

# DSCI 549: Introduction to Computational Thinking and Data Science

32438D — Spring 2024

## Instructor

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**Office Hours:** Before class, on request

## Teaching Assistant

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**Office Hours:** Every Thursday, 9am - 11am

**Zoom Link:** <https://usc.zoom.us/j/95297251542>

## Course Producer

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## Class Information

**Dates:** 01/09/2024 – 04/23/2024

**Time and classroom:** Tuesdays 3:30pm – 6:50pm PT, SLH200

All class communications, materials dissemination, and announcements will occur via Blackboard.

## Course Description

An introductory exploration of data analysis techniques and computing concepts tailored for those without a programming background. The course includes the fundamentals of data analysis, data visualization, parallel processing, metadata, data provenance, and data stewardship principles.

## Expanded Course Description

This course empowers non-programmers to adopt computational thinking in addressing contemporary issues and to analyze real-world phenomena using data science principles. Designed for students from non-computer science disciplines, it requires no previous experience in computer science. The course content is highly relevant for those with interests in the social, physical, and biological sciences, offering insight into various data types and analytical methods. Specific focus areas include time series analysis, complex network theory, geospatial data interpretation, and multimedia data handling.

## Learning Objectives and Outcomes

Students will learn to conduct multi-step analyses using a graphical workflow interface, gaining hands-on experience with complex data science concepts such as parallel computing, provenance, and data visualization. They will also become proficient in utilizing ontologies and logical representations to encapsulate metadata and extract knowledge from complex datasets. The course includes hands-on lessons on workflow and ontology development tools, alongside imparting best practices for data stewardship and effective dissemination.

Specifically, students will:

- Develop computational thinking skills necessary to model and solve complex problems in the digital domain.
- Gain an understanding of various data types, appreciating their potential and constraints in addressing complex issues within the scope of data science projects.
- Learn and apply best practices followed by data science professionals for data documentation and dissemination.

**Prerequisite(s):** None

**Co-requisite(s):** None

**Recommended preparation:** Mathematics, Statistics, and Logic undergraduate course.

## Textbooks and Software

No textbook is required for this course. All essential software can be freely downloaded and installed on personal computers or accessed via a web interface by students.

## Lectures

Class sessions are designed to incorporate both lectures and hands-on practicums, offering students a chance to actively engage with the material presented. This structure allows for direct application of lecture concepts through practical exercises. Roughly half of the class duration will be allocated to these practicums. Any course content **not** addressed during class will be recorded and posted on Blackboard. Students are required each week to complete a quiz that encompasses material from the lectures and additional online resources.

## Quizzes

Quizzes must be taken on Blackboard prior to attending class and completed by 3:30pm on Tuesday. Students are given a one-week window to finish each quiz. Exceptions for make-up quizzes will be made only for cases of late registration, if appropriate documentation is provided. Throughout the semester, there will be a total of ten quizzes.

## Examinations

Students are required to take three comprehensive in-class examinations over the course of the semester. Each examination will last two hours and will be cumulative in nature. The format of these exams will include multiple-choice, multiple-answer, matching, fill-in-the-blank, and short-answer questions. The use of class notes and electronic devices will be prohibited during the examinations.

In the event of a documented emergency, such as a family emergency or illness, students must contact the professor within four business days to arrange a make-up test. Make-up examinations will be conducted in person at the Information Sciences Institute in Marina Del Rey. No make-up tests will be permitted once the answers have been discussed in class, which typically allows a 2-3 week window for rescheduling.

An exception is made for the final test, which aligns with the course's final examination period. In cases of documented emergencies for this exam, students may be required to accept an "Incomplete" grade for the course and schedule their final examination in the early weeks of May. If a religious observance conflicts with any examination date, students must inform the professor at least two weeks in advance and arrange to take the test in person at the Information Sciences Institute in Marina Del Rey. Examination grades will be posted within one week of completion. However, the specifics of each test will be reviewed in class only after all students have completed the exam. Consequently, the course syllabus is subject to minor changes.

## Grading and Grade Scale

The final grade for this course will be computed based on the following components:

**Quizzes:** 10 points (10 quizzes, each worth 1 point)

**Exams:** 90 points (3 exams, each worth 30 points)

Final grades will be assigned according to the scale in Table 1.

Grade	Range	Grade	Range
A	94–100	C+	77–79.9
A-	90–94.9	C	74–76.9
B+	87–89.9	C-	70–73.9
B	84–86.9	D	64–69.9
B-	80–83.9	F	0–63.9

Table 1: Grading Scale

No grade rounding or curving will be implemented in this course. Should there be any extra-credit opportunities, they will be included as individual questions within the exams, with a total not exceeding 5 points.

## Use of AI Generators

In this course, the use of AI Generators is permitted for quizzes and in-class practicums. In fact, several practicums will incorporate this technology, allowing students to learn how to use it effectively and understand its associated challenges. However, mastering the fundamentals of data science is crucial, particularly for effective utilization of AI Generators. **Important:** The use of AI Generators during in-class examinations is strictly prohibited.

## Schedule

Class sessions are designed to incorporate both lectures and hands-on practicums. A tentative schedule is outlined in Table 2.

Date	Lecture	Practicum	Exam Reviews	Quiz
Jan 9	Syllabus / Intro to Data Science	Jupyter Notebooks		
Jan 16	Data / Data Privacy / Software	Data Exploration		Q1
Jan 23	Workflow / Parallel and Distributed Computing	Data science problems as computational workflows		Q2
Jan 30	Experimental Design / Probability / Inferential Statistics	Observational vs. Experimental Studies / Probabilities / Statistical tests / Simulations		Q3
Feb 6	A/B Testing	A/B testing in UI/UX	Test 1 Review	Q4
Feb 13	Guest Lecture			
Feb 20	<b>TEST 1</b>			
Feb 27	Machine Learning	Training and Testing ML models		Q5
Mar 5	Natural Language Processing and Multimedia	Spam classifier / Topic Modeling / Text Generation / Object Recognition		Q6
Mar 19	Timeseries and Network Analysis	Time series forecasting		Q7
Mar 26	Network Analysis	Social Network Analysis	Test 2 Review	Q8
Apr 2	<b>TEST 2</b>			
Apr 9	Semantic Metadata and Ontology	Protege / Ontology Design / Music Ontology		Q9
Apr 16	Provenance and Data Stewardship	GitHub, Figshare, Zenodo, and PROV-O		Q10
Apr 23	Guest Lecture		Test 3 Review	

Table 2: Schedule for DSCI 549

Note that classes will not be streamed on Zoom and will not be recorded. The only

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exception may pertain to *guest lectures*, which could be conducted via Zoom. Any course content **not** addressed during class will be recorded and posted on Blackboard. **Important:** Students are required to bring a laptop to class. Should there be any need for software installation, students will be notified via email before the class.

## **Attendance**

It is highly recommended that students participate in all in-person lectures and practicums. Furthermore, students are expected to listen to recorded lectures on course materials that have not been covered during in-class sessions. Engaging with these materials is crucial for staying current with the course content, as well as keeping up with assignments and class-related activities. Nevertheless, absence from lectures and practicums will not result in any penalties. Should you miss any sessions, it is your responsibility to acquire the missed materials from your peers. As per University guidelines, please refrain from attending in-person sessions if you are unwell or have tested positive for COVID-19.

## **Office Hours**

Office hours with the Teaching Assistant (TA) will be conducted virtually every Thursday from 9am to 11am. Should additional clarification be needed after meeting with the TA, students may request a meeting with the instructor, preferably in the morning before classes. Please arrive at these sessions prepared with specific questions related to the lecture materials and in-class exercises. It is important to note that individual answers for tests, including reviewing the test itself, will not be provided until after the class discussion of the test answers.

## **Communication**

This class will not utilize a Slack channel. All email communication should be directed to the TA and restricted to administrative queries and requests for make-up exams, as previously detailed. To schedule office hours, students should attend the Zoom session with the TA at the link provided during class.

## **Academic Integrity**

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to pursuing knowledge and transmitting ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form). This course will follow the expectations for academic integrity as stated in the USC Student Handbook. All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not

submit work written by others or “recycle” work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), 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 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<sup>1</sup> or the Office of Academic Integrity’s website<sup>2</sup>, and university policies on Research and Scholarship Misconduct<sup>3</sup>. If found responsible for an academic violation, students may be assigned university outcomes, such as suspension or expulsion from the university, and grade penalties, such as an “F” grade on the assignment, exam, and/or in the course.

## **Course Content Distribution**

USC has policies that prohibit the 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 relation 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).

## **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.

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<sup>1</sup><https://policy.usc.edu/studenthandbook/>

<sup>2</sup><https://academicintegrity.usc.edu/>

<sup>3</sup><https://policy.usc.edu/research-and-scholarship-misconduct/>

More information can be found at [osas.usc.edu](http://osas.usc.edu). You may contact OSAS at (213) 740-0776 or via email at [osasfrontdesk@usc.edu](mailto: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.

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- USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call. Emergency assistance and avenues 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](mailto: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.