COURSE INFORMATION

Course title:	Data Processing and Monte Carlo Simulation		
Course code:	BAMS 503	Credits:	1.5
Session, term, period:	2020W2 Period 4	Class location:	David Lam 337
Section(s):	BA1	Class times:	Tues. and Thurs. 10-12pm
Course duration:	Mar. 3 to Apr. 8, 2020	Pre-requisites:	Statistics, probability, calculus
Division:	Operations and Logistics	Co-requisites:	N/A
Program:	MBAN		

INSTRUCTOR INFORMATION

Instructor:	Steven Shechter		
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Email:	steven.shechter@sauder.ubc.ca	Office hours:	By appointment

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

Class time will consist of lectures, discussions and activities. Students will complete quizzes, readings, homework assignments, and the project outside of class time.

LEARNING OBJECTIVES

This course will:

1. To introduce students to the foundations of computer simulation
2. To learn the benefits of Monte Carlo simulation through several examples
3. To learn how to analyze and process available data for use in a simulation model
4. To learn how to create Excel-based Monte Carlo simulations, using the @Risk software
5. To learn how to develop Monte Carlo simulations in Python
6. To develop a student's ability to make data-driven decisions using simulation models

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

1. Explain the benefits of simulation modeling as a decision making tool and list the areas of application
2. Describe best practices in developing simulation models.
3. Know how to fit probability distributions to available data.
4. Know how to properly analyze Monte Carlo simulation outcomes, make comparisons, and report the results to a managerial audience.
5. Develop a variety of simulation models in Excel and Python

ASSESSMENTS

Summary

Component	Weight
Assignments (3, equal weight for each)	60%
Quizzes (4, drop the worst one)	30%
Instructor Assessment	10%
Total	100%

Details of Assessments

Homework Assignments

Assignments should be done in **groups of 3 or 4 people** each. You may choose your own groups; if you have trouble finding a group, please let me know. Students not in the same group may discuss assignments at a high level, but are not to share code, solution details, or any part of an assignment write-up with each other.

Solutions to assignments are not purely quantitative; they also involve discussion, interpretation, insights, justification, etc. (see more below). They 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 bad solution may receive a much lower mark. Also, while most CheckPlus solutions may receive 85%, a really outstanding solution may receive a higher mark.

In general, a "CheckPlus" means that the solution 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.

When working on assignments, 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. The first component involves things like correct modeling development, experimental design, and statistical analysis. Regarding the second item, be sure you don't just provide numerical results, but explain things clearly and concisely. Provide insight. Do the results make sense? Why or why not? Are there any other data that may be needed? Do you recommend any policy changes based on the results? Not all of these questions will apply to every problem, but the idea remains the same: clearly explain your results and don't just present numbers.

Also, make sure any programs you turn in are well-documented (i.e., put comments in the program where it would be helpful, make sensible labels for objects, etc.) so that someone else (like me and the course TA) can easily understand what's going on.

Quizzes
There will be four in-class Canvas quizzes, one in each of weeks 2-5 (i.e., no quiz in week one). These quizzes will take place on Thursdays, will be 20 minutes long, starting promptly at 10 AM and ending promptly at 10:20 AM. They will be based on material covered in the class through (and including) the Tuesday lecture of that week. The lowest of your four quiz marks will be dropped, with 10% of the course weight given to each of the remaining three. Unlike assignments, there is no subjective component to the quiz questions, so your quiz marks will be a numerical score.

Instructor Assessment
Instructor Assessment is based on class participation and professionalism (which includes being on time to class, not using cell phone, etc.).

LEARNING MATERIALS

Required Reading Materials: The following are excellent references, but are not required for purchase. They will be held in library reserve for short-term loans.

- Simulation Modeling and Analysis, by Law and Kelton
- Discrete-Event System Simulation, by Banks et al.

Technology Requirements: Students need to bring their own laptop to each class. The @Risk software is only compatible with Windows, so either you need a Windows-based laptop or you need to be able to install/run the software from a Windows environment on a Mac. If you have a Mac, you may obtain Windows 10 Education for free here: https://it.ubc.ca/services/desktop-print-services/software-licensing/windows-10-education. Apple has provided instructions on how to install Windows 10 here: https://support.apple.com/en-ca/HT201468. It's important to note that students must have enough space on their computers to handle both macOS and Windows 10.

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.

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

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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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

(Subject to change)

Class	Date	Topic	Readings or Activities	Assessments due
1	Mar. 3	Introduction Example model: Newsvendor problem		
2	Mar. 5	Random variable generation		HW 1 assigned (due Mar 14)
3	Mar. 10	Example models: e.g., Project management, Revenue management		
4	Mar. 12	Input modeling		**Quiz 1**
5	Mar. 17	Example models: e.g., Contract bidding, Surgical scheduling		HW 2 assigned on Mar 15 (due Mar 25)
6	Mar. 19	Output Analysis		**Quiz 2**
7	Mar. 24	Example models: e.g., Warranty analysis, Production planning		
8	Mar. 26	Variance reduction techniques (VRT)		**Quiz 3** HW 3 assigned (due Exam week)
9	Mar. 31	Example applications of VRT		
10	Apr. 2	Simulation optimization		**Quiz 4**
11	Exam Week			HW 3 due