected to attend lectures <u>in-person</u>.**

Instructor

Calvin Nguyen <cnt.nguyen@usc.edu>
Office Hours: after class on Tuesday and by appointment.
Contact Instructor for <u>Lecture-related</u> questions.

Teaching Assistant

Office Hours: see Brightspace/Piazza
Contact Teaching Assistants for <u>Assignment-related</u> questions.

Course Notes *brightspace.usc.edu*

Lecture slides and any supplemental course content will be posted to Brightspace. All announcements for the course will be posted to Brightspace. Information about assignments, due dates, exams and grades will also be posted on Brightspace. Students should check Brightspace regularly for updates.

Discussion Board *piazza.com*

Piazza is for students to ask questions and for Instructor & Teaching Assistants to answer questions in written form. Link to Piazza will be posted on Brightspace.

Textbook

No official textbook required.

Optional Books:
Carlos Coronel, Steven Morris. Database Systems: Design, Implementation, and Management. Boston, MA: Cengage Learning, 2018. ISBN-13: 978-1337627900

Additional reference material will be provided in class as needed.

Technological Proficiency and Hardware/Software Required

Most assignments in the class are done using software. Software will be available for download or available through a virtual lab. Students are expected to have access to a computer. TAC has a limited number of laptops that students can request to borrow.

Software

Students can use their own computers or login to the Viterbi Virtual Lab. Students are introduced to several tools most used in the industry:
- MySQL and MySQL Workbench
- NoSQL, MongoDB and Studio3T
- Tableau
- Neo4J, data-importer and Neo4J Browser

IT Help & Laptop Loaner

USC IT (ITS): https://itservices.usc.edu/contact
Viterbi IT: https://viterbi.usc.edu/resources/vit/contact-us.htm

USC Computing Center Laptop Loaner Program
Information Technology Services provides loaner laptops at the general-use computing center in the Ahmanson Information Commons at Leavey Library. Computing accessories may also to be checked out by faculty, staff, and students at the USC Computing Centers. Information about this program can be found at https://itservices.usc.edu/spaces/laptoploaner/.

TAC Loaner Devices Program
TAC has a limited number of laptops that are available to borrow for TAC classes. Eligible students will be able to borrow a MacBook or Dell XPS for TAC coursework once their request is approved and their contract is signed via DocuSign. Though the initial loan period is 7 days, they will still be able to renew their device and extend the loan period. They will need to pop into one of TAC's Zoom device check-in sessions before the end of each week. If all of them have been checked out, then the student will be placed on the waiting list. You will not be able to save your work on the TAC lab computers and the TAC laptops. Once they are restarted, all work will be deleted. Use an external USB drive, or a cloud-based service like Google Drive or Dropbox to save your work. TAC is not responsible for any lost work. Information about the TAC Loaner Laptop Program and the request form can be found at https://tac.usc.edu/current-students/itp-device-check-outs/.

Grading

The weight of the graded material during the semester is listed below:

Individual Homework Assignments	35%
Team Project	15%
Exam – Midterm	25%
Exam – Final	25%

The following Grading Scale will be used to determine your letter grade:

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

Half percentage points will be rounded up to the next whole percentage. So for instance, 89.50% is an A-, but 89.49% is a B+.

For the Pass/No Pass grading option, you must earn C- or higher to pass for undergraduates students, and B or higher to pass for graduate students.

Grading Timeline:
Assignments Grading will typically be completed 10 days after submission. Any variations will be announced in class or on Brightspace. All grading discrepancies must be resolved within a week of grade release. For grade disputes, contact your grader/TA first. If resolution is not reached, contact the instructor.

Individual Homework Assignments

This course will make use of Brightspace for assignments. All assignments will be posted to Brightspace under the "Assignments" section. Each assignment will include instructions, a due date, and a link for electronic submission. Assignments must be submitted using this link.

Team Project

For a hands-on experience, there will be a Team Project. The goal of the project is to solve real world problems using data analytics. This is a team project with each consisting of 2 to 3 members. Each team will work together to identify a problem to solve, collect the necessary data, prepare, clean and format the data, analyze the data, create visualizations, dashboards and models to analyze and understand the problem and to use insights to develop solutions.

Assignment Policies & Late Submissions

Students are expected to attend and participate in lecture discussions, in-class exercises and team meetings. If students would like to be considered for an excused absence, email the instructor and include name, week (1-15), day, date, reason, and documentation.

Students are responsible for completing individual assignments and their fair share of team assignments by stated deadlines. **Assignments turned in late will have 20% of the assignment points deducted from the graded score for each late day.** Within 24 hours after a deadline, the submission receives -20% assignment points. Between 24–48 hours late, -40%. Between 48-72 hours late, -60%. **After 72 hours late, the submission is not accepted and will be 0**. E.g. if an assignment is graded at 90/100 and is 35 hours late, the final assignment grade is 90 - 40 (40% of 100 points) = 50.

Students are given three (3) "grace" days for the semester where the late penalty doesn't apply (only for Homework Assignments). Other late submissions will be penalized, with no exceptions. Team Project does "not" have grace days.

Students can submit an assignment multiple times. The latest submission will be graded.

Students and Disability Accommodations:
If students need accommodations authorized by the Office of Student Accessibility Services OSAS, provide the instructor with the OSAS Accommodation Letter.

Exams
No make-up exams (except for documented medical or family emergencies) will be offered. If they will not be able to attend an exam due to an athletic game or other valid reason, then they must coordinate with the instructor before the exam is given. They may arrange to take the exam before they leave, with an approved university personnel during the time they are gone, or within the week the exam is given. If students do not take an exam, then they will receive a 0 for the exam.

According to USC Final Examinations Policy, no student is permitted to omit or take early a Final Examination and no instructor is authorized to permit a student to do so.

Adding the Course after Week 1
Any students wishing to add the course should plan on attending the course from the beginning of the semester. Prior to adding the course after week 1, the student needs to contact the instructor to make a plan for catching up on missed materials and completing homework assignments. **Our class is fast-paced and content-packed, students should have a definite catch-up plan prior to adding in order to succeed in the course. By the end of week 2, two assignments are posted and one is due. By the end of week 3, three assignments are posted and two are due.**

Course Content Distribution and Recordings Policies
USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Student Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. (Living our Unifying Values: The USC Student Handbook, page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. (Living our Unifying Values: The USC Student Handbook, page 13).

Statement on Academic Conduct and Support Systems

Academic Integrity:
The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, compromises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. **All incidences of academic misconduct will be reported to the Office of Academic Integrity (OAI)** and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call
The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

[Reporting Incidents of Bias or Harassment](#) - *(213) 740-5086 or (213) 821-8298*
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

[The Office of Student Accessibility Services (OSAS)](#) - *(213) 740-0776*
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

[USC Campus Support and Intervention](#) - *(213) 740-0411*
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

[Diversity, Equity and Inclusion](#) - *(213) 740-2101*
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

[USC Emergency](#) - *UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

[USC Department of Public Safety](#) - *UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call*
Non-emergency assistance or information.

[Office of the Ombuds](#) - *(213) 821-9556 (UPC) / (323-442-0382 (HSC)*
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

[Occupational Therapy Faculty Practice](#) - *(323) 442-2850 or* otfp@med.usc.edu
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.

Course Outline

	Topics	Reading	Homework
Week 1 **Jan 14**	**The Value of Data** ● Explanation of course objectives and tools ● Syllabus Review ● Discussion of the value and impact of data-driven decision making ● Discussion of visual analytics and common presentation strategies ● Excel Analytics ● Brief history of databases and their role in information systems ● Different types of databases and their organizational context ● Survey of DBMS ● Introduction to Database ● Keys: primary, foreign, candidate, surrogate, super	Check Brightspace	HW1 Model
Week 2 **Jan 21**	**Foundations of Databases and SQL Data Modeling** ● Data models ● Business rules ● Relational and entity-relationship modeling		HW2 ERD

	● Entities, attributes, relationships ● Minimum and maximum cardinality ● Designing Entity Relationship Diagram		
Week 3 **Jan 28**	**Normalization** ● Anomalies and the need for normalization ● Normal forms ● First, second, third normal forms ● Denormalization ● Dependency Diagrams		HW3 Normalization
Week 4 **Feb 04**	**Introduction to SQL** • Database structures • Introduction to SQL's SELECT statement with WHERE clauses • Query command tools: GROUP BY, HAVING, DISTINCT, COUNT, AND, and OR • Conditional operators: =, !=, >, <, IN, NOT IN, and BETWEEN • Aggregation functions: MIN, MAX, SUM, AVG, and COUNT		HW4 SQL
Week 5 **Feb 11**	**Combining Data in SQL** • Appending similar data together • Combining data from different tables together • Commands for combining data: JOIN and UNION **Cleaning Data and Creating Multiple Joins** • Creating relationships between tables: INNER, RIGHT, FULL OUTER, EXCEPTION and CROSS JOINs • Optimizing queries: WHERE, LIMIT and COALESCE		HW5 SQL Joins
Week 6 **Feb 18**	**Subqueries** • Asking multiple questions in a single query • Nesting queries • Multi-step aggregation or filtering		HW6 SQL Subqueries
Week 7 **Feb 25**	**Data Visualization with Tableau**		HW7 Tableau
Week 8 **Mar 04**	**Midterm Review**		
Week 9 **Mar 11**	**Midterm Exam**		
Spring Break **Mar 16-23**	**NO CLASSES**		
Week 10 **Mar 25**	**Fundamentals of MongoDB** ● Data storage ● Data Retrieval ● Queries		HW8 MongoDB
Week 11 **Apr 01**	**MongoDB Aggregation Framework**		HW9 MongoDB Aggregation
Week 12 **Apr 08**	**Graph DBs** ● Why graph databases? ● Introduction to Neo4J		Project Comprehensive
Week 13 **Apr 15**	**Working with graph databases** ● Querying ● Graph Visualization		
Week 14 **Apr 22**	**Machine Learning & Decision Tree**		

Week 15 Apr 29	Final Review Final Project Due	May 02		
Week of Finals	Study Days Sat-Tue	May 03-06		
	Final Exam Tuesday	May 13, 2-4 pm		