ECONOMICS 172B:
Introduction to Operations Research (Part B)

Winter 2015

Basic information

Lectures	T/Th 14:00-15:20 CENTR 214 & 17:00-18:20 CSB 002
Instructor	Prof. Alexis Akira Toda
Office hours	Thursdays 15:30-16:30, ECON 211
Email	atoda@ucsd.edu
Webpage	`https://sites.google.com/site/aatoda111/` (Go to `Teaching` → `Operations Research`)
TA	TBA

Course description

This course studies nonlinear (convex) programming and dynamic programming. Nonlinear programming means that we want to optimize (maximize or minimize) an objective function subject to some constraints, both of which may be nonlinear. Convex programming refers to the special case that the objective function and constraints are convex, in which case we can say more about the solution. The course also studies dynamic programming, which is a method of analyzing optimization problems that exploits the sequential structure of the problem. Examples of such problems are the decisions of savings or portfolio over time.

Prerequisites

Econ 172A or Math 171A. This course will use some mathematics. It will help if you know how to differentiate a function and what a vector and a matrix are. I will introduce the necessary mathematics over the course, so technically you don't need to know much beyond high school algebra. However, familiarity with some abstract mathematical reasoning (which can be acquired only by practice) is helpful.

Text

There is no required textbook for this course. The reason is because textbooks on Operations Research are expensive, and I could not find a textbook in math-

ematics or economics that covers the material in this course at a suitable level. Instead, I will post lecture notes on Ted as well as my webpage listed above. The standard textbook on Operations Research is [1], which covers all materials but at a level slightly lower than this course.

There are two versions to the lecture notes, 2014 and 2015. The 2014 version is what I prepared when I taught this course for the first time, and it turns out that it was a bit challenging. The 2015 version is what I will use this year. The challenging 2014 version is posted at my website. Ambitious students are welcome to study the challenging version.

Preliminary course outline

1. One-variable optimization
2. Multi-variable calculus
3. Multi-variable unconstrained optimization
4. Multi-variable constrained optimization
5. Dynamic programming
6. Queuing theory
7. Inventory theory

Exercises, assignments, and exams

Each lecture note contains a few exercises. Solve them by yourself: this is the best way to understand the material and to get prepared for the exams. Challenging problems are marked with (C), which you are not responsible for the exam. However, ambitious students should attempt to solve them.

There will be three assignments. In order to motivate you to study, the due date will be approximately one week before each exam.

There will be two midterms and a final. Please mark your calendar:

Midterm 1 Friday January 23, 19:00-20:20, CENTR 101.

Midterm 2 Friday February 20, 19:00-20:20, CENTR 101.

Final Friday March 19, 15:00-18:00 and 19:00-22:00, location TBA

The exam dates are non-negotiable. If you miss a midterm for a documented, university approved reason (*i.e.*, illness, funeral, official university trip, etc.) the weight for that exam will be placed on the final. If you miss a midterm for another reason (*i.e.*, oversleep, vacation, etc.) you will receive a zero for that exam. No one will be allowed to start an exam after the first person leaves it. You are only permitted to use pens, pencils, and a straight edge (*no* calculator).

The last year's exams are posted on my website, although they are not likely to be helpful since the focus of the course has changed a lot.

Grades

Your grade will be determined by the formula

$$G = 0.1A + 0.2M_1 + 0.2M_2 + 0.5F,$$

where G is the course grade, A is the scores on the assignments, and M_1, M_2, F are the scores on the midterms and the final. The course grade G will be converted to letter grades at my discretion (curve) at the end of the quarter. (So please don't ask me questions like "What is the letter grade corresponding to x points in midterm?")

Regrade requests must be made through a written statement *before* the start of class one week after the exam was first passed back. Extensions will only be permitted if you have a documented, university approved reason for missing the entire week after the exam was first passed back. If you request a regrade I reserve the right to regrade your entire exam and your score could go up, down, or stay the same. My regrade decision is final.

Questions

The best opportunity to ask questions is *during* the class, for two reasons. First, you can resolve your question immediately. Second, your classmates are likely to have similar questions, so they can benefit from questions being resolved and I benefit by saving time. If you have a question outside of class that cannot be resolved by Googling or discussing with your friends, please first ask your TA. If still unresolved, you can show up during my office hour listed above (no appointment necessary).

How to do well in this course

Get your favorite math text (linear algebra and calculus) so that you can refer if necessary. Experience tells that students who regularly attend classes outperform those who don't, so come to class. Ask questions during the class whenever you don't understand. Read the lecture notes. Solve exercises without looking at the solutions. If you do well in this course (say, top 3-5 students), you have a good chance to be admitted in a good Ph.D. program (and therefore get a lucrative job in the future). Let me know if you need a letter of recommendation. (I can write a letter to anybody, but remember that I will be an honest letter writer.)

Academic integrity

I take academic dishonesty seriously. Any student found guilty of academic dishonesty will earn a failing grade for the course. In addition to this sanction, the Council of Deans of Student Affairs will also impose a disciplinary penalty.

UCSD policy:
`http://senate.ucsd.edu/manual/appendices/appendix2.pdf`

Facts about academic integrity:
`http://students.ucsd.edu/academics/academic-integrity/facts.html`

Consequences of cheating:
http://students.ucsd.edu/academics/academic-integrity/consequences.html

References

[1] Frederick S. Hillier and Gerald J. Lieberman. *Introduction to Operations Research*. McGraw-Hill, 9th edition, 2010.