COURSE INFORMATION

Course title:	Optimal Decision Making II		
Course code:	BAMS 508	Credits:	1.5
Session, term, period:	2020W1, Period 2	Class location:	Zoom
Section(s):	BA1	Class times:	Mon/Weds 8 pm – 10 pm
Course duration:	Jan 4 – Feb 14, 2021	Pre-requisites:	BAMS 506
Division:	Operations and Logistics	Co-requisites:	N/A
Program:	MBAN		

Course website: https://canvas.ubc.ca

INSTRUCTOR INFORMATION

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

Teaching assistant: Forough Pourhossein
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COURSE DESCRIPTION

Optimization problems arise whenever one seeks to use activities in the best possible way, to maximize profits, to minimize costs, or more generally to find a "best" solution to a complex problem. Discrete Optimization models are those optimization models that involve a discrete structure, such as when activity levels are restricted to integer values, when modeling complex logical relationships using binary logic, or when optimizing over a graph or network. Discrete optimization applies to many functional fields of management, such as production and operations, supply chain, transportation and logistics, project planning, health care, marketing, as well as capital budgeting and investment planning involving discrete activities. It also applies to several disciplines in science, such as computer science, mathematics, physics and biology, and to many fields in engineering.

The course will present fundamental models and methods in discrete optimization. The emphasis will be placed on useful modeling methodologies and their application in some of the areas mentioned above. The course will present guidelines for choosing among alternate formulations, as well as among alternate solution approaches.

COURSE FORMAT

The course will consist of lectures, exposing the relevant material, in-class discussions, in-class hands-on work, out-of-class discussions on Piazza, and out-of-class practice problems.

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 after the lecture. You should supplement the slides with your own notes taken during the lectures.

LEARNING OBJECTIVES

Purpose/rationale for the course:

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

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

1. Formulate a discrete optimization model for a decision problem, solve it using appropriate tools, interpret the results, and derive managerial insights relevant to the intended application.
2. Compare alternate formulations and choose one that is most appropriate for a given situation.
3. Understand the main solution approaches used in practice, and appreciate their strengths and weaknesses in view of their practical applications.
4. Solve optimization problems using Excel Solver and OpenSolver.

ASSESSMENTS

Summary

Component	Weight
Four quizzes (15% each, drop worst one)	45%
Final group project:	40%
20% Report	
20% Optimization Models	
Participation/Professionalism	15%
Total	100%

Details of Assessments

Quizzes:

There will be four quizzes on Canvas, one in each of weeks 2-5 (no quiz in week one). The quizzes will be released Saturday, 12:01 AM Vancouver time and close on Sunday, 11:59 PM Vancouver time. You have that entire time to complete the quiz. Canvas auto-saves your work, so you can leave and re-enter a quiz until you actually click "Submit." I have decided to give you as much time as you need to complete the quizzes for the full two days it is released because many of you noted that some questions were unclear in quizzes from BAMS 506, and one hour did not allow you to time to clarify any confusion. Now you have that opportunity by reaching out to both me and the course TA (though if you are asking questions Sunday evening, the probability of us responding in time goes down!). With this extended time, it is important to maintain the highest standards of academic honesty and not discuss *anything* (including asking for clarifications) about the quiz *with each other* during the two days the quiz is released.

The quizzes will be based on material covered in class through that week (and may include material from previous weeks). The lowest of your four quiz marks will be dropped, with 15% of the course weight given to each of the remaining three (for a total weight of 45% on the three quizzes that are counted).

Participation/Professionalism:

There are a number of ways to actively participate in the course. These include: asking and answering questions during lecture by voice and/or chat, sharing thoughts/ideas/news stories/etc. that promote peer-to-peer learning via the Piazza discussion forum, participating in office hours, contributing to practice problems (e.g., by solving them and/or proposing new ones), and others.
The professionalism component includes being on time to class, appearing on video, avoiding distractions (e.g., cell phone usage), and treating others with respect. More aspects of professionalism are covered below in the "Robert H. Lee Graduate School" and "University" policies section

Final Project:

See end of this document for details

LEARNING MATERIALS

Technology requirements:

- Excel Solver, the optimization tool embedded in Excel spreadsheets.
- OpenSolver add-in for Excel, available here: https://opensolver.org/
- For students using a Mac, Solver in Excel for Mac is not reliable! You will need to run Excel/Solver through a Windows environment. 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. Also, Apple provides instructions on how to install Windows 10 here: https://support.apple.com/en-ca/HT201468. If you have any technical difficulties with this process, please contact: michael.berdan@ubc.ca

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).

COURSE-SPECIFIC POLICIES AND RESOURCES

Prerequisites

This course builds on the foundation established in BAMS 506, so a good understanding of that material is necessary for doing well in BAMS 508.

Missed or late assignments

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.

Other Course Policies and Resources

Code Plagiarism

Code plagiarism falls under the UBC policy for Academic Misconduct. Students must correctly cite any code that has been authored by someone else or by the student themselves for other assignments. Cases of "reuse" may include, but are not limited to:

- the reproduction (copying and pasting) of code with none or minimal reformatting (e.g., changing the name of the variables)
- the translation of an algorithm or a script from a language to another
- the generation of code by automatic code-generations software

An “adequate acknowledgement” requires a detailed identification of the (parts of the) code reused and a full citation of the original source code that has been reused.
Students are responsible for ensuring that any work submitted does not constitute plagiarism. Students who are in any doubt as to what constitutes plagiarism should consult their instructor before handing in any assignments.

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

During online lectures, students are not permitted to use any electronic devices other than the primary one used for attending the online lecture (e.g. laptop or desktop). Only Zoom should be open during the online lecture unless an instructor advises the use of another program/website for an in-class activity. Feedback from students indicates that personal devices are the number one distraction from effective learning and participation in the online learning environment.

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.

Respect for Equity, Diversity, and Inclusion

The UBC Sauder School of Business strives to promote an intellectual community that is enhanced by diversity along various dimensions including status as a First Nation, Metis, Inuit, or Indigenous person, race, ethnicity, gender identity, sexual orientation, religion, political beliefs, social class, and/or disability. It is critical that students from diverse backgrounds and perspectives be valued in and well-served by their courses. Furthermore, the diversity that students bring to the classroom should be viewed as a resource, benefit, and source of strength for your learning experience. It is expected that all students and members of our community conduct themselves with empathy and respect for others.

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.

COPYRIGHT

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 and could be subject to legal action. Any lecture recordings are for the sole use of the instructor and students enrolled in the class. In no case may the lecture recording or part of the recording be used by students for any other purpose, either personal or commercial. Further, audio or video recording of classes are not permitted without the prior consent of the instructor. Students may not share class Zoom links or invite others who are not registered to view sessions.

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.

ONLINE TEACHING TOOL & REQUIREMENTS

This course will be taught using Zoom for synchronous classes and office hours.

For this course, you are required to use a Zoom account during synchronous classes and office hours. If you do not have a Zoom account, you can create one here: https://zoom.us/signup. Note: creating a Zoom account requires that you provide a first name, last name, and email address to Zoom. For privacy purposes, you may consent to using your existing email address and your real name. Alternatively, if you prefer, you may sign up using an alternative email address and an anonymized name that does not identify you (i.e. Jane Doe, jane.doe@email.com). If you have trouble creating an account, or accessing a Zoom session, please contact CLCHelp@sauder.ubc.ca. You will be required to provide the email address associated with your Zoom account in a Canvas quiz for identification purposes.

To help replicate the classroom experience, make sessions more dynamic and hold each person accountable, both students and instructors are required to have their cameras on during Zoom sessions. Students who require an accommodation with regard to the "camera on" requirement must contact their instructors in advance of the first class to discuss options. As professional graduate students, students are expected to conduct themselves professionally by joining sessions on time, muting mics when not speaking, refraining from using any other technology when in-session, attending in business casual dress (at a minimum), and participating from a quiet environment. Content from synchronous sessions will be selectively recorded per instructor discretion and made available to students on Canvas for a maximum duration of the course length. This is done to allow students the opportunity to return to lecture content to solidify learnings.

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COURSE SCHEDULE

(Subject to change with class consultation)

Week	Date	Topic	Readings or Activities	Assessments due
1	Jan 4, 6	• Introduction to Discrete Optimization • Introduction to Computational Complexity • Network optimization: Transportation and Assignment problems	HL 9.1, 9.3	
2	Jan 11, 13	• Network optimization: Trees and Paths Min Cost Network Flows	HL 10.1-10.6, 10.8	Project Proposal due: Jan 15, 11:59 PM Quiz 1
3	Jan 18, 20	• Integer programming (IP) formulations • IP "tricks" • Covering, Packing, and Partitioning	HL 12.1-12.5	Quiz 2
4	Jan 25, 27	• Case study: Pediatrician Scheduling at BC Women's Hospital	BCWH Case Study	Quiz 3
5	Feb 1, 3	• IP solution methods ○ Branch-and-Bound ○ Cutting planes ○ Heuristics	HL 12.5-12.8 Ch. 14	Quiz 4
6		Final Project deliverables		Due: Feb 13, 11:59 PM

PROJECT DETAILS

Overview

The purpose of the course project is to gain optimization modeling, analysis, and report-writing experience. Groups of 3-4 students should propose an optimization project that interests them and that I approve after reviewing the proposal. You may form your own groups, or let me know if you need help finding a group.

The project may be something that groups come up with on their own, or based on a case study that requires optimization modeling, and which does not have a publicly available solution. One source of such case studies is the journal: INFORMS Transactions on Education. You can access this via the UBC Library here: https://pubsonline-informs-org.ezproxy.library.ubc.ca/journal/ited

Examples of past projects include:

- Staffing optimization at a clothing store
- Beer production optimization
- Assigning pharmaceutical sales representatives to different regions
- Airline revenue management

Note: Most projects require more decision variables and constraints than Excel Solver can handle, requiring the use of OpenSolver instead.

Deliverables and Deadlines

Project component	Due
Proposal	Jan 15 (11:59 PM)
Final report and Excel Models	Feb 13 (11:59 PM)

Proposal

In at most 2 pages (single-spaced), provide a brief background of your project topic and the questions you plan to investigate. I will give you feedback on your proposal within 48 hours of your submitting it (you can submit it prior to Jan 15).

Final report

Your report should be a very clear, well-written Word document that includes the following sections:

1. A one-page Executive Summary
2. Introduction
3. Model formulations
4. Model results
5. Discussion/Conclusion

If you are doing a case study, your report should also include solutions and discussions to any questions specifically asked in the case. These may be incorporated into your write-up of parts 3-5. Note that this does not mean that the questions asked in the case are the *only* aspects of the case to evaluate, discuss,

and comment on. There may be other analyses you want to include to provide overall managerial insights and recommendations.

When writing up your reports, consider two perspectives: 1) a student showing me you know the technical details of what is going on, and 2) a consultant explaining to management what is going on. With regard to the latter, be sure you don't just provide numerical results, but explain things clearly and concisely. Provide insight and justify your recommendations.

The average length of the document (before any appendices) should be approximately 10-15 pages single-spaced.

Optimization models

Optimization models should be developed and solved in Excel, using either regular Solver or OpenSolver (depending on your problem size, you may need the latter). Besides being logically correct and clean (i.e., if there are many ways to go about the same thing, you chose a simpler approach), your model should be easy to read and understand. A good question to ask yourself is "can someone else looking at my Excel model understand what it is doing and how it works, without me being there to explain it and answer any questions?" If you find it easier, you may include a "readme.doc" with your submission which explains aspects of your Excel model.

Marking of Final Projects

Projects will be marked on a "CheckPlus/Check/CheckMinus" scale. These will then be converted into a number. Usually, a "Check" means an "average" solution and will receive approximately 80%. CheckPlus will receive more than this (typically 85%) and CheckMinus will receive less (typically 75%). The category assigned will depend on the quality of the solutions, where quality involves a combination of good modeling and derivation of results, as well as good presentation and discussion of the solution. The modal mark will generally be a "Check." CheckPlus/Check/CheckMinus marks need not always map exactly to 85%/80%/75% marks. Some differences in quality may be accommodated by assigning different percentage marks. For example, while most CheckMinus solutions may receive 75%, a really poor job may receive a lower mark. Also, while most CheckPlus solutions may receive 85%, an especially outstanding solution may receive a higher mark.

In general, a "CheckPlus" means that the report was thorough and thoughtful, the model development was entirely (or nearly entirely) correct, and that recommendations were clearly justified. "Check" means that the solution was satisfactory but with room for improvement, due to modeling or analysis mistakes and/or due to recommendations that were not as compelling as they could be. Finally, "CheckMinus" means that the solution was unsatisfactory with significant room for improvement. For example, model development contained several errors and/or recommendations and explanations were unclear or unsupported by the evidence.