

RELEVANT COURSEWORK

DATA SCIENCE COURSEWORK:

DSC 40B - Theoretical Foundations of Data Science II

Fall 2022

The sequence DSC 40A-B introduces the theoretical foundations of data science and covers the following topics: mathematical language for expressing data analysis problems and solution strategies, probabilistic reasoning, mathematical modeling of data, and algorithmic problem solving. DSC 40B, the second course in the sequence, introduces fundamental topics in combinatorics, graph theory, probability, and continuous and discrete algorithms with applications to data analysis.

DSC 80 - The Practice and Application of Data Science

Fall 2022

The marriage of data, computation, and inferential thinking, or “data science,” is redefining how people and organizations solve challenging problems and understand the world. This course bridges lower- and upper-division data science courses as well as methods courses in other fields. Students master the data science life-cycle and learn many of the fundamental principles and techniques of data science spanning algorithms, statistics, machine learning, visualization, and data systems.

DSC 20 - Programming and Basic Data Structures for Data Science

Winter 2022

Provides an understanding of the structures that underlie the programs, algorithms, and languages used in data science by expanding the repertoire of computational concepts introduced in DSC 10 and exposing students to techniques of abstraction. Course will be taught in Python and will cover topics including recursion, higher-order functions, function composition, object-oriented programming, interpreters, classes, and simple data structures such as arrays, lists, and linked lists.

DSC 40A - Theoretical Foundations of Data Science I

Winter 2022

This course, the first of a two-course sequence (DSC 40A-B), will introduce the theoretical foundations of data science. Students will become familiar with mathematical language for expressing data analysis problems and solution strategies, and will receive training in probabilistic reasoning, mathematical modeling of data, and algorithmic problem solving. DSC 40A will introduce fundamental topics in machine learning, statistics, and linear algebra with applications to data analysis. DSC 40A-B connects to DSC 10, 20, and 30 by providing the theoretical foundation for the methods that underlie data science.

DSC 10 - Principles of Data Science

Summer 2020

This introductory course develops computational thinking and tools necessary to answer questions that arise from large-scale datasets. This course emphasizes an end-to-end approach to data science, introducing programming techniques in Python that cover data processing, modeling, and analysis.

COMPUTER SCIENCE COURSEWORK:

CSE 12 - Basic Data Structures and Object-Oriented Design

Summer 2022

Use and implementation of basic data structures including linked lists, stacks, and queues. Use of advanced structures such as binary trees and hash tables. Object-oriented design including interfaces, polymorphism, encapsulation, abstract data types, pre-/post-conditions. Recursion. Uses Java and Java Collections.

CSE 15L - Software Tools and Techniques Laboratory

Fall 2020

Hands-on exploration of software development tools and techniques. Investigation of the scientific process as applied to software development and debugging. Emphasis is on weekly hands-on laboratory experiences, development of laboratory notebooking techniques as applied to software design.

CSE 11 - Introduction to Programming and Computational Problem-Solving

Summer 2020

Accelerated introductory programming including an object-oriented approach. Covers basic programming topics from [CSE 8A](#) including variables, conditionals, loops, functions/methods, structured data storage, and mutation. Also covers topics from [CSE 8B](#) including the Java programming language, class design, interfaces, basic class hierarchies, recursion, event-based programming, and file I/O. Basics of command-line navigation for file management and running programs.

CSE 20 - Discrete Mathematics

Summer 2020

This course will introduce the ways logic is used in computer science: for reasoning, as a language for specifications, and as operations in computation. Concepts include sets, relations, functions, equivalence relations, partial orders, number systems, and proof methods (especially induction and recursion). Propositional and predicate logic will be introduced and applied to various computer science domains such as circuit design, databases, cryptography, and program correctness.

MAE 8 - MATLAB Programming for Engineering Analysis

Summer 2020

Computer programming in MATLAB with elementary numerical analysis of engineering problems. Arithmetic and logical operations, arrays, graphical presentation of computations, symbolic mathematics, solutions of equations, and introduction to data structures.

COGNITIVE SCIENCE COURSEWORK:

COGS 101C - Language

Summer 2022

An introduction to the structure of natural language, and to the cognitive processes that underlie its acquisition, comprehension, and production. This course covers findings from linguistics, computer science, psychology, and cognitive neuroscience to provide an integrated perspective on human language abilities.

COGS 107B - Systems Neuroscience**Summer 2022**

This course focuses on the electrical dynamics of neurons and how their patterns relate to perception, thought, and action. Neural activity patterns underlying vision, touch, audition, proprioception, and head orientation are examined in detail. Also examined are motor control, sleep/wake state production, action planning, learning, memory, attention, spatial cognition and function of the cerebellum, basal ganglia, and hippocampus.

COGS 107A - Neuroanatomy and Physiology**Spring 2022**

This first course in the sequence focuses on principles of brain organization, from neurons to circuits to functional networks. It explores developmental plasticity, neuronal connectivity, cellular communication, complex signaling, and how these various dimensions form functional brain systems.

COGS 101B - Learning, Memory, and Attention**Winter 2022**

A survey of the experimental study of learning, memory, and attention. Topics include conditioning, automaticity, divided attention, memory systems, and the nature of mental representation.

COGS 109 - Modeling and Data Analysis**Summer 2021**

Exposure to the basic computational methods useful throughout cognitive science. Computing basic statistics, modeling learning individuals, evolving populations, communicating agents, and corpus-based linguistics will be considered.

COGS 14B - Introduction to Statistical Analysis**Spring 2021**

Introduction to descriptive and inferential statistics. Tables, graphs, measures of central tendency and variability. Distributions, Z-scores, correlation, regression. Probability, sampling, logic of inferential statistics, hypothesis testing, decision theory. T-test, one and two-way Anova, nonparametric tests (Chi-square).

COGS 14A - Introduction to Research Methods**Winter 2021**

Introduction to the scientific method. Methods of knowledge acquisition, research questions, hypotheses, operational definitions, variables, control. Observation, levels of measurement, reliability, validity. Experimentation and design: between-groups, within-subjects, quasi-experimental, factorial, single-subject. Correlational and observational studies. Ethics in research.

COGS 17 - Neurobiology of Cognition**Winter 2021**

Introduction to the organization and functions of the nervous system. Topics include molecular, cellular, developmental, systems, and behavioral neurobiology. Specifically, structure and function of neurons, peripheral and central nervous systems, sensory, motor, and control systems, learning and memory mechanisms.

COGS 1 - Introduction to Cognitive Science**Fall 2020**

A team-taught course highlighting development of the field and the broad range of topics covered in the major. Example topics include addiction, analogy, animal cognition, human-computer interaction, language, neuroimaging, neural networks, reasoning, robots, and real-world applications.

COGS 13- Field Methods: Studying Cognition in the Wild**Fall 2020**

This course introduces students to multiple methods to investigate cognition and behavior in natural settings. Students will learn about ethnography, videography (video data collection, coding, and analysis), surveys design and conducting interviews, and how to move from observations to modeling.

MATHEMATICS COURSEWORK:**MATH 183 - Statistical Methods****Fall 2022**

Introduction to probability. Discrete and continuous random variables—binomial, Poisson and Gaussian distributions. Central limit theorem. Data analysis and inferential statistics: graphical techniques, confidence intervals, hypothesis tests, curve fitting.

MATH 20E - Vector Calculus**Winter 2021**

Change of variable in multiple integrals, Jacobian, Line integrals, Green's theorem. Vector fields, gradient fields, divergence, curl. Spherical/cylindrical coordinates. Taylor series in several variables. Surface integrals, Stoke's theorem. Gauss' theorem. Conservative fields.

MATH 20D - Introduction to Differential Equations**Summer 2020**

Ordinary differential equations: exact, separable, and linear; constant coefficients, undetermined coefficients, variations of parameters. Systems. Series solutions. Laplace transforms. Techniques for engineering sciences. Computing symbolic and graphical solutions using MATLAB.

MATH 20C - Calculus and Analytic Geometry for Science and Engineering**Spring 2020**

Vector geometry, vector functions and their derivatives. Partial differentiation. Maxima and minima. Double integration.

MATH 18 - Linear Algebra**Winter 2020**

Matrix algebra, Gaussian elimination, determinants. Linear and affine subspaces, bases of Euclidean spaces. Eigenvalues and eigenvectors, quadratic forms, orthogonal matrices, diagonalization of symmetric matrices. Applications. Computing symbolic and graphical solutions using MATLAB.

MATH 20B - Calculus for Science and Engineering**Winter 2020**

Integral calculus of one variable and its applications, with exponential, logarithmic, hyperbolic, and trigonometric functions. Methods of integration. Infinite series. Polar coordinates in the plane and complex exponentials.