

FALL 2018
IE 519: DYNAMIC PROGRAMMING (DP)
PROJECT DESCRIPTION

Contribution to Final Grade and Due Dates

Contribution to final grade: 25 %

Project proposal due date: Tuesday, October 16, 2018

Progress report due date: Tuesday, October 30, 2018

Final report due date: Thursday, December 6, 2018, 5:30 pm

Project presentation: Thursday, December 6, 2018, 5:30-8:00 pm, 311 Leonhard Bldg.

General Guidelines

Choose one of the following three types of projects:

- (a) Applications of DP to a novel area: choose a new application area and review the most significant work concerning the use of DP models to solve real problems in that area. A project of this type requires doing a literature review, reading the most relevant work (five or six papers), and summarizing various classes of problems and corresponding DP solution procedures. It is also important to compare DP with other approaches. Possible areas: customer relationship management, revenue management, big data, asset pricing, supply chain management, healthcare delivery, business and financial applications, terrorism, DNA sequence alignment, etc.
- (b) DP-based approximation methods, such as neuro-DP, approximations to Markov decision processes, learning and value function approximation, spline approximations to value functions, reinforcement learning for sequential decision making, etc. This type of project entails doing a literature review for a particular type of approximation, reading the most relevant work (five or six papers), clearly describing the basic approximation approach and possible extensions, accuracy of DP solution, and summarizing various successful applications. Instead of DP-based approximation methods, you can also work on continuous-time Markov Decision Processes.
- (c) Research problem: select a research problem that can be solved by DP, develop a DP formulation, solve few examples, determine the computational effort, implement the algorithm and perform a computational study, and/or identify special cases that can be easily solved (possibly in closed-form).

Students must work alone if they choose a type (a) or (b) project, and can work alone or in teams of two if they choose a type (c) project.

Only one student can work on a given application area, a given DP approximation method, or continuous-time Markov Decision Processes, and at most two students (or student teams) can work on the same research problem.

Project Proposal and Progress Report

The **project proposal** (1 to 2 pages) should include the title of the project, name of the author(s), date, the course number/name, a general description of the problem, and the work plan including the list of tasks to be performed. The inclusion of a task in your proposed research plan does not indicate any commitment that the work will be completed successfully. A task may be dropped, modified, completed successfully, or negative results may be presented in the final report.

The **progress report** (2 to 3 pages) should include a summary of the tasks that have been completed and a revised list of the tasks to be performed.

Report Requirements

The report must be typed in double space and be approximately 15 to 18 pages long without including the Appendix.

The format for the report may vary depending on the type of project. Recommended sections for a possible research project are:

- a. First page: title of project, names of authors, date, course number/name, and abstract (150 to 200 words).
- b. Introduction: provide insightful motivation for the research area, state the objective of the project, and provide an overview of the report.
- c. Problem statement: describe the problem and input data, and present the optimization model.
- d. Solution procedure: explain in detail the DP formulation of the problem, provide few examples, and show the computational effort.
- e. Computational experiments: describe implementation issues, programming language, procedure to generate test problems, and include tables of computational results (e.g., CPU time versus problem size, etc.).
- f. Conclusions and future research.
- g. References.
- h. Appendix: include computer code.

Each student or student group is also expected to prepare a presentation of about 12-15 min.

DP Research Journals

Advances in Applied Probability
Applied Mathematics and Optimization
Computers and Operations Research
Discrete Applied Mathematics
Engineering Optimization
European Journal of Operational Research
IIE Transactions
IEEE Transactions of Automatic Control
IEEE Transactions on Computers
INFORMS Journal on Computing
International Journal of Production Research
International Journal of Production Economics
Journal of the Association for Computing Machinery
Journal of Mathematical Analysis and Applications
Journal of the Operational Research Society
Journal of Optimization Theory and Applications
Operations Research Letters
Operations Research
Management Science
Mathematical Programming
Mathematics of Operations research
Naval Research Logistics
Networks
SIAM Journal of Algorithms and Discrete Methods
SIAM Journal of Computing
SIAM Journal of Control and Optimization