Econ 172B — Winter 2021 — Syllabus

Instructor: Miles Berg (mlberg@ucsd.edu) Course webpage: https://canvas.ucsd.edu/

Office hours: Wednesdays 3:00-4:00 pm (San Diego Time)

Lectures: MWF 2:00 – 2:50 pm (San Diego Time)

Discussions: Th 6:00 – 6:50 pm 7:00-7:50 pm

TA: Connor Redpath (credpath@ucsd.edu)

TA office hours: Tuesdays from 1:30 - 2:30 PM San Diego time

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. Before each lecture, I will post the slides on Canvas. There may be missing information on the slides; if there is, we will fill that information in during the lecture; you are encouraged to interact with me and ask questions. I will also provide you time to solve some questions on your own, before we solve them as a group.

Course Resources

This is remote learning course. We want to provide many different ways for you to access and interact with the material. The goal is for you to find what works best for you, not to overwhelm you. To keep the information clear we detail the resources below.

Video Resources

Lectures we have lectures via Zoom 3 days a week. Lectures will be recorded and uploaded to the "Media Gallery" section of Canvas. I ask and recommend you still attend the live lecture as much as possible

Discussion Sections will be hosted by the TA once a week on Zoom. The TA will go through and explain the solutions to weekly problem sets, which is excellent practice for the exam. The TA will post discussions on "Media Gallery" as well unless I learn that too few people are attending the live discussion

Exam Reviews will be held by the TA a few days before each exam. The reviews will be posted on "Media Gallery" as well.

Course Podcast Professor Newhouse has shared the podcast of his lectures from last year. You are encouraged to check them out for some additional structure. I will occasionally assign some of them as required viewing. If I do, I will say so in that week's weekly summary. *Note* although the material we go through is largely the same as Professor Newhouse's previous course, the areas of focus may end up a little different, and anything said in the podcast to do with assessment (exams grades etc.) is not relevant to this course.

https://podcast.ucsd.edu/watch/wi20/econ172b_a00

Written Resources

Course Notes which we go through in lecture are available in the "Course Resources" section of Canvas. Some notes and details are left out of the course notes. You will need to reference the lecture videos to fill in any blanks.

Problem Sets and solutions are posted under "Course Resources" each week. You do not hand in the problem sets, but they are excellent practice for the final exam

Piazza For all questions to do with the course, about the material, questions on exams or problem sets, questions about exam logistics or any other component to the course, you

are encouraged to post those questions on Piazza. This will allow you and your peers to view the answer to important questions that other students have asked. You can join the discussion at the following address: piazza.com/ucsd/winter2021/econ172b

Previous Exams select previous exams will be added to the Modules section. They will provide excellent practice for the exams we will have in this course. I highly suggest you try to go through some of them before each exam. I will post solutions to some of the previous exams as well.

Weekly Summary After each lecture I will post or update the summary of the material covered up to that point. This will provide you with an easy reference to keep track of where we are in the course.

Course Assessment

Grades are based on completing a weekly checklist (5%), a week two use of technology quiz (2%) and exams (93%).

Checklists should be submitted by Friday evening (midnight San Diego time) and are graded on completion. The lowest 2 scores for checklists will be dropped. The technology quiz is there to help you get acquainted with the lockdown browser which you will use to take the exam.

There will be four 50 minute exams this quarter, each one will count equally. We will conduct a time zone survey to see what times would work for the first 3 exams; the fourth will be scheduled during the official final exam period. Your lowest grade will be dropped. We do this as a way of accommodating you if you have some obligation or unforeseen circumstance that causes you to miss or perform poorly on an exam. It is best for you to plan to take all 4 exams. All exam times will be final and you will not have the opportunity to make up an exam that you missed.

The exam dates will be Friday Jan 22nd, Feb 12th and Feb 26th, and Monday March 15th (during the final exam period). Exams will be 40 minutes long with 10 extra minutes given for uploading your exam. The first 3 exams will be available in rolling window from 1:00pm-5:00pm

PST, and the fourth in a rolling window from 2:00-6:00pm PST. Your exam should be submitted by the end of the rolling window, so do not start your exam after 4:10 pm for the first 3, or after 5:10pm for the 4th. You are allowed to bring one A4 piece of paper with hand written notes on it to the exam (you may write on front and back). You should show that note paper to your webcam, displaying both the front and back, before you start the exam. No other materials except for blank paper and writing equipment is allowed.

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.

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/Respondus Monitor 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 via Gradescope during the weeklong regrade period. The regrade period will probably begin a day or two 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. You must write a complete and formal statement about exactly why you believe your answer is

not flawed, and what gradescope category you believe it should be placed in. If your TA agrees with your request, your score for that question will be corrected. If your TA disagrees with your request, you will not be penalized. However, I will review all rejected requests. If I decide request had little justification or if the student did not do proper work to explain the request, then you will lose 1 point for each 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