

# ENGR 597: Dynamic Optimization for System Operation Under Uncertainty

Special Topic course offered Fall semester 2019

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**Course Description:** This course will provide a survey of analytical and numerical methods for solving multi-stage decision problems which include uncertainty, with the goal of operating systems to minimize an undesirable outcome (e.g., economic cost, risk) over a number of stages. The course will introduce the dynamic programming framework and illustrate its use in solving multi-stage operational decision problems in areas such as energy, finance, and operations research. Finite horizon and infinite horizon problems will be discussed. This course will include individual review assignments to survey existing literature and application of concepts through numerical simulation.

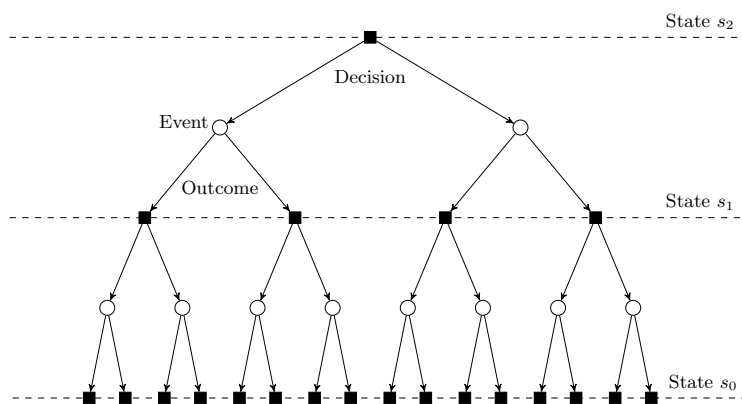


Figure 1: Decision tree for dynamic programming under uncertainty.

## Example Applications:

- Optimal storage and dispatch of fuel or energy in an electric grid/microgrid
- Asset allocation and portfolio management
- Inventory management

## Prerequisites<sup>1</sup>

- Students *must* have taken a previous course in undergraduate probability theory and preferably graduate coursework in probability and/or stochastic processes.
- Undergraduate engineering mathematics (calculus, differential equations, matrices).
- Proficiency in one or more of the following languages: MATLAB, Python, R.
- Recommended: previous coursework in undergraduate or graduate control theory.

## Course Grading Weights

Class participation (10%), homework (20%), mid-term project (30%), final project (40%).

## Textbooks

*Dynamic Programming and Optimal Control (Vol. 1), 4th ed.*, D. Bertsekas. Belmont, MA: Athena Scientific. 2017.

*Dynamic Optimization: The Calculus of Variations and Optimal Control in Economics and Management*, M. Kamien and N. Schwartz. New York, N.Y.: Elsevier. 1991.

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<sup>1</sup>Contact the instructor (jcale@colostate.edu) with questions and/or requests for waivers for the prerequisites.