COURSE INFORMATION

Course title:	Optimal Decision Making I		
Course code:	BAMS 506	Credits:	1.5
Session, term, period:	2019W1, Period 1	Class location:	Henry Angus 337
Section(s):	BA1	Class times:	M/W 10am – 12 pm
Course duration:	Sept 3 – Oct 12, 2019	Pre-requisites:	n/a
Division:	Operations and Logistics	Co-requisites:	n/a
Program:	MBAN		
Course website:	https://canvas.ubc.ca		
Makeup class:	There is no class on Monday, Sept 2. Instead, there will be a make-up class on Friday, Sept 6, 10am-12pm, HA 337		

INSTRUCTOR INFORMATION

Instructor:	Steven Shechter		
Phone:	604-822-8340	Office location:	Henry Angus 477
Email:	steven.shechter@sauder.ubc.ca	Office hours:	By appointment

Teaching assistant:	Hossein Piri and Forough Pourhossein
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COURSE DESCRIPTION

Optimization problems arise whenever one seeks to use limited available resources in the best possible way to maximize profits, to minimize costs or, more generally, to find a "best" solution to a complex problem. Optimization applies to many functional fields of management (e.g., logistics and operations management, health care, marketing, accounting and finance), to several disciplines in science (e.g., computer science, mathematics, physics and biology), and to most fields in engineering.

This course will present the basic models and methods in Continuous Optimization, also known as Linear and Nonlinear Programming. Applications to functional areas of business and related fields will be introduced in class and in homework assignments, and solved using computer software.

COURSE FORMAT

The course will consist of lectures and in-class exercises completed using students' own laptops.

LEARNING OBJECTIVES

- To introduce students to the basic concepts and models of continuous optimization.
- To enable students to develop and use continuous optimization models arising in business applications.

By the end of the course, students will be able to:

- Formulate an optimization model, solve it using appropriate tools, interpret the results, and derive managerial insights relevant to the intended application.
- Understand the principles behind, and properties of, solutions to linear and nonlinear programs.
- Understand the role of convexity in nonlinear optimization.
- Solve optimization problems using Python and Gurobi, as well as Excel Solver.

ASSESSMENTS

Summary

Component	Weight
Three Assignments (20% each)	60%
Final exam	30%
Class participation/Professionalism	10%
Total	100%

Details of Assessments

Assignments:

There will be 3 homework sets assigned during this course. Homework will be performed by teams consisting of three students each (it's possible there will be one or two teams of 4 each, depending on class size). You will be *randomly assigned* to groups for each homework set. You should not work with other students (besides your team partner) or obtain outside help on assignments.

I realize that random matchings of students for assignments may create some discomfort for some people. However, I truly believe there is important real-world value with this approach. Most of us do not end up with professional colleagues of our choosing, and so this is meant to simulate the need to successfully complete various jobs with random co-workers.

Unless otherwise noted, each optimization problem that needs to be solved in an assignment should be done so within a Jupyter notebook, using Python and Gurobi as the optimization software. Your notebooks should be well-documented (e.g., clear labeling of variables, markdown text and comments clarifying steps of the code), so that someone who has not developed the model can easily understand it and replicate your results and findings.

When presenting an optimization model, make sure all variables, constraints and objective(s) are clearly defined in words before being used. Then include an algebraic formulation of the optimization model before you solve it. Use natural language when describing solutions (for example: "Produce 300 chairs", instead of "C = 300"). Provide managerial insights, not just numerical solutions. You may use tables or other visualizations if you think that would improve the presentation and discussion of your results.

Final Exam:

There will be a three-hour exam in the examination week. This will be a computer-based exam, run on your own laptops. More information will be provided after the course begins.

Participation/Professionalism:

This is based on both constructive class participation, as well as common courtesy (e.g., being on time to class, not using cell phone, etc.; see RHL Polices below). Students should bring their laptops to each class for in-class activities. Note, however, that the default policy for class will still be "lids down," and laptops should only be opened up when we are working on in-class activities.

LEARNING MATERIALS

Requirements:

- Familiarity with linear algebra and calculus.
- A basic understanding of computer programming principles.
- The lectures will be self-contained and no textbook is required for this course. Copies of the slides used in class will be available on the course website. You should supplement them with your own notes taken during the lectures.

Suggested Reading Materials:

- Hillier, Frederick S. and Lieberman, Gerald J. (2014). Introduction to Operations Research, 10th Edition. McGraw Hill.
    - Relevant sections in the 10th edition are indicated in the Course Schedule below (marked with "HL" in the readings column).
    - While this text is not required, I believe that anyone pursuing a career in Operations Research or Prescriptive Analytics would benefit by having this on their bookshelf, but it is not required for this course.

Technology Requirements:

- Please bring a laptop that you can run Windows on to each class. If you own an Apple laptop, you are responsible for configuring Windows on your Mac. A free copy of Microsoft Windows 10 Education is available for all eligible active UBC Students here: https://it.ubc.ca/services/desktop-print-services/software-licensing/windows-10-education
- Excel Solver, the optimization tool embedded in Excel spreadsheets. For students using a Mac computer, Excel Solver will run better when accessing Excel through the Windows environment. The Mac version has been buggy in the past (and might still be).
- Python and Gurobi (see installation notes on the course website).

COURSE-SPECIFIC POLICIES AND RESOURCES

Missed or late assignments, and regrading of assessments

Late submissions will not be accepted and will receive a grade of zero.

Academic Concessions

If extenuating circumstances arise, please contact the RHL Graduate School program office as early as reasonably possible, and submit an Academic Concession Request & Declaration Form https://webforms.sauder.ubc.ca/academic-concession-rhlee. If an academic concession is granted during the course, the student will be provided options by RHL, or by the instructor in consultation with RHL, per UBC's policy on Academic Concession.

POLICIES APPLICABLE TO COURSES IN THE ROBERT H. LEE GRADUATE SCHOOL

Attendance

Excepting extenuating circumstances, students are expected to attend 100% of their scheduled class hours. Absent students limit their own academic potential, and that of their classmates, and cause unnecessary disruption to the learning environment. Students missing more than 20% of the total scheduled class hours for a course (including classes held during the add/drop period) without having received an academic concession will be withdrawn from that course. Withdrawals, depending on timing, could result in a "W" or an "F" standing on the transcript.

Punctuality

Students are expected to arrive for classes and activities on time and fully prepared to engage. Late arrivals may be refused entry at the discretion of the instructor or activity lead. Students arriving later than halfway through a scheduled class will be treated as absent for that class.

Electronic Devices

Devices such as laptops, tablets, and cell phones are not permitted to be used in class unless directed by the instructor for in-class activities. Students who do not follow the School's policy in this regard may be required to leave the room for the remainder of the class, so that they do not distract others. Research shows that students' use of laptops in class has negative implications for the learning environment, including reducing their own grades and the grades of those sitting around them.

Citation Style

Please use the American Psychological Association (APA) reference style to cite your sources.

Details of the above policies and other RHL Policies are available at:
http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,199,506,1625

UNIVERSITY POLICIES AND RESOURCES

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the UBC Senate website at https://senate.ubc.ca/policies-resources-support-student-success.

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences.

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All materials of this course (course handouts, lecture slides, assessments, course readings, etc.) are the intellectual property of the instructor or licensed to be used in this course by the copyright owner. Redistribution of these materials by any means without permission of the copyright holder(s) constitutes a breach of copyright and may lead to academic discipline. Audio or video recording of classes are not permitted without the prior approval of the Instructor.]

ACKNOWLEDGEMENT

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəy̓əm (Musqueam) people, who for millennia have passed on their culture, history, and traditions from one generation to the next on this site.

COURSE SCHEDULE

Class #	CLASS TOPICS	ACTIVITIES / READINGS	ASSIGNMENTS / DELIVERABLES
Week 1 (Sept 4, 6)	• Introduction to optimization and to linear optimization. • Linear programming (LP) formulations and solution properties. • LP solution methods	HL Chs.1-3, 4.1	HW 1 assigned on Sept 6 (Due: Sept 15)
Week 2 (Sept 9,11)	• Sensitivity analysis • Shadow prices and reduced costs • LP duality.	HL 4.7, 6, 7.1-7.3	
Week 3 (Sept 16, 18)	• LP "tricks" • LP under uncertainty • Stochastic programming	HL 7.6	HW 2 assigned on Sept 16 (Due: Sept 25)
Week 4 (Sept 23, 25)	• Introduction to nonlinear programming (NLP) • Unconstrained optimization vs. constrained optimization • Convexity	HL 13.1-13.5	HW 3 assigned on Sept 26 (Due: Oct 4)
Week 5 (Sept 30, Oct 2)	• NLP solution methods • Introduction to metaheuristics	HL 13.6-13.8, 13.10	
Week 6 (Oct 7-12)	Final Exam		To be scheduled by the RHL Office