COURSE INFORMATION

Course title:	Simulation 1: Data Processing and Monte Carlo Simulation		
Course code:	BAMS 503	Credits:	1.5
Session, term, period:	2020W1, Period 4	Class location:	Zoom
Section(s):	N/A	Class times:	Tues/Thurs 2 pm – 4 pm
Course duration:	April 20 – May 20, 2021	Pre-requisites:	Stats, Probability, Calculus
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: TBD
Office hours: TBD
Email: TBD

COURSE DESCRIPTION

Simulation is a widely used methodology in both industry and academia because it is a vital tool for decision making under uncertainty. A simulation model allows the user to test a variety of "what-if" scenarios on a computer and evaluate a variety of outcomes from complex processes before considering implementing any changes to the real system. Areas of application include health care, finance, risk analysis, manufacturing, logistics, call centers, sports, and military.

This course introduces students to the foundations of Monte Carlo simulation. The course also covers how to analyze and process raw data, with the goal of creating useful inputs to a simulation model.

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

- To learn the benefits of Monte Carlo simulation through several examples
- To learn how to develop Monte Carlo simulations in Excel, Python, and R
- To learn how to analyze and process available data for use in a simulation model
- To develop critical thinking skills when making decisions under uncertainty
- To develop the ability to translating technical content into managerial insights

ASSESSMENTS

Summary

Component	Weight
Three quizzes (15% each)	45%
Final project:	40%
Participation/Professionalism	15%
Total	100%

Details of Assessments

Quizzes:

There will be three quizzes on Canvas, one in each of weeks 2-4 (no quiz in week 1 or week 5). Quizzes will be based on material covered in class through that week (and may include material from previous weeks).

Note, unlike in BAMS 506 and 508, each of the three quizzes counts (i.e., there is no longer "drop the worst 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." If any question is unclear, you may e-mail me and the TA for clarification (e-mail us both directly; do not ask via Piazza). While we will try our best to respond, the likelihood of a response is greater if asked on a Saturday than a Sunday! Given the duration available to complete the quiz, 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.

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:

- Students should have both Python and R up and running on their laptops.
- Models discussed in the course will mostly be written in Python (using Jupyter notebooks), with some models presented in both Python and R.

- I will also show some examples of interactive simulations created in Shiny with RStudio, so I recommend installing RStudio as one of your R editors and installing Shiny (I believe you mostly used Jupyter for running R in the stats classes).

Suggested Reading Materials:
An excellent simulation textbook used for graduate courses at many universities is: "Simulation Modeling and Analysis" by Law and Kelton (there are several updated editions of this, and I think the most recent editions just have the single author "Law"). This book is a good reference for both BAMS 503 and BAMS 504. The book is by no means required for the course, just a good textbook to have on your bookshelf if you see yourself doing simulation modeling in the future.

COURSE-SPECIFIC POLICIES AND RESOURCES

Prerequisites
Simulation modeling requires a solid understanding of other analytics methodologies; namely statistics and probability. It also requires comfort with coding (the coding you did already in the program with Python and R will be enough coding background for this course).

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	Assessments due
1	Apr 20, 22	• Introduction to Simulation • The "Flaw of Averages" • Example models: Project management Newsvendor problem	
2	Apr 27, 29	• Random number and random variable generation • Example models: Revenue management Warranty analysis	Quiz 1 (Released 12:01 AM, May 1; Due 11:59 PM, May 2)
3	May 4, 6	• Input modeling • Distribution fitting • Example models: Surgical scheduling Production planning	Quiz 2 (Released 12:01 AM, May 8; Due 11:59 PM, May 9)
4	May 11, 13	• Output Analysis • Comparing Multiple Systems • Variance Reduction Techniques • Example model: Contract bidding	Quiz 3 (Released 12:01 AM, May 15; Due 11:59 PM, May 16)
5	May 18, 20	• Simulation Optimization • Example model: Inventory planning	
6	May 24-29	Exam week	Final project deliverables Due: **Final project deadline TBA**

PROJECT DETAILS

Overview

The purpose of the course project is to gain simulation modeling, analysis, and report-writing experience. Groups of 3-4 students will choose among a set of project topics or case studies I provide (in week 1). You may form your own groups, or let me know if you need help finding a group.

Project Deliverables

The final deliverable can either be a Jupyter Notebook or an R Markdown file. That is, instead of submitting a final report and your code separately, I want you to integrate all of your storytelling and code/analysis in one of these two popular environments for analytics-based reporting.

This is an opportunity to hone your "storytelling with analytics" skills. In creating your report, consider two types of readers that may focus on different parts of the report: 1) a manager without a technical background who wants to understand clearly the key managerial insights and how they are supported by the analysis, and 2) an analytics professional who wants to understand the technical details and code (e.g., for the coding sections, make sure you add comments and clearly name variables, so that someone who knows Python or R can clearly understand what you did and reproduce it).

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.