Alexander Lanine

Relevant Coursework

Note on French Grading Systems: Grades are given out of 20. The following general equivalencies apply:

- **16–20**: Equivalent to an **A+** in North America (Outstanding performance).
- **14–15.9**: Equivalent to an **A** (Excellent performance).
- **12–13.9**: Equivalent to a **B** (Good performance).
- **10–11.9**: Equivalent to a **C** (Satisfactory performance).
- **Below 10**: Failing grade.

École Normale Supérieure – Paris-Saclay (MVA Masters Courses)

In Progress — **Reinforcement Learning**
Prof. Emmanuel Rachelson and Claire Vernade

Mathematically rigorous course on theory of reinforcement learning based on Richard Sutton's *Reinforcement Learning: An Introduction*. Covers Markov Decision Processes (MDPs), Bellman equations, and dynamic programming, as well as advanced methods like Deep Q-Networks (DQN), policy gradients (REINFORCE, PPO), and applications such as stochastic bandits and Monte Carlo Tree Search (MCTS).

In Progress — **Deep Learning**
Prof. Vincent Lepetit

Comprehensive, project-based introduction to deep learning, exploring foundational principles and recent advancements. Topics include feedforward networks, optimization techniques, representation learning, generative adversarial networks (GANs), and recurrent networks for natural language processing, with applications in computer vision, NLP, and deep reinforcement learning.

In Progress — **Probabilistic Graphical Models and Deep Generative Models**
Prof. Pierre Latouche

Unifying introduction to probabilistic modelling through the framework of graphical models and associated inference algorithms. Topics covered include: maximum likelihood estimation, Bayesian linear regression, Gaussian processes, and model selection; inference techniques such as variational inference, Monte Carlo methods (MCMC), and amortized variational inference; and deep latent variable models, including variational autoencoders (VAEs), generative adversarial networks (GANs), and normalizing flows.

École Normale Supérieure – Ulm

In Progress — **Action, Decision, Volition**
Prof. Etienne Koechlin

Course on modelling how humans make voluntary decisions and adapt actions, with a focus on the neural bases of executive functions in the frontal lobes. It emphasizes computational modeling approaches to understanding judgment, decision-making, and the integration of motives, preferences, and beliefs with behavior. Significant time is devoted to discussing empirical design, neuroimaging, and behavioral techniques as they relate to studying these processes.

17/20 — **Robotic Modelling Approaches to Cognitive Science**
Prof. Mehd Khamassi

This course examines the computational and engineering foundations of cognitive robotics. Topics include robot learning (with a focus on deep learning), Bayesian inference, evolutionary algorithms, and optimal control.

Real-world applications such as human-robot interaction, autonomous navigation, and integrated cognitive architectures are explored.

19/20 — **Computational Neuroscience (Methods)**
Prof. Srdjan Ostojic

This practical course focuses on implementing computational models of neural systems and analyzing neural activity. Key projects include simulating spiking neurons, modeling neural networks, estimating receptive fields from neural data, calculating information in neural responses, and simulating animal behavior during reinforcement learning.

20/20 — **Computational Neuroscience (Theory)**
Prof. Boris Gutkin

Covers theoretical and mathematical foundations of brain information processing, introducing key concepts in computational neuroscience. Topics include modeling cognition and behavior (conditioning, reinforcement learning), information processing (neural decoding, sensory encoding), and neural dynamics (biophysics, networks, synaptic plasticity). Unlike the methods course, this course focuses on developing mathematical models and understanding their theoretical underpinnings.

18.62/20 — **Decision Science**
Prof. Mohammed Abdellaoui, Brian Hill, and Frederic Koessler

Covers the principal results and foundational tools in decision making for individual and strategic situations. Topics include decision theory and game theory, emphasizing their mathematical, experimental, and conceptual underpinnings. The course bridges economic theory with philosophy, experimental and behavioral economics, and psychology, providing a rigorous foundation in formally-based decision sciences.

19/20 — **Modeling Brain, Mind, and Behavior**
Prof. Alex Cayco Gajic

Covers computational modelling approaches to cognitive science, artificial intelligence, and neuroscience. Emphasis on theoretical foundations.

18.63/20 — **Intro to Cognitive Neurosciences**
Prof. Claire Sergent, Pierre Bourdillon, and Quentin Gaucher

This course offers a comprehensive introduction to neuroscience for cognitive science students, covering human neuroanatomy, cellular neuroscience, and the neural mechanisms underlying cognition. Topics include perception, memory, and executive functions, spanning scales from neurons to networks.

University of Victoria

97% — **Math 435 Real Analysis II: Measure Theory**
Prof. Chris Eagle

Lebesgue measure and integration, Lp spaces, Stone-Weierstrass theorem, Arzela-Ascoli theorem. Theory of Banach and Hilbert space. Fourier analysis and series. Textbook: *Measure, Integration & Real Analysis* (Sheldon Axler).

97% — **Math 492 Topics in Applied Mathematics: Graph Homomorphisms and Colourings**
Prof. Gary MacGillivray

A study of the theory of graph homomorphisms and coloring, with a focus on algorithm design, algorithmic proofs, and complexity theory. As part of final project, proved original result demonstrating that circular chromatic numbers generalize to graphons, which are limit objects of dense graph sequences often applied in network

science.

98% — **Math 348 Numerical Methods**
Prof. David Goluskin

This course covers numerical methods for solving equations, linear systems, function approximation, differentiation, integration, and ordinary differential equations, with an introduction to finite difference methods for partial differential equations.

97% — **Math 301 Complex Variables**
Prof. Jane Ye

Theory of complex-valued functions, analytic functions, elementary functions, integration, power series, residue theory.

97% — **Math 379 Nonlinear Dynamical Systems and Chaos**
Prof. David Goluskin

Course on dynamical system theory. Topics included: existence theory, geometric analysis, stability theory, bifurcation theory and chaos for differential equations with emphasis directed to applications in science.

93% — **Math 248 Computer Assisted Mathematics and Physics**
Prof. Alexander Chernyavsky

Rigorous introduction to utilizing high-level computer languages for mathematical and scientific experimentation, simulation, and computation.

100% — **Math 335 Real Analysis I**
Prof. Heath Emerson

Euclidean n-space and introduction to metric spaces. Limits, continuity, differentiation and the Riemann integral for functions in Euclidean n-space. Implicit and Inverse Function Theorems. Sequences and series of functions and uniform convergence.

99% — **Math 312 Abstract Algebra (Upper-Level)**
Prof. Stephen Skully

Theory of groups, rings, and fields, including quotient structures. Covered Isomorphism Theorems, Sylow Theorems, and introductory Galois theory.

99% — **Math 311 Linear Algebra (Upper-Level)**
Prof. Peter Dukes

Theory of vector spaces, linear transformations, matrix decompositions, canonical forms, inner product spaces, and spectral theory.

100% — **Phil 370 Theoretical Logic**
Prof. Audrey Yap

Course on meta-theoretic logic. Covered soundness and completeness for first-order classical logic.

99% — **Mathematical Probability Theory**
Prof. Gourab Ray

Probability spaces, random variables, combinatorial analysis, expectation, moment generating functions, Markov chains, and proof of central limit theorem.

100%, 98%, 97%, 99% — **Calculus I-IV**
Prof. Chris Eagle and Trefor Bazett

Introductory calculus, multi-variable calculus, vector calculus, differential equations.

99% — **CSC 111 Fundamentals of Programming With Engineering Applications**
Prof. Bill Bird

Introductory programming course using the C language. Topics included control flow, debugging techniques, algorithms, data representation, data structures, and memory management, alongside fundamental concepts such as variable types, loops, and other essential programming constructs.

92% — **Phys 111 Physics II**
Prof. Mark Laidlaw

Harmonic motion, coupled oscillations, and wave phenomena, including standing waves and their applications. Topics extend to collective variables, thermodynamics (calorimetry, first and second laws), geometric optics, and an introduction to relativity and modern physics.

92% — **Phys 110 Physics I**
Prof. Richard Keeler

Newton's laws, particle dynamics, and curvilinear motion. Topics include force and momentum, kinetic and potential energy, circular and rotational motion, and an introduction to gravitational and electric forces.

100% — **Psych 100A Intro Psych I**
Instructor: Randall Tonks

Focuses on the historical, methodological, biological, learning, and cognitive aspects of psychology.

Last updated: November 29, 2024