Syllabus

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Official course title. The course catalog lists this course as "Introduction to Mathematical Modeling." The unofficial title above better captures the spirit of the course.

Course objectives. By the end of this course, students will be able to

(i) identify when a real-world decision-making problem can be modeled as a shortest path problem, deterministic dynamic program, or stochastic dynamic program;

(ii) formulate such models for real-world decision-making problems;

(iii) set up these models with data from large-scale real-world sources;

(iv) solve these models with computational tools and interpret their output.

Schedule. Here is a tentative schedule.

Week	Topics
	The shortest path problem
1	Overview. The OR approach. Graphs and the shortest path problem.
2	The shortest path problem, cont. Longest paths and negative cycles. Introduction to Jupyter Notebook and Python.
3	Solving shortest path problems with `networkx`. The mileage running problem.
4	Solving the mileage running problem with large-scale real-world data. Review
5	Exam 1
	Dynamic programming
	Introduction to dynamic programming – shortest/longest path representation.
6	Dynamic programming, cont. Solving dynamic programs with `networkx`.
7	Big DPs and the curse of dimensionality. Drafting a fantasy basketball team.
8	Solving the fantasy basketball draft problem with large-scale real-world data. Machine scheduling.
9	The principle of optimality and formulating DP recursions. Formulating DP recursions, cont.

Week	Topics
10	Spring Break
11	Review Exam 2
Stochastic dynamic programming	
12	Introduction to stochastic dynamic programming. Stochastic dynamic programming, cont.
13	Solving stochastic dynamic programs with Python. The points-after-touchdown problem.
14	Solving the points-after-touchdown problem with real data.
15	More stochastic dynamic programming models.
16	Review
17	Review