Course Bulletin

104507	Introduction To Computer Science			
Subject:	Catalog Nbr:			
CS	0011			
2023 SUMR	Primary	James Mattei	James.Mattei@tufts.edu	
2023 SUMR	Primary	Di Zhou	Di.Zhou@tufts.edu	
2024 SUMR	Primary	Carson Powers	Carson.Powers@tufts.edu	
2024 SUMR	Primary	Owen Morrissey	Owen.Morrissey@tufts.edu	
2025 SPRG	Primary	Partha Biswas	Partha.Biswas@tufts.edu	

The study of computer science centers on two complementary aspects of the discipline. First, computer science is fundamentally concerned with the problem-solving methodologies it derives from its foundational fields: the design principles of engineering, mathematical theory, and scientific empirical study. Second, these methodologies are applied in the complex context of a modern day computing system. In this course we will address both of these important aspects. As a means for developing your design skills, we will discuss the fundamental features of a high level, general purpose programming language — namely C++ — and learn how to use it as a tool for problem solving. We will also consider the performance of solutions, and how to apply both analytical and empirical assessment techniques. Finally, we will explore the Unix operating system as a context for problem solving.

104621	Data Structures			
Subject:	Catalog Nbr:			
CS	0015			
2023 SUMR	Primary	Matthew Russell	Matthew.Russell613354@tufts.edu	
2024 FALL	Primary	Christopher Magnano	Christopher.Magnano@tufts.edu	
2024 SUMR	Primary	Shivam Goel	Shivam.Goel@tufts.edu	
2024 SUMR	Primary	Mavis Murdock	Mavis.Murdock@tufts.edu	
2025 SPRG	Primary	Partha Biswas	Partha.Biswas@tufts.edu	

A second course in computer science. Data structures and algorithms are studied through major programming projects. Topics include linked lists, trees, graphs, dynamic storage allocation, and recursion.

Enrollment priority given to freshmen or sophomores; computer science majors or minors; or majors or minors that list CS15 as a requirement or elective.

104981	Discrete Mathematics			
Subject:	Catalog Nbr:			
CS	0061			
2024 FALL	Primary	Michael Jahn	Michael.Jahn@tufts.edu	
2024 SUMR	Primary	Aleksandr Fedchin	Aleksandr.Fedchin@tufts.edu	
2024 SUMR	Primary	Patrick Feeney	Patrick.Feeney@tufts.edu	
2025 SPRG	Primary	Emmely Rogers	No Email on file.	

(Cross-listed as MATH 61). Sets, relations and functions, logic and methods of proof, combinatorics, graphs and digraphs.
Recommendations: MATH 32 or COMP 11 or permission of instructor.

Course Bulletin

105344	Programming Languages
Subject:	Catalog Nbr:
CS	0105

Principles and application of computer programming languages. Emphasizes ideas and techniques most relevant to practitioners, but includes foundations crucial for intellectual rigor: abstract syntax, lambda calculus, type systems, dynamic semantics. Case studies, reinforced by programming exercises. Grounding sufficient to read professional literature. CS 80 and CS 105 cannot both be taken for credit.

105468	Operating Systems
Subject:	Catalog Nbr:
CS	0111

2025 SPRG Primary Hifza Khalid Hifza.Khalid@tufts.edu

(Cross-listed as EE 128). Fundamental issues in operating system design. Concurrent processes: synchronization, sharing, deadlock, scheduling. Relevant hardware properties of uniprocessor and multiprocessor computer systems.

105548	Database Systems
Subject:	Catalog Nbr:
CS	0115

2025 SPRG Primary Cody Doucette Cody.Doucette@tufts.edu

Fundamental concepts of database systems, including conceptual design, relational and object-oriented data models, query languages (SQL, QBE), and implementation issues (indexing, transaction processing, concurrent control). The concepts and algorithms covered encompass many of those used in commercial and experimental database systems. Other topics include distributed databases and distributed query processing. Recommendations: CS 40

105569	Introduction to Security
Subject:	Catalog Nbr:
CS	0116

2025 SPRG Primary Ming Chow ming.chow@tufts.edu

A holistic and broad perspective on cyber security. Attacking and defending networks, cryptography, vulnerabilities, reverse engineering, web security, static and dynamic analysis, malware, forensics. Principles illustrated through hands-on labs and projects, including Capture The Flag (CTF) games.

105587	Web Programming and Engineering
Subject:	Catalog Nbr:
CS	0120

2025 SPRG Primary Lisa Diorio Lisa.Diorio@tufts.edu

Course Bulletin

Web applications as complex systems that deliver functionality to a large number of users, and exhibit unique behaviors and demands in terms of performance, scalability, usability, and security. How the web works, limitations of client-side and server-side technologies including frameworks and APIs, content optimization, and data persistence and storage. Projects will involve search, using the cloud infrastructure, location-based services, mobile web development, and using tools to assess the security and privacy of web applications.

105668	**Artificial Intelligence**			
Subject:	Catalog Nbr:			
CS	0131			
2025 SPRG		Primary	Fabrizio Santini	Fabrizio.Santini@tufts.edu

History, theory, and computational methods of artificial intelligence. Basic concepts include representation of knowledge and computational methods for reasoning. One or two application areas will be studied, to be selected from expert systems, robotics, computer vision, natural language understanding, and planning.

105772	**Introduction To Machine Learning And Data Mining**			
Subject:	Catalog Nbr:			
CS	0135			
2024 FALL		Primary	Roy Shilkrot	Roy.Shilkrot@tufts.edu
2024 SUMR		Primary	Abdullah Bin Faisal	Abdullah_Bin.Faisal@tufts.edu
2025 SPRG		Primary	Prasad Saripalli	No Email on file.

An overview of methods whereby computers can learn from data or experience and make decisions accordingly. Topics include supervised learning, unsupervised learning, reinforcement learning, and knowledge extraction from large databases with applications to science, engineering, and medicine. Recommendations: CS 160 is highly recommended.

105893	**Algorithms**			
Subject:	Catalog Nbr:			
CS	0160			
2023 SUMR		Primary	Ambrose Laing	No Email on file.
2023 SUMR		Primary	Diane Souvaine	Diane.Souvaine@tufts.edu
2024 FALL		Primary	Martin Allen	Martin.Allen@tufts.edu
2025 SPRG		Primary	Michael Jahn	Michael.Jahn@tufts.edu

Introduction to the study of algorithms. Strategies such as divide-and-conquer, greedy methods, and dynamic programming. Graph algorithms, sorting, searching, integer arithmetic, hashing, and NP-complete problems. High demand (see "course notes" for signup procedure).

106079	**Computation Theory**			
Subject:	Catalog Nbr:			
CS	0170			
2023 FALL		Primary	Martin Allen	Martin.Allen@tufts.edu

Course Bulletin

2023 SUMR	Primary	Ambrose Laing	No Email on file.
2025 SPRG	Primary	Andrew Winslow	Andrew.Winslow@tufts.edu

(Cross-listed as MATH 191). Models of computation: Turing machines, pushdown automata, and finite automata. Grammars and formal languages, including context-free languages and regular sets. Important problems, including the halting problem and language equivalence theorems.

106140	**Software Engineering**		
Subject: CS	Catalog Nbr: 0121		
2023 SUMR	Primary	Ronald Simmons	Ronald.Simmons@tufts.edu
2024 FALL	Primary	Jeffrey Foster	Jeffrey.Foster@tufts.edu
2025 SPRG	Primary	Perry Donham	Perry.Donham@tufts.edu

Core principles and ideas that enable development of large-scale software systems, with a focus on programming. Abstraction, modularity, design patterns, specification, testing, verification, and debugging.

110369	**Probabilistic Systems Analysis**		
Subject: EE	Catalog Nbr: 0104		
2025 SPRG	Primary	Khaled ElMahgoub	Khaled.ElMahgoub@tufts.edu

Advanced analysis in probabilistic systems with strong emphasis on theoretical methods. Development of analytical tools for the modeling and analysis of random phenomena with application to problems across a range of engineering and applied science disciplines. Probability theory, sample and event spaces, discrete and continuous random variables, conditional probability, expectations and conditional expectations, and derived distributions. Sums of random variables, moment generating functions, central limit theorem, laws of large numbers. Statistical analysis methods including hypothesis testing, confidence intervals and nonparametric methods. Undergraduates may not take both EE 0024 and EE 0104 for degree credit.
Prerequisite: Math 0042 or equivalent.
Recommendation: Senior or graduate standing or consent of instructor.

121471	**Linear Algebra**		
Subject: MATH	Catalog Nbr: 0070		
2024 FALL	Primary	Daniel Riley	Daniel.Riley@tufts.edu
2025 SPRG	Primary	Kim Ruane	kim.ruane@tufts.edu

Introduction to the theory of vector spaces and linear transformations over the real or complex numbers, including linear independence, dimension, matrix multiplication, similarity and change of basis, inner products, eigenvalues and eigenvectors, and some applications. Recommendations: MATH 34 or 39 or permission of instructor. Students may count only one of MATH 70 and MATH 72 for credit.

142164	**Mathematical Aspects of Data Analysis**

Course Bulletin

Subject:	Catalog Nbr:			
MATH	0123			
2024 FALL		Primary	James Murphy	JM.Murphy@tufts.edu

Dimension reduction and data compression via principal component analysis, and the singular value decomposition; k-means clustering; clustering via diffusion on weighted graphs; support vector machines; tensor data analysis; kernel trick. Homework includes programming. Prerequisite: MATH 42, and MATH 70 or MATH 72. Some prior programming experience desirable, but not required.

143433	**Big Data**			
Subject:	Catalog Nbr:			
CS	0119			
2023 FALL		Primary	Andrew Winslow	Andrew.Winslow@tufts.edu
2025 SPRG		Primary	Jitendra Singh	Jitendra.Singh@tufts.edu

Collecting, processing, analyzing and acting on data at Internet scale with speed and complexity. Techniques and infrastructures developed for big data including parallel and distributed database systems, map-reduce infrastructures, scalable platforms for complex data types, stream processing systems, and cloud-based computing. Course blends theory, algorithms and practical (hands on) work.

143784	**Principles of Data Science in Python**
Subject:	Catalog Nbr:
DS	0205

Fundamentals of python programming for data analysis. Common python data structures and algorithms. Design of python programs. Coding standards and practices. Use and creation of software libraries. Examples drawn from data preparation and transformation, statistical data analysis, machine learning, deep learning, and deep data science including recommendation systems and trend analysis. Labs utilizing iPython and the Jupyter data analysis workflow framework.

144258	**Reinforcement Learning**			
Subject:	Catalog Nbr:			
CS	0138			
2025 SPRG		Primary	Yash Shukla	Yash.Shukla@tufts.edu

Agents that learn, plan, and act in complex, uncertain environments. Varying topics that may include practical successes and challenges of reinforcement learning; common software libraries and packages used to implement and test reinforcement learning algorithms, and advanced topics such as transfer learning and deep reinforcement learning. Recommendations: CS 131 and/or CS 135. Proficiency in one of C++, Java, or Python.

145159	**Database Systems**
Subject:	Catalog Nbr:
CSO	0115

Course Bulletin

Fundamental concepts of database systems, including conceptual design, relational and object-oriented data models, query languages (SQL, QBE), and implementation issues (indexing, transaction processing, concurrent control). The concepts and algorithms covered encompass many of those used in commercial and experimental database systems. Other topics include distributed databases and distributed query processing.

145287	Programming for Data Science

Subject:	Catalog Nbr:			
CS	0030			
2025 SPRG		Primary	Benjamin Stubbs	Benjamin.Stubbs@tufts.edu

Fundamentals of programming for data-intensive science. Data structures and algorithms for data manipulation, cleaning, and preparation. Design of data manipulation programs. Coding standards and practices. Use and creation of software libraries. Techniques for improving program performance. Examples drawn from data preparation and transformation, statistical data analysis, machine learning, deep learning, and deep data science including recommendation systems and trend analysis.

145459	Master of Science Capstone Project I

Subject:	Catalog Nbr:			
CS	0288			
2023 FALL		Primary	Ming Chow	ming.chow@tufts.edu
2025 SPRG		Primary	Martin Allen	Martin.Allen@tufts.edu

Part one of a two-course, hands-on, and project-based culmination to
the Master of Science in Computer Science Online program. Application of principles, strategies, methods, and tools for requirements analysis and design of a programming project, including project planning, project management, and proof of concept prototyping. Formulation of a project plan, including estimation of project completion requirements and timeline. To be taken in the second-to-last term of the Master of Science in Computer Science Online degree. Not available to students outside that program.
Prerequisites: CS 180 or 121, and enrollment in the Master of
Science in Computer Science Online program.

146186	Master of Science Capstone Project I

Subject:	Catalog Nbr:			
DS	0288			
2025 SPRG		Primary	Martin Allen	Martin.Allen@tufts.edu

Part one of a two-course, hands-on, and project-based culmination to the Master of Science in Data Science Online program. Application of principles, strategies, methods, and tools of Data Science to analyze data and justify real-world decisions based upon those data. The first term includes creation of a proof of concept prototype of a chosen data analysis project. To be taken in the second-to-last term of the Master of Science in Data Science Online degree.

Course Bulletin