ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Institute for Dynamic Systems and Control
IDSC
Institut für Dynamische Systeme und Regelungstechnik

151-0563-00 Dynamic Programming and Optimal Control (Fall 2009)

Class Website

All information concerning the class: announcements, class facts, problem sets, etc.

`http://www.idsc.ethz.ch/Courses/optimal_control`

Please check regularly. Announcements concerning the class are only made on the website.

Description

Contents:
Dynamic Programming Algorithm; Deterministic Systems and Shortest Path Problems; Infinite Horizon Problems; Value/Policy Iteration; Deterministic Continuous-Time Optimal Control; Problems with Perfect State Information.

Book:
The lecture is based on the textbook by Dimitri P. Bertsekas:
Dynamic Programming and Optimal Control by Dimitri P. Bertsekas, Vol. I, 3rd edition, 2005, 558 pages, hardcover.

Requirements:
Knowledge of advanced calculus, introductory probability theory, and matrix-vector algebra.

Class Facts

Instructor	Prof. Raffaello D'Andrea, `rdandrea@ethz.ch`
Teaching Assistants	Angela Schöllig, `aschoellig@ethz.ch` Sebastian Trimpe, `strimpe@ethz.ch`
Lecture	Wednesday, 13:15 to 15:00, ML F38
Exercise	Wednesday, 15:15 to 16:00, ML F38
Office hours	Monday, 18:30 to 19:30, ML K37.1 (IDSC library), Angela Tuesday, 16:00 to 17:00, ML K37.1 (IDSC library), Sebastian
Exam	Final exam during the examination session, covers all material.
Grading	*40% quizzes/programming exercises, 60% final exam* if the grade for quizzes and programming exercises is better than the grade in the final exam; *100% final exam* otherwise. PhD students will get credits for the class if they pass the class (final grade of 4.0 or higher).
Repetition	The final exam is only offered in the session after the course unit. Repetition is only possible after re-enrolling. Students who took the class in Fall 08 and have to retake the course have the option of keeping their old homework grades. **They have to inform the teaching assistants before the beginning of the new class.**

Lectures

#	Date	Topic	Reading
1	Sep 23	The Dynamic Programming Algorithm	1.1 – 1.4
2	Sep 30	The Dynamic Programming Algorithm	1.1 – 1.4
3	Oct 07	The Dynamic Programming Algorithm	1.1 – 1.4
4	Oct 14	Deterministic Systems and the Shortest Path Problem	2.1 – 2.3
5	Oct 21	Deterministic Systems and the Shortest Path Problem	2.1 – 2.3
6	Oct 28	Infinite Horizon Problems, Value Iteration, Policy Iteration	7.1, 7.2
7	Nov 04	Infinite Horizon Problems, Value Iteration, Policy Iteration	7.1, 7.2
8	Nov 11	Infinite Horizon Problems, Value Iteration, Policy Iteration	7.1, 7.2
9	Nov 18	Deterministic Continuous-Time Optimal Control	3.1 – 3.4
10	Nov 25	Deterministic Continuous-Time Optimal Control	3.1 – 3.4
11	Dec 02	Deterministic Continuous-Time Optimal Control	3.1 – 3.4
12	Dec 09	Problems with Perfect State Information: Linear Systems and Quadratic Cost	4.1
13	Dec 16	Problems with Perfect State Information: Linear Systems and Quadratic Cost	4.1

Quizzes and Programming Exercises

During the semester, there will be graded quizzes and programming exercises, which can be used to improve the final grade for the course (see "grading"). Quizzes will take place at the beginning of the lecture and will test the student's understanding of the corresponding topic. The programming exercises will require the student to apply the lecture material.

#	type	topic	dates
Q1	Quiz	The Dynamic Programming Algorithm	Oct 14
P1	Programming	Deterministic Systems and the Shortest Path Problem	Oct 21 (issued), Nov 04 (due)
P2	Programming	Infinite Horizon Problems, Value Iteration, Policy Iteration	Nov 11 (issued), Nov 25 (due)
Q2	Quiz	Deterministic Continuous-Time Optimal Control	Dec 09

- Up to three students can work together on the programming exercises. If they do, they have to hand in one solution per group and will all receive the same grade.

Problem Sets

We will make sets of problems and solutions available online for the chapters covered in the lecture. It is the student's responsibility to solve the problems and understand their solutions. The teaching assistants will answer questions in office hours and some of the problems might be covered during the exercises.

#	topic
1	The Dynamic Programming Algorithm
2	Deterministic Systems and the Shortest Path Problem
3	Infinite Horizon Problems, Value Iteration, Policy Iteration
4	Deterministic Continuous-Time Optimal Control
5	Problems with Perfect State Information: Linear Systems and Quadratic Cost