ECONOMICS 172B: INTRODUCTION TO OPERATION RESEARCH B Spring 2020

Instructor: Herb Newhouse (hnewhouse@ucsd.edu) Course webpage: https://canvas.ucsd.edu/
Lectures: MWF 9:00 – 9:50 am Discussions: Th 7:00 – 7:50 pm and 8:00 – 8:50 pm
TAs: Edoardo Briganti (ebrigant@ucsd.edu) and Yuchang Chen (yuc391@ucsd.edu)
The instructor and TA office hours will be held online. Further information will be posted on Canvas.

This course primarily studies non-linear programming. We will examine optimization problems where the objective function, the constraint, or both are non-linear. We will use computational methods to find approximate solutions and calculus to find exact solutions. The course also studies dynamic programming, search models and inventory models. Dynamic programming is a method of analyzing optimization problems that exploits the sequential structure of the problem.

Prerequisites: ECON 172A or Math 171A.

Planned structure:

The topics covered in this course will be presented in a hybrid format, with flexible use of the classroom time and lectures delivered online. The first lecture will be primarily organizational and administrative. I will also provide you with quick overview about the material we will cover during the second lecture.

Before each lecture, I will ask you to watch the appropriate parts of podcasts from former classes. During that time, I encourage you to fill in the incomplete PowerPoint notes that will be available on Canvas.

At the start of each lecture, I will briefly review the material that was covered in the podcast. During this review you will have the opportunity to ask questions. You will then be given problems to work. You will have the opportunity to ask a TA or me for help with the problems. We will then go over the problems and finish with a quick overview about the material we will cover during the next lecture.

We will do our best to record lectures, discussion sections and review sessions.

Grading:

My prediction of how I will assess you in this course is:

Grades are based on completing a weekly checklist (5%), a week two use of technology quiz (1%), exams (75%) and a project (19%). The weekly checklist is on Canvas. Your score will be based on the percentage of weekly checklists you complete. Your lowest two weeks will be dropped. There will be four exams. Your lowest score will be dropped. There will be one project.

Note: **If you miss a weekly checklist or exam because of illness, your score for that assignment will be a zero. That assignment will use up one of your drops for that category.** I suggest treating all assignments as if they will count towards your final grade.

Exams will be held during our normal class or final exam times. Midterm 1 will be held on Friday, April 17th. Midterm 2 will be held on Monday, May 4th. Midterm 3 will be held on Friday, May 22nd. The final exam will be held on Wednesday, June 10 during some time period between 8:00 and 11:00 am. If you know in advance that you cannot make an exam, please let me know as soon as possible.

While I will do what I can to keep to the predicted assessments for this course, the evolving situation may make it necessary for me to make changes.

Academic dishonesty:

I take academic dishonesty seriously. Any student found guilty of academic dishonesty will most likely 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. For a review of UCSD policy, please see http://www-senate.ucsd.edu/manual/appendices/app2.htm.

We will likely use Zoom or Loom for proctoring this quarter. These programs use video and audio recording or other personal information capture for the purpose of facilitating the course and/or test environment. UC San Diego does not allow vendors to use this information for other purposes. Recordings will be deleted when no longer necessary. However, if cheating is suspected, the recording may become part of the student's administrative disciplinary record. Finally, I reserve the right to give an oral test if I feel it is necessary to uphold academic integrity.

Regrade requests:

Regrade requests may be submitted online during the weeklong regrade period. The regrade period will probably begin a few days after the exam results are made available to the class. Please do not contact the instructor or any of the TAs regarding the grading of an exam or the grading for the course before the regrade period begins. If your TA agrees with your request, your score for that question will be corrected. If your TA disagrees with your request, you will lose 1 point for each midterm question and 2 points for each final exam question.

Text:

Introduction to Operations Research, 10th Edition, Hillier and Lieberman, McGraw-Hill. I will give references for the 10th edition but other recent editions should also be fine. The material for this course is fairly standard; other Operations Research texts are also likely to be helpful.

Practice Problems:

Practice problems will be available online. We will go over these questions in office hours and in the discussion sessions. Your best practice for the exams is to try these questions yourself first.

Preliminary Course Outline:

1. Introduction
    a. Ch. 12: Intro.
    b. 12.1: Sample Applications.
    c. 12.2: Graphical Illustration of Nonlinear Programming Problems.
    d. 12.3: Types of Nonlinear Programming Problems.
2. Concavity and Convexity
    a. Appendix 2: Convexity.
    b. Appendix 3: Classical Optimization Methods.
3. Unconstrained Optimization
    a. 12.4: One-variable Unconstrained Optimization.
    b. 12.5: Multivariable Unconstrained Optimization.
4. Equality Constrained Optimization
    a. Briefly covered in readings for Introduction and Concavity and Convexity.
5. Inequality Constrained Optimization (KKT)
    a. 12.6: The Karush-Kuhn-Tucker (KKT) Conditions for Constrained Optimization.
    b. 12.7 Quadratic Programming.
    c. 12.8 Separable Programming.
    d. 12.9: Convex Programming.
    e. 12.10: Nonconvex Programming (with Spreadsheets).
6. Dynamic Programming
    a. 10.1: A Prototype Example for Dynamic Programming.
    b. 10.2: Characteristics of Dynamic Programming Problems.
    c. 10.3: Deterministic Dynamic Programming.
    d. 10.4: Probabilistic Dynamic Programming.
7. Search Models