COURSE INFORMATION

Course title:	Managerial Decision Modeling and Analytics		
Course code:	BAMS 523	Credits:	1.5
Session, term, period:	2020W1, Period 6	Class location:	Zoom
Section(s):	001	Class times:	T/Th 10am – 12 pm
Course duration:	Sept 8 – Oct 17, 2020	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:	Zoom
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Teaching assistant:	Hossein Piri		
Office hours:	TBD		
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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 mostly synchronous (live) lecture, discussion, and in-class exercises completed using students’ own laptops. There may be a small amount of asynchronous (pre-recorded) delivery.

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
Simulation Group Assignment	25%
Optimization Group Assignment	25%
Final Project	40%
- Project Write-up: 50%	
- Project Modeling Work: 50%	
Class participation/Professionalism	10%
Total	100%

Details of Assessments

Assignments:

There will be two problem sets during this course, one on the topic of simulation and one on the topic of optimization. Homework will be performed by teams consisting of 3-4 students each. You will be *randomly assigned to groups* for each of the two assignments (but you will choose your own groups for the final project).

Final Project:

For the final project, you may choose your own groups of 3-4 students each. If you would like me to place you in a group, please let me know.

The final project should involve either optimization and/or simulation modeling on a problem of your choosing. The methods introduced in this course are applicable to nearly every industry, so this is an opportunity to work on an application that truly interests you. Half of the project mark will be based on the project write-up, and half will be based on the correctness and readability of your programs (whether they are in Excel for optimization or Python for simulation). Each group should submit a short project proposal by the end of the second week of class (sooner is welcome as well). I will then provide quick feedback so we can agree on the scope and plan (while I may suggest you should consider more details or analyses, it could also be that I think your proposal is too ambitious for the timeframe of the course and I'll suggest scaling it down). More information on the project will be provided in the first week of class.

Marking

Assignments and projects 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 project 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:

This is based on a combination of attendance, constructive class participation, and common courtesy (e.g., punctuality, avoiding distractions like cell phone use, etc.; see more on this in the RHL Polices below).

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 your projects, you may find that you want to use a more powerful version of Solver for Excel, called OpenSolver (available for free download here: https://opensolver.org/installing-opensolver/). For students using a Mac, Excel Solver has been buggy at times in the past (especially for integer programming). It may be better to run Excel 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.

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.

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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 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.

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.

COURSE SCHEDULE

Class#	CLASS TOPICS	ASSIGNMENTS / DELIVERABLES
Week 1 (Sept 8,10)	• Introduction to Decision Making under Uncertainty • Monte Carlo (MC) Simulation in Excel and Python	HW 1 assigned on Sept 10 (Due: Sept 25, by midnight)
Week 2 (Sept 15, 17)	• MC Simulation in Python • MC Simulation: Examples	Project Proposals Due: Sept 20, by midnight
Week 3 (Sept 22, 24)	• MC Simulation: Examples • Introduction to Optimization	HW2 assigned on Sept 24 (Due: Oct 9, by midnight)
Week 4 (Sept 29, Oct 1)	• Optimization via Linear Programing (LP) • LP: Examples	
Week 5 (Oct 6, Oct 8)	• Network Optimization • Optimization via Integer Programming (IP) • Examples	
Week 6 (Oct 14-18)	• Exam week	Project deliverables: Due: Oct 18, by midnight