

CE 191: Civil and Environmental Engineering Systems Analysis

LEC 00 : Course Introduction

Professor Scott Moura
Civil & Environmental Engineering
University of California, Berkeley

Fall 2014



Why take CE 191?

*Learn to abstract mathematical programs
from physical systems to “optimally” design
a civil engineered system.*

Class Format

Lectures: TuTh 9:30–10:30am, 406 Davis Hall

Lab Section: Th 2-5pm (Jacob) or 5-8pm (Andrea), 345 Davis Hall

Website: <http://bcourses.berkeley.edu>

Professor Scott Moura
smoura@berkeley.edu

Office Hours: Tu 10:30-12, W 2-3:30
@ 625 Davis Hall

GSI Jacob Shaw
jacobshaw3@gmail.com

Office Hours: Tu 4:30-6, W 10:30-12
@ 504 Davis Hall

GSI Andrea Mengual
a.mengual@berkeley.edu

Office Hours: M 3:30-5, F 9:30-11
@ 651 Davis Hall

Optimization Topics

- Linear programming (LP)
- Quadratic programming (QP)
- Integer programming (IP)
- Nonlinear programming (NLP)
- Dynamic programming (DP)

CEE Topics

- Water supply networks
- Planning California's future energy supply mix
- Scheduling a Memorial Stadium construction project
- Berkeley WiFi Tower Location
- Big Game Week Special: Cal Band Pregame

Course Notes & Textbooks

CE 191 Course Notes are provided. No textbooks are required.

The following is officially recommended for additional background:

- 1 Civil and Environmental Systems Engineering; C. Revelle, E. Whitlatch, R. Wright; Pearson Prentice Hall, 2004.
- 2 Design and Operation of Civil and Environmental Engineering Systems; C. Revelle, A. E. McGarity; John Wiley & Sons, 1997.

The following textbooks are also useful resources:

- 3 Convex Optimization; S. Boyd and L. Vandenberghe; Cambridge University Press, 2004.
- 4 Principles of Optimal Design; P. Papalambros and D. Wilde; Cambridge University Press, 2000.

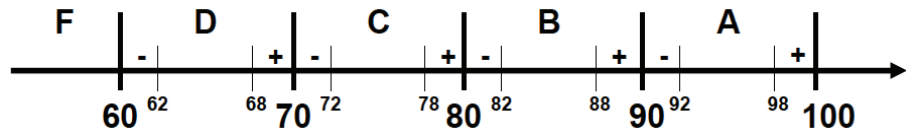
#1,3 have been placed **on 2 hr. reserve** in the library. #2,4 are available to peruse during Prof. Moura's office hours.

Lecture format:

- Mostly blackboard w/ some slides
- Supplemental slides available online

Grading

Nominally straight scale (no curve):



Labs: 50pts - 5 lab assignments, 10pts each

Midterm: 20pts - Tues Oct 16, 9:30-10:30am, in-class

Final: 30pts - Exam Group 7: Tues Dec 16, 2014 3-6pm

A total of 100pts are possible.

Philosophy: Consistency and transparency

F13 Grades: Mean: 91% (A-) Low: 76% (C) High: 98% (A+)

F14 Grades are NOT guaranteed to match F13 distribution

Late Submissions: One point is subtracted for each 24 hours submitted late (rounded up to nearest integer). Two free late days are allowed on any lab of your choice. Late submissions not accepted after the Tues following a Fri due date.

Regrade Policy: If you feel a problem was graded incorrectly, you may submit a regrade request to the GSI. This request **MUST** be submitted within one week of receiving the graded assignment, with a short paragraph justifying the regrade. Any regrade request is subject to a full regrade, i.e. points may be lost.

Extra Credit: Students who find errors and supply corrections to the notes will receive 0.1 pts extra credit. You receive 0.1 pts for each new error and correction that you supply, subject to instructor approval. First come-first reward. Students must report the corrections by e-mail, to leave a paper-trail. Each student can receive a maximum of 2 pts, i.e. for twenty corrections. Keep in mind that the notes are continuously updated on bCourses, so make sure the correction is applicable to the most up-to-date version.

Planned Absences: You may request to submit assignments early or late. E-mail me your request two weeks prior to the assignment due date. Requests due to extended holidays will not be granted. Requests due to emergencies will be handled case-by-case.

MATLAB used for lab assignments.

UCB IST License: You can request a license at
<http://ist.berkeley.edu/software-central/matlab>

For purchase from Mathworks for \$99:
http://www.mathworks.com/academia/student_version/

Computer Access: A CEE Computer Lab Account is required to use the computers in 345 Davis. Use the link below to request an account.
http://www.ce.berkeley.edu/resources/computing/create_lab_account

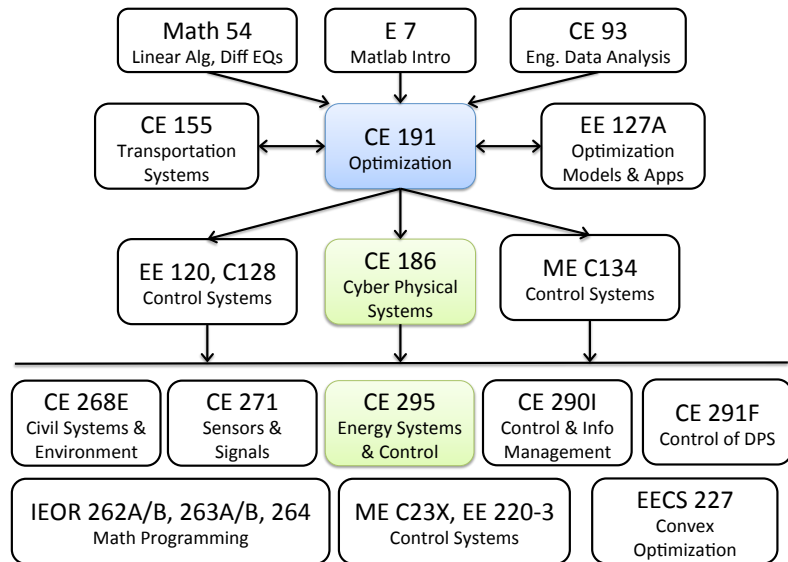
Lab 0 - Matlab Review

- Familiarize yourself with computer lab in 345 Davis
- Use class website `bcourses.berkeley.edu`
- Complete survey on background
- Review basic Matlab tasks
- Rehearse electronic submission to bCourses

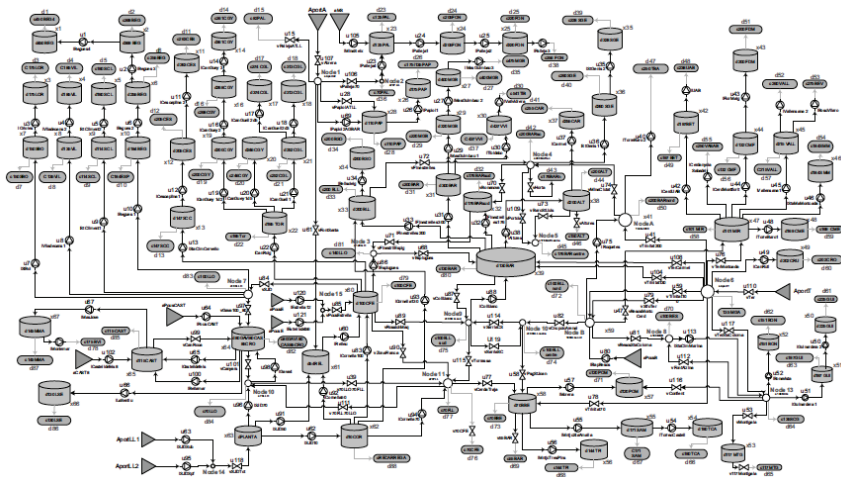
How to Succeed

- Ask questions in class
- Form a study group
- Read the course notes
- Complete the exercises in the course notes
- Start lab assignments early
- See instructor after class
- See instructor during OH
- See GSI during OH
- Send us an e-mail. Use [CE 191] in subject.

Flowchart of Methods-based Courses



Example 1: Barcelona Water Network



Covers 425 km², total length of 4470 km, 237.7 hm³ of water to 2.8M inhabitants.

There are 67 tanks, 10 water sources, 111 valves / pumps, 88 points of water consumption and 15 complex nodes. [Trnka, Pekar, Havlena, IFAC2011]

Example 2: Shortest Path (routing)

MobileMillennium
http://traffic.berkeley.edu

The cyberphysical system that keeps traffic moving

Drop the phone into the car to begin.

Zoom Out Zoom In

San Francisco San Jose Fremont Oakland Palo Alto Berkeley Sacramento

Traffic Speed
Fast Slow

Download Station

Ex 3: Cloud Enabled Smart Charging of PEVs (CE 186)

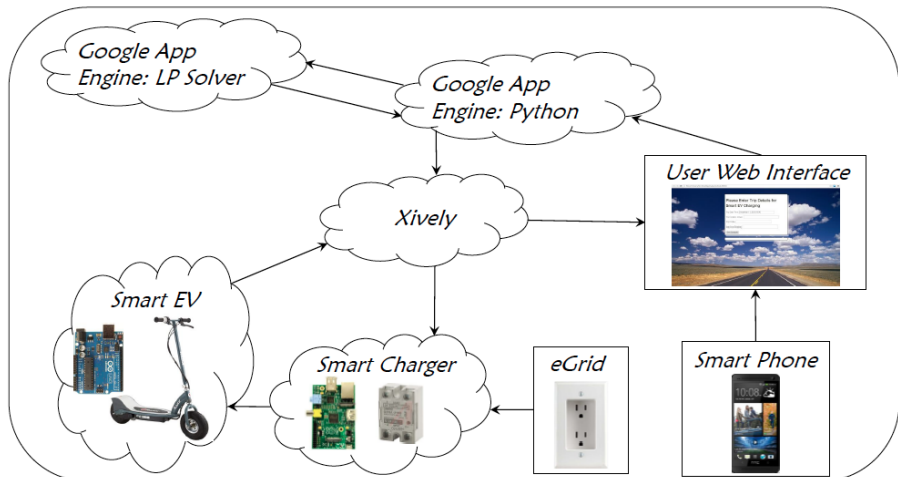


Figure 2. On the Cloud Optimization System for Smart EV Charging

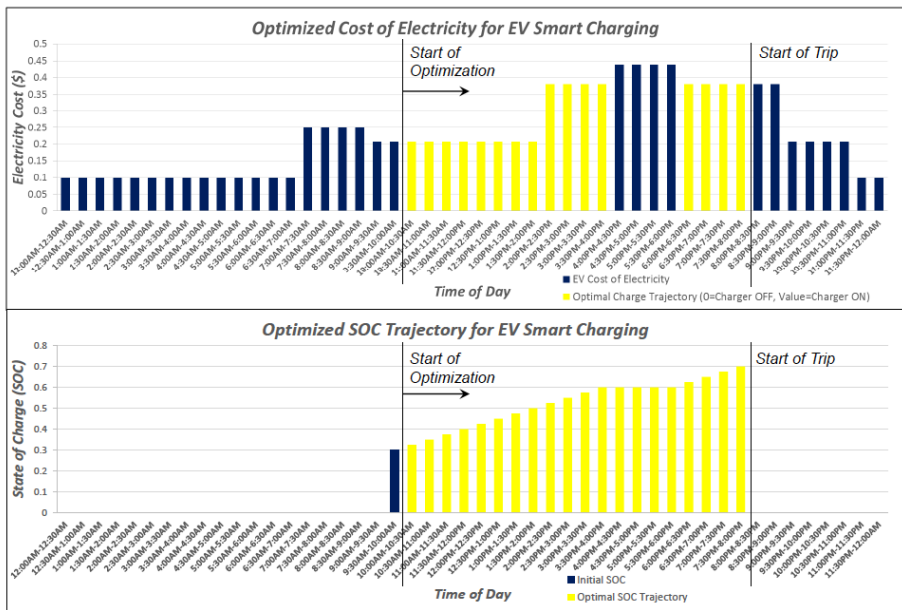


Figure 3. Optimal Charge Cost and SOC Trajectory