ISyE 7674
Dynamic Programming
Fall 1998
Administrative Info

Instructor: Anton J. Kleywegt
Office: Groseclose 409
Office hours: Monday, Wednesday, Friday 2:00–3:00
e-mail: Anton.Kleywegt@isye.gatech.edu
WWW URL: http://www.isye.gatech.edu/faculty/Anton_Kleywegt
Phone: 894-4323
Fax: 894-0390

Class Room: ISyE 404
Class Times: Monday, Wednesday, Friday 11:00–12:00

Description:
The course covers deterministic as well as stochastic dynamic programming (DP). To develop
the intuition, and because some results apply specifically to deterministic DP and not to
stochastic DP, we will begin with the basics of deterministic DP. This will be reinforced
with an introduction to deterministic continuous time optimal control. Next stochastic
DP will be introduced, covering both finite and infinite horizon problems. Special topics
include problems with imperfect state information, and approximation methods for large-
scale problems. Computational techniques and applications will be emphasized throughout.

The objectives of the course are

- to develop an understanding of the types of problems for which a dynamic programming
  formulation and solution methods are useful;

- to become familiar with the major DP algorithms and the issues involved in their
  implementation;

- to develop insight in the use of DP to establish structural characteristics of problems;

- to understand the limitations of DP algorithms, and to become familiar with some
  approximation methods for dealing with large-scale problems;

- to understand the fundamental role of the process by which information becomes avail-
  able in dynamic optimal control problems.
Prerequisites:
Basics of optimization, calculus, linear algebra, and Markov chains. Previous exposure to real analysis will be helpful (concepts such as supremum, infimum, contraction mapping), but not essential. Programming skills will help for the optional problems.

Textbook:
No textbook is required. The books by Bertsekas and Puterman are recommended. Approximately 30% of the lecture material is based on Bertsekas, 30% on Puterman, 10% on Denardo, 10% on Bertsekas and Tsitsiklis, and 20% on journal articles.

References:


Topics Covered:

- Deterministic Dynamic Programming
- Computational Methods
- Deterministic Continuous Time Optimal Control
- Stochastic Dynamic Programming
  - Finite Horizon Problems
  - Infinite Horizon Problems
- Imperfect State Information (Partially Observed) Problems
- Approximation Methods
- Applications: Shortest Path Problem and extensions, Resource Allocation, Inventory Control, Portfolio Selection, Computer Chess

Grading:
Grades will be based on assignments. Two types of problems will be given in assignments. The first type covers the basics, and these problems will be compulsory. The second type covers a variety of topics, from which you can choose problems according to individual interests. Among these will be programming problems, on which you may work in groups of two. On the remaining problems, you are expected to do your own work.