ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

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

151-0563-01 Dynamic Programming and Optimal Control (Fall 2012)

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.

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 linear algebra.

Class Facts

Instructor	Angela Schoellig, `aschoellig@ethz.ch`
Teaching Assistants	Nico Huebel, `nhuebel@ethz.ch` Mohanarajah Gajamohan, `gajan@ethz.ch`
Lecture	Wednesday, 13:15 to 15:00, ML H 44
Exercise	Wednesday, 15:15 to 16:00, ML H 44
Office hours	Thursday, 17:00 to 18:00, ML K 35, Nico/Gajan
Feedback	Please use the ETH EduApp (`http://www.eduapp.ethz.ch/home_en.html`) for giving us feedback.
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.
Only the three best grades from the quizzes and the programming exercises will count towards the 40% above.
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 have to retake the course and want to keep their old homework grades have to inform the teaching assistants **before the beginning of the new class**.

Plagiarism

When handing in any piece of work, the student (or, in case of a group work, each individual student) listed as author confirms that the work is original, has been done by the author(s) independently and that s/he has read and understood the *ETH Citation etiquette* (http://www.ethz.ch/students/exams/plagiarism_s_en.pdf).

Each work submitted will be tested for plagiarism.

Lectures

#	Date	Topic	Reading
L1	Sep 26	The Dynamic Programming Algorithm	1.1 – 1.4
L2	Oct 03	The Dynamic Programming Algorithm	1.1 – 1.4
L3	Oct 10	The Dynamic Programming Algorithm	1.1 – 1.4
L4	Oct 17	Deterministic Systems and the Shortest Path Problem	2.1 – 2.3
Q1 + L5	Oct 24	Q1: The Dynamic Programming Algorithm L5: Deterministic Systems and the Shortest Path Problem	1.1 – 1.4 (Q1) 2.1 – 2.3 (L5)
L6	Oct 31	Infinite Horizon Problems, Value Iteration, Policy Iteration	7.1 – 7.3
L7	Nov 07	Infinite Horizon Problems, Value Iteration, Policy Iteration	7.1 – 7.3
L8	Nov 14	Infinite Horizon Problems, Value Iteration, Policy Iteration	7.1 – 7.3
L9	Dec 21	Deterministic Continuous-Time Optimal Control	3.1 – 3.4
L10	Dec 28	Deterministic Continuous-Time Optimal Control	3.1 – 3.4
L11	Dec 05	Deterministic Continuous-Time Optimal Control	3.1 – 3.4
Q2 + L12	Dec 12	Q2: Deterministic Continuous-Time Optimal Control L12: Final recitation class	3.1 – 3.4 (Q2)

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. 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.

#	type	topic	dates
Q1	Quiz	The Dynamic Programming Algorithm	Oct 24
P1	Programming	Deterministic Systems and the Shortest Path Problem	Oct 24 (issued), Nov 07 (due)
P2	Programming	Infinite Horizon Problems, Value Iteration, Policy Iteration	Nov 14 (issued), Nov 28 (due)
Q2	Quiz	Deterministic Continuous-Time Optimal Control	Dec 12

Problem Sets

We will make sets of problems and solutions available online for the topics 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.
The problem sets are password protected. The password will be announced in class or can be obtained from the teaching assistants.

#	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