Rowechen Zhong

Coursework

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Daggered courses are ongoing.
Notes for some mathematics (including many subjects I self-studied, such as algebraic topology and functional analysis!) can be found at https://github.com/rowechenzhong/Vision.

Computer Science

P **6.1220**, *Design and Analysis of Algorithms*, Fall 2022, Piotr Indyk
Sorting, search trees, heaps, and hashing. Divide-and-conquer, dynamic programming, and greedy algorithms. Amortized analysis. Graph algorithms and shortest paths. Network flow, computational geometry, number-theoretic algorithms, polynomial and matrix calculations, caching, and parallel computing.

A **6.7800**, *Inference and Information*, Spring 2023, Polina Golland
Graduate course on Bayesian and non-Bayesian statistical inference. Hypothesis testing and parameter estimation, sufficient statistics; exponential families. EM agorithm. Log-loss inference criterion, entropy and model capacity. Kullback-Leibler distance and information geometry. Asymptotic analysis and large deviations theory. Model order estimation; nonparametric statistics. Computational issues and approximation techniques; Monte Carlo methods. Universal inference and learning, and universal features and neural networks.

† **6.7900**, *Machine Learning*, Fall 2023
Graduate course on machine learning, formalized by statistical inference. Representation, generalization, and model selection; and methods such as linear/additive models, active learning, boosting, support vector machines, non-parametric Bayesian methods, hidden Markov models, Bayesian networks, and convolutional and recurrent neural networks.

† **6.8611**, *Quantitative Methods for Natural Language Processing*, Fall 2023
The study of human language from a computational perspective, including syntactic, semantic and discourse processing models. Emphasizes machine learning methods and algorithms. Uses these methods and models in applications such as syntactic parsing, information extraction, statistical machine translation, dialogue systems.

P **6.9620**, *Web Lab: A Web Programming Class and Competition*, IAP 2023
Design and Build functional and user-friendly web applications. Topics included HTML, CSS, JavaScript, ReactJS, and nodejs.

Physics

P **8.05**, *Quantum Physics II*, Fall 2022, Barton Zwiebach
Part of standard quantum physics sequence. General formalism of quantum mechanics, Harmonic oscillators, central potentials and the radial equation, bound and scattering states, qualitative analysis of wavefunctions. Angular momentum operators, their algebra, and the spherical harmonics. Clebsh-Gordan coefficients. Nuclear magnetic resonance, spin and statistics.

A **8.06**, *Quantum Physics III*, Spring 2023, Max Metlitski
Part of standard quantum physics sequence. A focus is put on quantitative analysis. Degenerate and nondegenerate perturbation theory, variational method, Born-Oppenheimer approximation, applications to atomic and molecular systems. The structure of one- and two-electron atoms: Spin-orbit, relativistic, and fine structure corrections. Variational approximation, screening, Zeeman and Stark effects. Charged particles in an electromagnetic field: Landau levels and integer quantum hall effect. Scattering: general principles, partial waves, review of one-dimension, low-energy approximations, resonance, Born approximation. Time-dependent perturbation theory.

† **8.13**, *Experimental Physics I*, Fall 2023
Advanced laboratory sequence in modern physics. Experimental options include special relativity, quantum mechanics, atomic structure and optics, statistical mechanics, and nuclear and particle physics.

P **8.223**, *Classical Mechanics II*, IAP 2023, Michael Williams
Generalized coordinates, Lagrangian and Hamiltonian formulations, canonical transformations, and Poisson brackets. Applications to continuous media. The relativistic Lagrangian and Maxwell's equations.

A+ **8.323**, *Quantum Field Theory*, Spring 2023, Hong Liu
Graduate course on quantum field theory. Classical field theory, symmetries, and Noether's theorem. Quantization of scalar fields, spin fields, and Gauge bosons. Feynman graphs, analytic properties of amplitudes, and unitarity of the S-matrix. Calculations in quantum electrodynamics. Introduction to renormalization.

† **8.324**, *Quantum Field Theory II*, Fall 2023
Graduate course on quantum field theory. Perturbation theory, Feynman diagrams, scattering theory, Quantum Electrodynamics, one loop renormalization, quantization of non-abelian gauge theories, the Standard Model of particle physics.

A **8.371**, *Quantum Information Science*, Spring 2023, Isaac Chuang
Graduate course on quantum computing. Quantum circuits, the quantum Fourier transform and search algorithms, the quantum operations formalism, quantum error correction, Calderbank-Shor-Steane and stabilizer codes, fault tolerant quantum computation, quantum data compression, quantum entanglement, capacity of quantum channels, and quantum cryptography and the proof of its security.

Mathematics

† **18.112**, *Functions of a Complex Variable*, Fall 2023, A. Lawrie
Standard complex analysis course. Conformal mappings, Poincare model of hyperbolic geometry. Cauchy-Gorsat, Cauchy integral formula, Taylor and Laurent series, residue calculus. Harmonic functions, Dirichlet's problem, partial fractions, infinite series and product expansions. Gamma function, Riemann mapping theorem, Elliptic functions.

A **18.615**, *Stochastic Processes*, Spring 2023, Jimmy He
Graduate combinatorics course on Markov chains (finite and infinite state spaces, discrete and continuous-time), Poisson processes, random walks, birth and death processes, Brownian motion. Markov Chain Monte Carlo methods.

† **18.675**, *Theory of Probability*, Fall 2023
Graduate measure-theoretic probability course. Sums of independent random variables, central limit phenomena, infinitely divisible laws, Levy processes, Brownian motion, conditioning, and martingales.

P **18.701**, *Abstract Algebra I*, Fall 2022, Henry Cohn
Part of standard algebra sequence. Covers groups, vector spaces, linear transformations, symmetry groups, bilinear forms, and linear groups.

† **18.745**, *Lie Groups and Lie Algebras I*, Fall 2023
Graduate course on the theory of Lie algebras. Theorems of Engel and Lie; enveloping algebra, Poincare-Birkhoff-Witt theorem; classification and construction of semisimple Lie algebras; the center of their enveloping algebras; elements of representation theory; compact Lie groups and/or finite Chevalley groups.