Rotman Commerce
UNIVERSITY OF TORONTO

Course Outline

Course Code	RSM 412 H1 F
Course Name	Analytics for Service and Healthcare Management
Term, Year	Fall, 2022
Course Schedule	L0101 Monday 11-1 p.m. – UC 85 T0101 Monday 3-4 p.m. – UC 85
Web page URL	https://q.utoronto.ca

Instructor Details

Name	Email	Phone	Office Hours	Office Link
Akram Khaleghei	akram.khaleghei@mail.utoronto.ca		Friday 6-7pm Monday 6-7pm	online link will be posted

Course Scope, Mission and Learning Outcomes

Objectives: The overall objective of this course is to teach students how to use advanced analytics and data-driven decision-making techniques to solve important service management problems, with a main focus on healthcare settings.

Learning outcomes: Students will learn to develop appropriate data-driven predictive models and to apply flexible and more general machine learning techniques to tackle the following problems: devise a sound strategic service expansion plan by using real time information; properly assign risk-adjusted hospital readmission rates to patients, to reduce avoidable costs; determine employee resignation rates and causes of employee turnover, to develop a tailored employee retention program; identify customer purchasing patterns, to develop more effective product placement, pricing, cross-sell, and up-sell strategies; measure the effects of human behaviour on queueing system performance and the value of capacity pooling across multiple hospitals.

To achieve this overall objective, the course will give students not only an understanding, but also a working knowledge, of all phases of analytics-based problem solving:

- data acquisition, preparation, and structuring
- data analysis techniques
- selecting appropriate data analysis technique(s) to support effective decision-making
- deriving meaningful insights based on the results
- effectively communicating findings and their implications
- hands-on training for the use and development of software tools and Python code

Course Prerequisites

Completion of 9.0 credits; ECO220Y1 or equivalent.

Course Materials

Required Readings

- Main textbook: Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, *An Introduction to Statistical Learning with Applications in R*, Springer, 2013
- Readings
  - Choi Tsan-Ming, Wallace Stein, Wang Yulan "*Big Data Analytics in Operations Management*", Production Y Operations Management, 2017.
  - Finlay Steven, "Artificial Intelligence and Machine Learning for Business: A No-Nonsense Gide to Data Driven Technologies", 2018.
  - Velibor V. Misic, Georgia Perakisb, "Data Analytics in Operations Management: A Review", Manufacturing and Service Operations Management, 2020.
- Cases, problems, and other materials
  - See the list of the cases in the Weekly Schedule table.

Electronic Course Materials

Electronic course Packet, the link to which is provided on Quercus. This consists of the additional case(s) from Ivey Business School. These are:
(i) Pooling Ontario's Kidney Transplant Waiting Lists
The cost is $4.95 for student.

Evaluation and Grades

Grades are a measure of the knowledge and skills developed by a student within individual courses. Each student will receive a grade on the basis of how well they have command of the course materials, skills and learning objectives of the course.

Work	**Percentage of grade**	**Due Date**
Class Participation/Attendance	10%	Ongoing
Full case analyses(x3)	15% - Online submission/Individual	See Weekly Schedule
Full case analyses(x2)	10% - Online submission/Group	See Weekly Schedule
Project	15% - Online submission and in class presentation/Group	See Weekly Schedule
Mid Term Test	20% - Online /Individual	See Weekly Schedule
Final Exam	30% - In class/ Individual	Will be posted

Course Format and Expectations

Lectures

The course is organized into five modules (shown in the Weekly Schedule table): Each module focuses on one "type" of analytical technique and its application to an important service or

healthcare management problem, in the context of a case study that closely portrays a real-world setting.
Each module is organized into two classes. The first class focuses on preparing students so that they can effectively tackle the subsequent case assignment they are to solve for the second class. Therefore, the first class reviews, explains, and demonstrates the concepts in the context of the relevant business context; this includes a review of the readings. The first class also briefly discusses selected business problems in healthcare settings, to help students better understand the concepts and their application. The second class focuses on discussing the application case in detail, and on summarizing the learnings about the underlying techniques and the business problem.

Tutorials

The primary objective of tutorials is to give students a regular "supervised" training environment in which they develop their coding skills. In particular, the tutorials will go over coding exercises that are designed to (a) complement the examples shown during the lectures, and (b) have students develop their own application code in order to "learn by doing".

Class Participation

Students are expected to prepare thoroughly and make every effort to attend every class. As class participation is a graded component of the course, students will be evaluated on the following:

- Thoughtful responses
- Understanding and analysis of topic
- Idea generation
- Promoting further discussion

Missed Tests and Assignments (including mid-term and final-term assessments)

Students who miss a test or assignment for reasons entirely beyond their control (e.g. illness) may request special consideration.

In such cases, students must:

1. Notify the instructor AND the Rotman Commerce Program Office **on the date** of the missed course deliverable, e.g. missed test, final assessments, assignment or class (in the case of participation marks).
2. Complete a Request for Special Consideration Form and submit it along with your Absence Declaration on ACORN (please read the instructions on how to use the Absence Declaration in ACORN) within **2 business days** of the originally scheduled course deliverable.

Students who do not provide this information will be given a grade of 0 (zero) for the missed course deliverable.

Missed Mid-Term Test

A makeup exam will be arranged for those students who, for reasons beyond their control, are unable to write their Mid-Term test,

Late Assignments

All assignments are due on the date and at the time specified in Quercus (see also weekly schedule). Late submissions will normally be penalized by 50% if the assignment is not received on the specified date, at the specified time.

Statement on Equity, Diversity, and Inclusion

The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. U of T does not condone discrimination or harassment against any persons or communities.

Commitment to Accessibility

The University is committed to inclusivity and accessibility, and strives to provide support for, and facilitate the accommodation of, individuals with disabilities so that all may share the same level of access to opportunities and activities offered at the University.

If you require accommodations for a temporary or ongoing disability or health concern, or have any accessibility concerns about the course, the classroom or course materials, please email Accessibility Services or visit the Accessibility Services website for more information as soon as possible. Obtaining your accommodation letter may take up to several weeks, so get in touch with them as soon as possible. If you have general questions or concerns about the accessibility of this course, you are encouraged to reach out to your instructor, course coordinator, or Accessibility Services.

Academic Integrity

Academic Integrity is a fundamental value essential to the pursuit of learning and scholarship at the University of Toronto. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that the U of T degree that you earn will continue to be valued and respected as a true signifier of a student's individual work and academic achievement. As a result, the University treats cases of academic misconduct very seriously.

The University of Toronto's Code of Behaviour on Academic Matters outlines the behaviours that constitute academic misconduct, the process for addressing academic offences and the penalties that may be imposed. You are expected to be familiar with the contents of this document. Potential offences include, but are not limited to:

In papers and assignments

- Using someone else's ideas or words without appropriate acknowledgement.
- Submitting your own work in more than one course without the permission of the instructor.
- Making up sources or facts.
- Obtaining or providing unauthorized assistance on any assignment (this includes collaborating with others on assignments that are supposed to be completed individually).

On test and exams

- Using or possessing any unauthorized aid, including a cell phone.
- Looking at someone else's answers.
- Misrepresenting your identity.
- Submitting an altered test for re-grading.

Misrepresentation

- Falsifying institutional documents or grades.

- Falsifying or altering any documentation required by the University, including (but not limited to) medical notes.

All suspected cases of academic dishonesty will be investigated by the procedures outlined in the *Code of Behaviour on Academic Matters.* If you have any question about what is or is not permitted in the course, please do not hesitate to contact the course instructor. If you have any questions about appropriate research and citation methods, you are expected to seek out additional information from the instructor or other U of T or RC resources such as the RC Centre for Professional Skills, the College Writing Centres or the Academic Success Centre.

Email

At times, the course instructor may decide to communicate important course information by email. As such, all U of T students are required to have a valid UTmail+ email address. You are responsible for ensuring that your UTmail+ email address is set up and properly entered on ACORN. For more information visit the Information Commons Help Desk.

Forwarding your utoronto.ca email to a Gmail or other type of email account is not advisable. In some cases, messages from utoronto.ca addresses sent to Gmail accounts are filtered as junk mail, which means that important messages from your course instructor may end up in your spam or junk mail folder.

Recording Lectures

Lectures and course materials prepared by the instructor are considered by the University to be an instructor's intellectual property covered by the Canadian Copyright Act. Students wishing to record a lecture or other course material in any way are required to ask the instructor's explicit permission, and may not do so unless permission is granted. Students who have been previously granted permission to record lectures as an accommodation for a disability are excepted. This includes tape recording, filming, photographing PowerPoint slides, Quercus materials, etc.

If permission for recording is granted by the instructor (or via Accessibility Services), it is intended for the individual student's own study purposes and does not include permission to "publish" them in any way. It is forbidden for a student to publish an instructor's notes to a website or sell them in any other form without formal permission.

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Weekly Schedule

Session	Topic	Readings	Submit/ Due Date
1 Sep 12	Introduction and principles of data analytics Statistical/Machine learning problem types, Training, validation, and test dataset, Bias-variance trade off	Ch. 2.1, 2.2 Textbook	
2 Sep 19	**Module 1: Regression Analysis-concepts** Linear regression and Generalized linear models, Model performance evaluation, Application: Predicting hospital length of stay	Ch 3.1, 3.2, 3.3, 6.2 Textbook	
3 Sep 26	**Module 1: Regression Analysis - Case** Analyzing Bike Sharing Demand		Case. #1 (individual)
4 Oct 3	**Module 2: Classification Analysis – Concepts** Logistic Regression, K-nearest neighbors, Model performance comparison Application: Forecasting medical appointment no-shows to pursue targeted interventions	Ch 4.1, 4.2, 4.3, 4.5 Textbook	
5 Oct 17	**Module 2: Classification Analysis - Case** Predicting and Reducing Unplanned Hospital Readmissions		Case. #2 (individual)
6 Oct 24	**Module 3: Tree Based Methods - Concepts** Decision trees, Bagging vs. boosting, Random Forest, XGBoost Application: Predicting medical insurance costs and their drivers to improve healthcare accountability	Ch 8.1, 8.2 Textbook	
7 Oct 31	**Module 3: Tree Based Methods - Case** Understanding and Managing Employee Turnover		Case. #3 (individual)
Nov 14	**Mid-Term (Online)**		
8 Nov 14	**Module 4: Clustering Analysis - Concepts** K-means clustering, Hierarchical clustering, Density-based spatial clustering, Optimal number of clusters Application: Detecting fraud among healthcare providers	Ch 10.1, 10.3 Textbook	
9 Nov 21	**Module 4: Clustering Analysis – Case** Product Basket Analysis and Optimization		Case. #4 (group)
10 Nov 28	**Module 5: Queueing Theory and Discrete Event Simulation - Concepts** Characteristics of queuing systems, Measures of performance, Parameter estimation, Discrete event simulation models Application: Analysis of optimal capacity sizing for hospitals	Will be posted	
11 Dec 5	**Module 5: Queueing Theory and Discrete Event Simulation - Case** Pooling Ontario's Kidney Transplant Waiting Lists		Case. #5 (group)
12 Dec 8	Project Presentation (Make up session)		Project (group)

Please note that the last day you can drop this course without academic penalty is November 16, 2022.

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Other Useful Links

- Become a volunteer note taker
- Accessibility Services Note Taking Support
- Credit / No-Credit in RSM courses
- Rotman Commerce Academic Support

URL links for print

- Book an appointment with a writing or presentation coach: http://uoft.me/writingcentres
- Writing and Presentation Coaching academic support page: https://rotmancommerce.utoronto.ca/current-students/academic-support/writing-and-presentation-coaching/
- Centre for Professional Skills Teamwork Resources page: https://rotmancommerce.utoronto.ca/teamwork-resources
- Book an appointment with a Teamwork Mentor: http://uoft.me/writingcentres
- Request for Special Consideration Form: https://rotmancommerce.utoronto.ca/current-students/forms-requests-and-appeals/forms/
- ACORN: http://www.acorn.utoronto.ca/
- Email Accessibility Services: accessibility.services@utoronto.ca
- Accessibility Services website: http://studentlife.utoronto.ca/as
- University's Plagiarism Detection Tool FAQ: https://uoft.me/pdt-faq
- The University of Toronto's Code of Behaviour on Academic Matters: http://www.governingcouncil.utoronto.ca/policies/behaveac.htm
- Information Commons Help Desk: http://help.ic.utoronto.ca/category/3/utmail.html
- Become a volunteer note taker: https://studentlife.utoronto.ca/program/volunteer-note-taking/
- Accessibility Services Note Taking Support: https://studentlife.utoronto.ca/service/note-taking-support/
- Credit / No-Credit in RSM courses: https://rotmancommerce.utoronto.ca/current-students/degree-requirements/credit-no-credit-option/
- Rotman Commerce Academic Support: https://rotmancommerce.utoronto.ca/current-students/academic-support/