TOMS 5301A: Prescriptive Analytics

Winter 2026

Instructor	Ryan Nazari
Email Address	Ryannazari@cunet.carleton.ca
Class Times	Wednesday, 6:05 pm - 8:55 pm
Modality	In-Person
Office Hours	Fridays, 3:00-5:00 PM by appointment
Office Location	In Zoom
TA Name/Email	TBD

Pre-Requisites & Preclusions:

Prerequisites: BUSI 5801, ITIS 5431.

Course Description/Instructor's Statement

Carleton Calendar Description (Find at https://calendar.carleton.ca/grad/courses/)
Quantitative models focusing on optimization, decision analysis, and simulation for decision-making with less risk and better outcomes. Data integration, model formulation, implementation, result analysis, managerial insights, and applications across various business functions.

Instructor's Description:
Organizations worldwide, across private and public sectors, large and small, for-profit and non-profit, are increasingly confronted with complex and uncertain business environments. Yet, despite these challenges, some managers consistently make bold decisions that reduce risk and deliver superior outcomes. These decisions often lead to substantial performance improvements such as revenue growth, cost reduction, market share expansion, productivity gains, faster turnaround times, and more efficient use of scarce resources. A key enabler of these successes is quantitative analysis, which supports managers in addressing problems characterized by complexity, unfamiliarity, or significant risk.
This course introduces several essential frameworks and quantitative methods that serve as analytical tools for decision-makers in almost every industry, managerial function, and organizational level. It also examines real-world applications of these methods, demonstrating how they enhance decision quality in diverse sectors such as transportation, telecommunications, banking, manufacturing, healthcare, retail, and natural resources, across both public and private contexts and across organizations of all sizes. The course places particular emphasis on:

(a) optimization methods, which help identify the best solutions from a vast set of feasible alternatives;
(b) decision analysis methods, which support optimal strategy development under uncertainty and risk;

(c) and simulation methods, which allow decision-makers to experiment with different options in a virtual environment to explore potential improvements.

Together, these quantitative tools are referred to as management science thinking tools. The course is designed to be accessible and valuable to both technical and non-technical participants, enabling them to appreciate the benefits of these methodologies, critically evaluate analytical results, and adopt an alternative, structured way of thinking about managerial problems.

The course format combines lectures, case and article discussions, peer presentations, and in-class problem solving, ensuring a balanced emphasis on theory, application, and experiential learning.

Course Learning Objectives:

Upon successful completion of this course, students will be able to:

1. Understand the strategic role of modeling in managerial decision-making and problem-solving, and appreciate the full modeling process—from problem identification and formulation to solution development, implementation, and evaluation.
2. Diagnose problem types and recognize which situations are most suitable for optimization, decision analysis, or simulation, and what is required to identify an effective or optimal solution.
3. Extract, interpret, and communicate insights from management science models and use these insights to persuade stakeholders, support decision-making, and motivate organizational change.
4. Develop end-user modeling skills, enabling them to structure managerial problems effectively, communicate with technical experts or consultants, and apply management science tools independently as decision-makers.
5. Identify and leverage available analytical resources, understanding how modeling tools are used in practice to address real-world business challenges and support evidence-based decision-making.

Required/Optional Materials & Prices

These readings are available on Carleton Library.

Required Textbook

An Introduction to Management Science with Spreadsheets

- Stevenson, W. J.; Ozgur, C.; Nsakanda, A. L.
- 1st Canadian Edition; McGraw-Hill Ryerson; 2009 1st Edition
- ISBN: 9780070813809
- Price: $0

Additional Resource

Introduction to Management Science: A Modeling and Case Studies Approach with Spreadsheets

- Hillier, F. S.; Hillier, M. S.
- 6th Edition; McGraw-Hill Education; 2019 sixth edition / 2023 seventh edition
- ISBN: 9781260091854 (6e) / ISBN13: 9781265470609 (7e)
- Price: $0

Lab and software

The course will utilize Excel and Excel Solver to implement optimization and decision-analysis techniques. For simulation modeling, Arena software (www.arenasimulation.com/) or the

Crystal Ball Excel add-in (www.oracle.com/crystalball/index.html) will be used, allowing students to run simulations directly within Excel. Additionally, TreePlan (https://treeplan.com/download/), another Excel add-in, will be used to construct decision trees.
The minimum computing requirements are as follows:

- Hardware: Laptop
- OS: Windows 10, Mac OS 10.14, Linux Ubuntu 18.04
- Internet Browser: Google Chrome, Mozilla Firefox, Apple Safari, or Microsoft Edge

Note: Tablets, Chromebooks and Smartphones are not supported at this time. Windows-based tablets are not supported at this time.

Students are **not required** to purchase a physical copy of the textbooks or other tools and materials needed in this course. Only chapters indicated in the course schedule are required that are available through the library website.

Grading Scheme

Contribution to Class Discussion	25%
Case-based Report #1	15%
Case-based Report #2	20%
Final Exam	40%
TOTAL	100%

Important Dates to Note

Case-based Report #1	March 31th, 2026
Case-based Report #2	April 7th, 2026
Contribution to Class Discussion	Throughout the term

Final Exam Date: TBD - Monday April 13th to Friday April 17th

University Academic Calendar: https://calendar.carleton.ca/academicyear/

Policies & Accommodations

https://students.carleton.ca/course-outline/
https://carleton.ca/pmc/current-students/academic-accommodations/

Stay updated with important notifications and announcements from Carleton University, by downloading the Carleton University App!

Additional Information on Deliverables and Grading

Contribution to Class Discussion: Mastering prescriptive analytics requires connecting quantitative modeling techniques with managerial interpretation. Active participation is therefore essential to your learning experience. Your engagement will be evaluated based on the quality of your contributions during discussions and your involvement in short, practice-based activities. Each week includes a 30-

minute in-class exercise based on the case or modeling topic covered in that session. Across the term, there will be four such exercises.

- Case Analysis (4*4 points):
  One of the weekly exercises will include a brief case-based analysis where you apply model-driven reasoning to interpret results and propose decisions.
- Participation Component (9 points):
  The remaining participation marks reflect your preparedness, engagement with discussions, willingness to contribute ideas, and thoughtful involvement during modeling activities.

Case-based Report:

There will be two individual or group case-based managerial reports (group size to be announced). These reports require you to apply prescriptive analytics methods such as optimization modeling, decision analysis, and simulation, to analyze managerial decisions and provide evidence-based recommendations.

Deadlines and Weights

- **Report #1 – 15%, Due March 31st** , Focuses on optimization and decision modeling.
- **Report #2 – 20%, Due April 7th** , Must include simulation-based analysis in addition to prescriptive modeling.

Deliverables

Each report must consist of four sections:

1. **Cover/Introduction:** Case title, student names, overview of the problem, and objectives of the analysis.
2. **Executive Summary:** A concise statement of the key results, insights, and managerial recommendations.
3. **Analytical Section:**
   - Modeling approach (LP/ILP, decision analysis, simulation, depending on the case).
   - Assumptions, constraints, data used, interpretations of model outputs.
   - Answers to the specific guiding questions provided for each case.
4. **Conclusion & Recommendations:**
   Actionable recommendations supported by the model and sensitivity/what-if insights.

Peer Evaluations for Group Work

Each student must submit a peer evaluation form for each report.

- Missing peer evaluation → 30 percentage-point penalty applied to the student's individual grade for the report.
- Peer evaluations will be used to differentiate individual grades within the same group.

Final Exam:

There will be a take-home final exam that will be opened up on April 13th to 17th for about 6 hours (date and time will be announced). It will be comprehensive and will consist of a combination of case analyses and questions requiring the use of models and the interpretations of solutions. Details will be discussed in class.

Late Assignments:

To ensure fairness for all students, penalties will be applied to late reports and exercises: Failure to submit an assignment on time will result in an initial penalty of five 5 percentage points, followed by an additional 20 percentage points per day thereafter.

Preparation and Participation:
Active engagement is essential for mastering the concepts and applications of prescriptive analytics. Students are expected to come prepared, contribute thoughtfully to discussions, and participate actively in class activities. Quality participation includes asking relevant questions, sharing insights, and applying analytical reasoning to the topics covered. Engagement during class time is an important component of the learning process and contributes to your overall performance in the course. Students should review the assigned cases before class and be prepared to discuss modeling choices, assumptions, and managerial implications.

Conduct:
Professional conduct is built on mutual respect and active participation. Expectations include:

- Attendance & Punctuality: Attend all classes and arrive on time. You are responsible for materials and announcements if absent.
- Assignments: Include your name, student number, and group number, plus a signed academic integrity declaration. Teams form in the first week. Attend meetings; missing more than two without reason may affect your participation grade.
- Preparedness: Be ready to discuss readings, exercises, and cases each class.
- Feedback & Communication: Use Brightspace for course feedback. Email only for urgent matters; responses may take up to 48 hours.
- Grades & Feedback: Assignment feedback is on Brightspace. Peer review and participation grades reflect ongoing engagement.

Use of Generative Artificial Intelligence
This is a human-centered course. In this course, evaluation focuses on what you can do *without* AI assistance. While you are welcome to use AI tools to explore ideas, study, or clarify concepts, all submitted work must represent your independent thinking and original effort. Use AI for learning, not for producing graded submissions. Your understanding and reasoning—not AI output—will form the basis of assessment. Using AI for graded submissions constitutes and academic integrity violation.

Contribution to Program Learning Goals (MBA):

MBA Learning Goal	Not Covered	Introduced	Taught but Not Assessed	Taught and Assessed
MB1 Leadership and Collaboration *Graduates will be equipped for leadership and collaboration.*	✓			
MB2 Communication *Graduates will be effective communicators*		✓	✓	
MB3 Critical Thinking and Problem Solving *Graduates will be skilled in critical thinking and problem solving.*				✓

MB4 Functional Knowledge *Graduates will have functional knowledge of all areas of business.*		✓	✓	
MB5 Global Business *Graduates will have an appreciation of the global environment of business.*	✓			
MB6 Ethical Reasoning *Graduates will be skilled in ethical reasoning and decision-making.*	✓			

COURSE SCHEDULE

Week	Date	Topic/Agenda	Pre-class Prep
1	March 4th	**Introduction & Linear Programming Basics:** • Introduction to business modeling with management science approaches • Thinking simultaneously using linear programming (LP) models – Basics, problem framing, graphical solution method & Solving LP using Excel	• Lecture notes (Brightspace) • *SON* Chapter 2: sections 2.1, 2.2, 2.4, 2.5, 2.8 • Instructor's notes: Solving LP with Excel Solver (Brightspace)
2	March 11th	**LP Interpretation & Sensitivity Analysis:** • LP - Problem framing, solution interpretation and managerial insights • Business applications of LP	• Reading case: Wivco Company Inc. (The link in Brightspace) • Instructor's notes: Sensitivity Analysis (Brightspace) • *SON* Chapter 3: sections 3.1, 3.3, 3.5 • Reading case: Merton Truck Company (The link in Brightspace) • Document on LP Applications (Brightspace) • *Exercise: Apply linear programming or optimization models to a short case.*
3	March 18th	**Integer Linear Programming (ILP):** • Thinking simultaneously using integer linear programming (ILP) Models - Problem framing, solution interpretation and managerial insights	• Integer Linear Programming slides (Brightspace) • *SON* Chapter 6: sections 6.1–6.6, 6.8 • Reading case: AgrEvo International, Inc. (The link in Brightspace) • *Exercise: Use integer linear programming or scheduling techniques in a mini case.*

4	Marth 25th	**Decision Analysis (DA):** • Decision trees • Probabilities & payoffs • Sensitivity in DA	• Reading case: The Goferbroke Company (The link in Brightspace) • Reading case: Appshop, Inc. (The link in Brightspace) • Decision Analysis slides (Brightspace) • *SON* Chapter 10: sections 10.5, 10.7, 10.8, 10.9 • *Decision analysis exercise: decision tree, probabilities, and payoffs.*
5	April 1st	**Simulation:** • Stochastic modeling • Generating distributions • Trend charts • Simulation-based optimization	• Reading case: Appshop Inc. (continued) • Simulation notes (Brightspace) • *SON* Chapter 13: sections 13.6–13.11 • *Simulation or scenario-based modeling exercise to evaluate options under uncertainty.* **Report #1 due March 31st, 11:59 PM**
6	April 8th	**Wrap-Up & Integration:** • Connecting all modeling approaches • Applying MS/Analytics to real decisions • Final managerial takeaways	• Closing notes (available on Brightspace). **Report #2 by April 7th ,11:59 PM**

ADDITIONAL INFORMATION

Course Sharing Websites:

Materials created for this course (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s).

Recommended Calculator for Examinations:

If you are purchasing a calculator, we recommend any one of the following options: Texas Instruments BA II Plus (including Pro Model), Hewlett Packard HP 12C (including Platinum model), Staples Financial Calculator, Sharp EL-738C & Hewlett Packard HP 10bII

Group Work:

The Sprott School of Business encourages group assignments. They provide you with opportunities to develop and enhance interpersonal, communication, leadership, followership and other group skills. Group assignments are also an effective way to learn integrative skills for putting together a complex task. Your professor may assign one or more group tasks, assignments, or projects in this course. Before embarking on a specific problem as a group, it is your responsibility to ensure that the

problem is meant to be a group assignment and not an individual one.

Peer Evaluation for Group Work

To deter social loafing and ensure fairness in grading, you will be asked to assess the contribution of your fellow group members. This information will be used when assigning the grade for the final project. The procedure is as follows: Each student should take 100 points and allocate those points to the various members of the group (including him/her/themself) to reflect the contributions made by each member. For instance, if there are four members in a group and everyone contributed equally, each individual would receive 25 points. Conversely, if an individual contributed relatively little, the remaining group members might allocate few points to that member. To ensure that these peer evaluation scores are reasonable and free from personal bias, you will be asked to provide a detailed written explanation for your point allocation.

Letter Grades:

In accordance with the Carleton University Undergraduate Calendar (p 34), the letter grades assigned in this course will have the following percentage equivalents:

A+ = 90-100	B+ = 77-79	C+ = 67-69	D+ = 57-59	F = Below 50
A = 85-89	B = 73-76	C = 63-66	D = 53-56	
A - = 80-84	B - = 70-72	C - = 60-62	D - = 50-52	

Grades entered by Registrar:

WDN = Withdrawn from the course
DEF = Deferred

Academic Regulations:

University rules regarding registration, withdrawal, appealing marks, and most anything else you might need to know can be found on the university's website, here:
https://calendar.carleton.ca/grad/gradregulations/

Requests for Academic Accommodation:

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances, are outlined on the Academic Accommodations website (students.carleton.ca/course-outline).

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

- **Pregnancy**
  Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: Pregnancy Academic Accommodation

Information - Equity and Inclusive Communities

- **Religious Obligations**
  Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: Academic Regulations for Students with Religious Obligations < Carleton University

- **Students with Disabilities**
  If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. https://carleton.ca/pmc/

- **Survivors of Sexual Violence**
  As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and its survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: Sexual Violence Prevention & Survivor Support - Equity and Inclusive Communities

- **Student Activities**
  Carleton University recognizes the substantial benefits, to both the individual student and the university, that result from participating in activities beyond the classroom experience. Reasonable accommodation will be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

For more information on academic accommodation, please contact the departmental administrator or visit: https://students.carleton.ca/course-outline/

Academic Integrity:

Violations of academic integrity—presenting another's ideas, arguments, words or images as your own, using unauthorized material, misrepresentation, fabricating or misrepresenting research data, unauthorized co-operation or collaboration or completing work for another student—are a serious academic offence, weaken the quality of the degree, and will not be tolerated. Penalties may include; a grade of Failure on the submitted work and/or course; academic probation; a refusal of permission to continue or to register in a specific degree program; suspension from full-time studies; suspension from all studies at Carleton; expulsion from Carleton, amongst others. Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy which is available, along with resources for compliance at: https://carleton.ca/registrar/academic-integrity/

Centre for Student Academic Support:

The Centre for Student Academic Support (CSAS) is a centralized collection of learning support services designed to help students achieve their goals and improve their learning both inside and outside the classroom. CSAS offers academic assistance with course content, academic writing and skills development. Visit CSAS on the 4th floor of MacOdrum Library or online at: https://carleton.ca/csas/

Other Important Information:

- Students must always retain a copy of all work that is submitted.
- All final grades are subject to the Dean's approval.
- For us to respond to your emails, we need to see your full name, CU ID, and the email must be written from your valid CARLETON address. Therefore, in order to respond to your inquiries, please send all email from your Carleton cmail account. If you do not have or have yet to activate this account, you can do so by visiting https://carleton.ca/its/get-started/new-students-2/