



## INFO 3440: Optimization Modeling

<p><b>Term and Credits:</b> Winter 2020 4 Credit Hours</p>	<p><b>Time and Location:</b> Section 1 CRN 2827 DCB 130, TR, 8-9:50 AM Final Time: Tue Mar 17 8:00a-9:50am Section 2 CRN 2587 DCB 130, TR, 10-11:50 AM Final Time: Tue Mar 17 10:00a-11:50am You will be required to review some material outside of class which will be delivered through Canvas. Make sure you have a good internet connection during class for access to Canvas.</p>
<p><b>Instructor:</b> Name: Kellie Keeling Department: Business Information &amp; Analytics Office Location: DCB 590 Office Hours: T/Th 1:00p-2:30p Virtual Office: <a href="https://udenver.zoom.us/my/kelliekeeling">https://udenver.zoom.us/my/kelliekeeling</a> If you cannot make it to office hours due to scheduling conflicts, I will happily meet you remotely over Zoom. You can get this app for free as a DU student: <a href="https://udenver.zoom.us/">https://udenver.zoom.us/</a>  Email: <a href="mailto:kkeeling@du.edu">kkeeling@du.edu</a> Office Phone: 303-871-2296 (forwards to my cell)</p>	<p><b>Communication Conduct:</b> Feel free to refer to me as Dr. Keeling, Professor, or Kellie as you feel comfortable. Email is usually the best way to contact me. If I haven't responded in 36 hours, feel free to resend your message. I will send class level communications via Canvas announcements. I will typically initiate communication with individual students directly through your DU email or through Canvas email. My open office hours times are available on the home page in Canvas under "Syllabus/Office Hours." To specifically make an appointment with me, click that link which goes to <a href="http://doodle.com/kkeeling">http://doodle.com/kkeeling</a> which will allow you to request an appointment time. If there is an open time, you can also just stop by.</p>

### COURSE DESCRIPTION

This course introduces concepts and techniques for the modeling and solution of business decision problems. It gives broad coverage to the formulation of optimization models and the use of commercially available software tools for solving them. These models include topics such as linear programming, integer programming, the transportation and assignment problems, network optimization models and nonlinear programming. Emphasis is placed on the process of analyzing business scenarios, formulating models in spreadsheet software, and interpreting model output.

### COURSE RATIONALE/GOAL

This course teaches how mathematical and optimization modeling can be used to drive business decisions. The critical thinking and analysis skills developed in this class are highly sought after in industry and have widespread applicability across domains.

### LEARNING OUTCOMES

By the end of this course, students will:

- Identify problems appropriate for optimization
- Understand the challenges with solution techniques with optimization problems
- Learn to convert written descriptions into optimization problems
- Learn to solve optimization problems using open source software

### PREREQUISITE:

INFO 2020



**REQUIRED MATERIAL**

**Software:** Instructions for free installation will be posted in Canvas

- Microsoft Excel with the Data Analysis and Solver Toolkits
- Anaconda Installation of Python 3
- GNU Linear Programming Kit (GLPK)

**Textbook:** Optimization Modeling with Spreadsheets, 3<sup>rd</sup> Edition, Kenneth R. Baker. ISBN: 978-1-118-93769-3

**Top Hat:** Polling Software (~\$30) – look for email inviting you to course

**GRADING STRUCTURE AND SCALE:**

A: 93-100%; A-: 90-92.9%; B+: 87-89.9%, B: 83-86.9%; B-: 80-82.9%; etc.

Requirement	Amount
Homework	20%
Preparation/Participation	10%
In Class Quizzes	10%
Project	20%
Exam 1	20%
Exam 2	20%
<b>Total</b>	<b>100%</b>

**ASSESSMENTS:**

You may talk with others and get advice about the approaches to solve the problems, but **DO NOT SHARE COMPUTER FILES** – this work should be completed on your own. If I feel you turn in work that is not your own, I will turn you in to the DU Honor Code reporting system. See policy information here:

<http://www.du.edu/studentlife/studentconduct/index.html>. If you have a question about what it means to cheat in this class, contact the instructor before you turn in questionable content. As a rule of thumb, if you did not do the analysis and writing yourself, you should not turn it in; this is considered plagiarism under the University’s honor code.

**Exams:** There are two in-class exams. Students will need a personal computer with Solver and Python/Pyomo and will be allowed to reference any notes, programs, or other online or offline materials, except another person. In the event a student has an excused absence which conflicts with a scheduled exam, the student may complete the exam in office hours one week prior to or up to one week after the scheduled date. **It is the students’ responsibility to prove the absence is excused and to schedule the alternate time.**

**Course Project:** Information will be distributed through Canvas after the half-way point in the class. **Late work will be accepted with a penalty of 15pts a day.**

**Preparation/Participation:**

- **Participation** – Throughout the quarter there will be a number of surveys, video exercises and other “soft” assignments that will not be graded by the instructor. For such assignments, you will receive full credit for on-time completion. **No Late Assignments Accepted.**
- **Top Hat** – must be in class to get credit and complete web-based quiz questions during class.
  - **No Late Assignments Accepted.** For an Excused Absence (university activity, job interview, illness; max of 2) to miss class, you can complete this outside of class. You must formally request approval from the Canvas class home page. The missed assignment is due during the next class.
- **Pre Class Reading/Lecture Quizzes:** There will be quizzes to be completed before each class (except the first class where the quiz can be completed after the lecture) that will cover the reading material and any video lectures. **No late submissions will be accepted.**



- **In-Class Assignment:** Short problems will be assigned for each lesson. These can be completed in groups or individually. You will submit your progress on the problem at the end of class EVEN IF YOU ARE NOT FINISHED. Once you submit your version, you will be able to see my solution to the assignment. You can then continue to work on the problems and grade your work. Your score for this will be based on effort put in during class rather than actual correctness, so make sure to self-grade your work for your own understanding as you move through the material.
  - **No Late Assignments Accepted.** For an Excused Absence (university activity, job interview, illness; max of 2) to miss class, you can complete this outside of class. You must formally request approval from the Canvas class home page. The assignment is due during the next class.

**Homework:** There will be 5 graded homework assignments given during the course which must be turned in via Canvas by the allotted due date. **No late work will be accepted and there will be no exceptions to this policy unless pre-coordinated with the instructor before the due date.**

**In-Class Quizzes:** Quizzes are meant to provide concept review and exam prep with relatively low risk (small effect on overall grade). These are in-class assignments that will take anywhere from 30-50 minutes depending on the topic. You will receive 50% credit simply for being present, the remainder will reflect your actual quiz performance. **If you miss class on these days you will receive a zero unless you have pre-arranged to make it up with the instructor.** In the event a student has an excused absence which conflicts with a scheduled exam, the student may complete the exam in office hours one week prior to or up to one week after the scheduled date.

## COURSE POLICIES

**Classroom Seating:** Please try to sit in the same seat regularly so I can memorize your name quickly.

**Technology Use in the Classroom:** Technology use in the classroom is strictly limited to that for educational purposes. Be respectful to those around that might be distracted by your extraneous use of technology.

**Attendance Policy:** I will take "attendance" by way of the Top Hat polling questions. If you need to miss class, you should meet with a classmate to see what you might have missed.

**Class Preparation and Participation Policies:** Optimization is a "hands on" activity. We will be putting what you read and watch before class as well as the lecture during class to use during class time, so you need to be prepared to "dig in and work" during class. That means having your equipment ready (computer and software) and being prepared to practice the materials for the day by having read/watched the material beforehand. This includes doing assigned readings, homework or other activities before class starts.

### Deliverables:

- Late work will not be accepted unless arranged ahead of time with the instructor by requesting an excused absence or for the Course project deliverables which have a 15pt a day late policy.
- All work must submitted on Canvas. You might want to start early just in case you have computer issues. It's up to you to double check that your submission was correctly registered by the system.
- You are required to show all work for HW, Quizzes and Exams. If you do not show your work for a given problem, you might receive zero credit for that problem. **As the student, it is your responsibility to clearly communicate your results and how answers were obtained.**
- **Extra Credit.** The syllabus reflects a fair and accurate assessment of your skills in the class. Under no circumstances will you be given the option to complete extra credit to make up for missing assignments and/or to raise your grade.

## UNIVERSITY EXPECTATIONS, POLICIES, AND RESOURCES:

**Students with Disabilities.** A student who qualifies for academic accommodations because of a disability must submit a Faculty Letter to the instructor from the DU Disability Services Program (DSP) in a timely manner, so that the needs of the student can be addressed. Accommodations will not be provided retroactively, e.g., following an exam or after the due date of a project. DSP determines eligibility for accommodations based on documented disabilities. DSP is located in Ruffatto Hall, 1999 E. Evans Ave. (303-871-2278).



**University Expectations.** Please review the University Expectations on the Daniels College of Business syllabus webpage (<http://daniels.du.edu/university-expectations/>)

- University of Denver Honor Code
- Policy Concerning Official Communication
- Students with Disabilities
- Policy Concerning Religious Accommodations
- Policy Concerning Emergency Procedures
- Policy Concerning Conflicts of Interest, Including Gifts from Students

### CLASS SCHEDULE

The schedule below is tentative and subject to change. Please check Canvas regularly to look for announcements and modified due dates.

Week	Dates	Topics	Reading	Due
1	Jan 7 Jan 9	Course Introduction / Intro to Optimization and LP Allocation, Covering, Blending Problems	OM Ch. 1 OM Ch. 2	Sun DC M1
2	Jan 14 Jan 16	Network Models Network Models	OM Ch. 3 OM Ch. 3	Quiz 1 Sun DC M2
3	Jan 21 Jan 23	Parameter Analysis Integer Programming (IP) Models	OM Ch. 4 OM Ch. 6	HW 1 Quiz 2 Sun DC M3
4	Jan 28 Jan 30	Integer Programming (IP) Models Exam 1	OM Ch. 6	HW 2 Exam 1 Sun DC M4
5	Feb 4 Feb 6	Optimization Modeling in Python Optimization Modeling in Python		
6	Feb 11 Feb 13	IP Logical Constraints IP Logical Constraints / Nonlinear Models (online lecture)	OM Ch. 7 OM Ch. 7	HW 3 Quiz 3
7	Feb 18 Feb 20	Nonlinear Models Nonlinear Models/Evolutionary Algorithms	OM Ch. 8 OM Ch. 9	
8	Feb 25 Feb 27	Optimization Modeling in Python Exam 2		HW 4 Exam 2 Project Proposal
9	Mar 3 Mar 5	Optimization Modeling in Python Optimization Modeling in Python		Quiz 4
10	Mar 10 Mar 12	Optimization Modeling in Python Optimization Modeling in Python		Quiz 5 & HW 5
Final	Mar 17	In-class coding session (no exam)		Coding Project