COURSE INFORMATION

Course title:	Managerial Decision Modeling and Analytics		
Course code:	BAMS 523	Credits:	1.5
Session, term, period:	2021W1, Period 5	Class location:	Henry Angus 335
Section(s):	001	Class times:	M/W 10am – 12 pm
Course duration:	Nov 1 – Dec 11, 2021	Pre-requisites:	n/a
Division:	Operations and Logistics	Co-requisites:	n/a
Program:	MBA		
Course website:	https://canvas.ubc.ca		

INSTRUCTOR INFORMATION

Instructor:	Steven Shechter		
Phone:	604-822-8340	Office location:	HA 477
Email:	steven.shechter@sauder.ubc.ca	Office hours:	By appointment
Teaching assistant:	TBD		
Office hours:			
Email:			

COURSE DESCRIPTION

The success of many organizations, across a variety of industries, hinges on the ability to combine available data with advanced analytical techniques to improve decision-making. The term "analytics" is rather broad in its scope and spans three main categories: descriptive, predictive, and prescriptive analytics. This course primarily focuses on the last item: prescriptive analytics, which involves learning how to formulate and solve challenging decision problems, using specialized software. This course does not cover the topics of predictive analytics, such as machine learning, artificial intelligence, and regression. It assumes that any descriptive and predictive modeling has already been completed, and now an organization wants to use these analyses as inputs to prescriptive models, which seek to determine optimal, or near optimal, decisions. For example, organizations may want to know the best way to schedule their employees or the best way to manage their inventory. This course explores examples across a wide range of industries and functional areas of business.

COURSE FORMAT

The course will consist of live lectures, discussions, and in-class exercises completed using students' ownlaptops.

LEARNING OBJECTIVES

- To introduce the concepts and best practices of decision modeling.
- To understand when and how to incorporate uncertainty into decision making.

- To learn how to formulate and solve a variety of problems using the mathematical optimization methods of Linear Programming and Integer Programming. Primary software used for this will be Excel Solver.
- To learn how to formulate and solve a variety of problems using the probabilistic analysis method of Monte Carlo simulation. Primary software used for this will be Python.
- To develop skills in conveying the results of decision models to managerial audiences.

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

- Recognize different problems types and be able to formulate an appropriate decision model.
- Implement decision models in Excel and Python.
- Gain insight into solutions obtained from decision models.
- Understand how changes in different inputs might affect models' outputs ("sensitivity analysis").
- Learn several examples of companies and organizations successfully applying these techniques.

ASSESSMENTS

Summary

Component	Weight
Optimization Group Assignment	30%
Simulation Group Assignment	30%
Final Exam	30%
Class participation/Professionalism	10%
Total	100%

Details of Assessments

Assignments

There will be two problem sets during this course, one on the topic of optimization and one on the topic of simulation. Homework will be performed by teams consisting of 3-4 students each. You may choose your own groups. If you would like me to place you in a group, please let me know.

Final Exam

There will be a 3-hour open-note exam on Canvas in the examination week. More information will be provided after the course begins.

Marking

Assignments are marked on a "CheckPlus/Check/CheckMinus" scale. These will then be converted into a number. Usually, a "Check" means the work "meets expectation" and will receive approximately 80%. CheckPlus ("exceeds expectations") will receive more than this (typically 85%) and CheckMinus ("below expectations") 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 solution may receive a lower mark. Also, while most CheckPlus solutions may receive 85%, a really good solution may receive a higher mark.

In general, a "CheckPlus" means that the solution was very thorough and thoughtful, the model development was entirely (or nearly entirely) correct, and that recommendations were clearly justified. "Check" means that the solution was good but with room for improvement, due to a small number of modeling or analysis mistakes and/or due to recommendations that could be justified better. "CheckMinus" means that the solution had significant room for improvement. For example, model development contained several errors and/or recommendations and explanations were unclear or unsupported by the evidence.

My default policy is that each person in a group gets the same grade. If there are any issues with group dynamics, try your best to work it out among yourselves. If problems persist, then speak to me about them.

PARTICIPATION/PROFESSIONALISM:

There are a number of ways to actively participate in the course. These include: asking and answering questions during lecture, sharing thoughts/ideas/news stories/etc. that promote peer-to-peer learning in class and/or via the Piazza discussion forum, contributing to practice problems (e.g., by solving them and/or proposing new ones).

The professionalism component includes being on time to class, 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 sections.

LEARNING MATERIALS

Requirements:

- 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.

Suggested Reading Materials:

There are several good textbooks on decision modeling. Two examples are:

- *Managerial Decision Modeling with Spreadsheets*, second Canadian edition, by Render, Stair, Balakrishnan, Smith
- *Management Science: The Art of Modeling with Spreadsheets*, by Powell and Baker.
  - Note: this book is also available online, via the UBC library:

http://gw2jh3xr2c.search.serialssolutions.com/?sid=sersol&SS_jc=TC0001980413&title=Management%20science%20%3A%20the%20art%20of%20modeling%20with%20spreadsheets

The Render et al. book is particularly illustrative of real-world applications of various analytical models and obviously has greater breadth and depth of coverage than we can cover in 5 weeks. That being said, you can do well in the course without purchasing a book, and you will be introduced to numerous applications throughout.

Technology Requirements:

- For Monte Carlo simulation, we will use Python, run through Jupyter notebooks. If you want to create a notebook and run Python without having to download/install anything, then you can use the UBC Jupyter hosting service available here: https://ubc.syzygy.ca/ (click on "Sign-In" in the upper right corner; don't click on the Jupyter icon that shows up—that just takes you to the Jupyter webpage). Alternatively, if you want to run Jupyter and Python from your own machine, you can obtain them by first installing Anaconda, a data-science platform: https://www.anaconda.com/products/individual. After installation is complete, you should be able to run Jupyter by typing "jupyter" in the command line (without the quotation marks). If you have any problems with this approach, please let me know.
- For optimization (Linear and Integer Programming), we will be using Solver, a free Excel add-in that comes with Excel (you all already have it as an add-in available within Excel). For students using a Mac, Excel Solver has been buggy at times in the past (especially for integer programming). It is best 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

COURSE-SPECIFIC POLICIES AND RESOURCES

Prerequisites

This is a quantitative course. Students should have a basic familiarity with statistics and probability. I also assume that you all have taken BA 515 with Professor Gene Lee, which introduces MBA students to Python. However, if you have not taken this, then you can go through the below two Python modules to familiarize yourself with some Python basics. These are the same modules completed by MBA students who took BA 515.
https://learn.datacamp.com/courses/intro-to-python-for-data-science
https://learn.datacamp.com/courses/intermediate-python-for-data-science

Missed or late assignments, and regrading of assessments

Late submissions will not be accepted and will receive a grade of zero (this is standard for RHL courses). If you disagree with how something was marked, e-mail me within 48 hours of receiving your feedback, clearly indicating why you think the mark should be different.

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 withRHL, per UBC's policy on Academic Concession.

Code Plagiarism

Code plagiarism falls under the UBC policy for Academic Misconduct. Students must correctly cite anycode 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 minimalreformatting (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 anda 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.

COVID-19 Policies for Attendance & Academic Concessions:

If a student feels unwell, they should stay home and send a courtesy email to each impacted instructor and cc their program manager. The student should also submit an Academic Concession Request & Declaration Form.

If a student suspects possible Covid-19 infection, they should use the BC Ministry of Health's self-assessment tool, to help determine whether further assessment or testing for COVID-19 is recommended.

If a student is required to self-isolate (e.g., while waiting for test results), they should follow the steps above (stay home, email instructor(s) and program manager, submit an Academic Concession Request & Declaration Form, and follow BC Health Guidance.

Students who are required to quarantine, should get in touch with their Program Manager to discuss the possibility of academic concessions for each impacted course. The Program Manager will work closely with your instructors to explore options for you to make up the missed learning.

Covid-19 Safety in the Classroom:

Masks: Masks are **required** for all indoor classes, as per the BC Public Health Officer orders. For our in-person meetings in this class, it is important that all of us feel as comfortable as possible engaging in class activities while sharing an indoor space. For the purposes of this order, the term "masks" refers to medical and non-medical masks that cover our noses and mouths. Masks are a primary tool to make it harder for Covid-19 to find a new host. You will need to wear a medical or non-medical mask for the duration of our class meetings, for your own protection, and the safety and comfort of everyone else in the class. You may be asked to remove your mask briefly for an ID check for an exam, but otherwise, your mask should cover your nose and mouth. Please do not eat in class. If you need to drink water/coffee/tea/etc, please keep your mask on between sips. Students who need special accommodation are asked to discuss this with the program office.

Seating in class: To reduce the risk of Covid transmission, please sit in a consistent area of the classroom each day. This will minimize your contacts and will still allow for the pedagogical methods planned for this class to help your learning.

Visit the following website for the most recent updates regarding Covid-19 protocol on campus:https://students.ubc.ca/campus-life/returning-to-campus

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 laterthan 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 berequired 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.

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 survivorsof 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 othersand 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 allstudents 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 cheatingmay 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.

Academic Freedom and Students Studying from Outside Canada

During this pandemic, the shift to online learning has greatly altered teaching and studying at UBC, including changes to health and safety considerations. Keep in mind that some UBC courses might cover topics that are censored or considered illegal by non-Canadian governments. This may include, but is notlimited to, human rights, representative government, defamation, obscenity, gender or sexuality, and historical or current geopolitical controversies. If you are a student living abroad, you will be subject to the laws of your local jurisdiction, and your local authorities might limit your access to course material or take punitive action against you. UBC is strongly committed to academic freedom, but has no control over foreign authorities (please visit http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,33,86,0 for an articulation of the values of the University conveyed in the Senate Statement on Academic Freedom). Thus, we recognize that students will have legitimate reason to exercise caution in studying certain subjects. If you have concerns regarding your personal situation, consider postponing taking a course with manifest risks, until you are back on campus or reach out to your academic advisor to find substitute courses. For further information and support, please visit: http://academic.ubc.ca/support- resources/freedom-expression

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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, andtraditions from one generation to the next on this site.

COURSE SCHEDULE

Class#	CLASS TOPICS	ASSIGNMENTS / DELIVERABLES
Week 1	• Introduction to Optimization and Linear Programming	HW 1 assigned on Nov 3 (Due: Nov 19, by midnight)
Week 2	• Linear programming Sensitivity Analysis • Network optimization • Introduction to Integer Programming	
Week 3	• Integer Programming examples • Introduction to Decision Making under Uncertainty and the "Flaw of Averages"	HW2 assigned on Nov 18 (Due: Dec 3, by midnight)
Week 4	• Introduction to Monte Carlo Simulation • Monte Carlo (MC) Simulation in Excel and Python	
Week 5	• Examples of Monte Carlo simulation across several industries • Simulation optimization	
Week 6	• Exam week	Exam date/time TBD