

# CSE 257/190: Search and Optimization (Winter 2026)

Instructor: Sicun Gao

## Content

We cover topics that help you build some intuition about how to approach hard search and optimization problems in mathematically principled ways from three different perspectives: analytic, probabilistic, and combinatorial (in an untraditional sense), and also understand their connections. In particular:

- Numerical Optimization (Week 1-3): zero-order, first-order, and second-order perspectives, line search, trust regions, various accelerations. (We'll likely only have time for unconstrained problems, with the exception of the case of single constraints for understanding projections.)
- Probabilistic Optimization (Week 4-6): cross-entropy methods, search gradient, natural gradient, KL projection, Fisher geometry, variational inference. (We say “probabilistic” rather than the more commonly used “stochastic” to note the focus on methods that evolve distributions rather than samples.)
- Policy Optimization (Week 7-10): Markov decision processes, actors and critics, off-policy and on-policy methods (Q-learning, DDPG, TRPO, PPO, SAC), Monte Carlo tree search.

Prerequisites: multivariate calculus, linear algebra, basic probability.

## Grading

- Assignments: 35 Points
- Midterm (Feb-4 4pm-6:20pm): 30 Points
- Final (Mar-16 7pm-10pm): 35 Points