

MBA O701 – Modeling & Prescriptive Analytics Fall 2024 Course Outline

Operations Management Area DeGroote School of Business - McMaster University

COURSE OBJECTIVE

This course will introduce students to the fundamental concepts of prescriptive analytics using *Microsoft Excel* and *Analytic Solver Platform* and discuss the practical approaches to solving business cases using optimization techniques and simulation modeling. The course will take a practical (less of math and more of logic and intuition) approach and cover topics like Linear and Non-linear Optimization, Integer Optimization, Optimization of non-smooth models and Simulation techniques to build intuition, structure the problem, solve, analyze and evaluate prescriptive models from a business perspective. The students will learn when to use a specific model and understand the implementation using a hands-on problem-solving approach. The students of this course will benefit from having a prior knowledge of basic excel formulae.

INSTRUCTOR AND COURSE COMMUNICATIONS

Dr. Srikanth Balasubramanian
Instructor

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Office Hours: By Appointment

<https://www.linkedin.com/in/srikabala/>



Course website: [BUSADMIN O701:Modeling and Prescriptive Analytics](#)

Teams site: [O701- Fall 2024 Microsoft Teams](#)

Credit Value: 3	Leadership: No	IT skills: Yes	Global view: Yes
Avenue: Yes	Ethics: Yes	Numeracy: Yes	Written skills: Yes
Participation: No	Innovation: Yes	Group work: No	Oral skills: Yes
Evidence-based: Yes	Experiential: Yes	Final Exam: Yes	Guest speaker(s): No

COURSE DESCRIPTION

This course will discuss the most popular prescriptive analytics techniques, and then use them to logically model real-world applications from a variety of business areas such as operations, marketing, finance, etc. The logical model will be converted into a computer model, which will then be solved and analyzed via *Analytic Solver Platform* (within a spreadsheet environment).

The first part of the course will focus on developing a strong understanding of the core ideas of prescriptive modeling by implementing basic linear optimization models like allocation, blending and covering models.

The second part of the course will delve into a special type of linear optimization models called Network Flow models. The students will learn how to solve cases using transportation, assignment and transshipment models.

The third part of the course will focus on examples using integer optimization, non-linear optimization and optimization of non-smooth models.

The final part of the course will focus on the basics of simulation modeling covering aspects of Monte-Carlo simulation, stochastic optimization, chance constraints and recourse decisions.

LEARNING OUTCOMES

Upon completion of this course, students will be able to complete the following key tasks:

- ✓ Use prescriptive analytics techniques to solve managerial problems.
- ✓ Logically model, solve, and analyze a problem in Analytics Solver Platform (& Excel).
- ✓ Simulate (components of) a decision problem.
- ✓ Apply modeling and analytical techniques to real-world applications.

COURSE MATERIALS AND READINGS

- Custom textbook developed with Wiley entitled, “O701: Modeling and Prescriptive Analytics”. ISBN: TBD.
- Analytic Solver Platform (www.solver.com). The requisite license will be purchased by the School, and the relevant installation details will be shared in class.
- [Avenue registration](#) for lecture notes, course content, readings, datasets and assessments.

The students can go through Chapters 1 through 5 in the custom textbook by themselves as needed. No component of these 5 chapters will be used in any assessment for this course.

EVALUATION

Learning in this course results primarily from in-class discussion and participation of business cases as well as out-of-class analysis. The balance of the learning results from the lectures on strategic concepts, from related readings, and from researching your presentations, cases, assignments, simulation decisions. All work will be evaluated on an individual basis except in certain cases where group work is expected. In these cases, group members will share the same grade adjusted by peer evaluation. In this course, there is no evaluation component at the group level. Your final grade will be calculated as follows:

Quizzes (50%) - Top five out of six assessments

There will be six quizzes, each worth 10% and would be conducted based on a multiple-choice questions format. The top five scores from these quizzes will be used for grading. These quizzes would be conducted in-class and will be for a maximum duration of 30 minutes. No make-up quizzes will be offered if a student misses the quiz for any reason.

The quizzes are planned as per the following schedule (subject to change):

- Quiz #1: Weight: 10%. Date: Oct 03, 2024
- Quiz #2: Weight: 10%. Date: Oct 10, 2024
- Quiz #3: Weight: 10%. Date: Nov 07, 2024
- Quiz #4: Weight: 10%. Date: Nov 14, 2024
- Quiz #5: Weight: 10%. Date: Nov 21, 2024
- Quiz #6: Weight: 10%. Date: Dec 05, 2024

Mid-Term (20%)

There will be one mid-term assessment, and it would be conducted in-class on October 24, 2024. It would likely take a candidate about 2-hour and 30 minutes to complete the assessment using Excel and Analytic Solver Platform. The answers must be marked using a multiple-choice question format. Working files must be submitted for auditing purposes.

Please note that each student must write the midterm test. If you are unable to write the exam on the scheduled date, and have advanced knowledge and permission, the instructor will provide you with an opportunity to write an alternate version of the test at an alternate time. Note that this is not automatic and that a written request for alternate exam must be made, along with the supporting documents, well ahead of the scheduled date.

Final Exam (30%)

Final Exam will be held during the exam week, and more details will be provided in the class. It will likely be a 3-hour exam. You will complete this exam using Excel and Analytic Solver Platform. Final answers must be marked using a multiple-choice question format. Working files must be submitted for auditing purposes.

Please note that each student has to complete the final exam. If you are unable to write the exam on the scheduled date, and have advanced knowledge and permission, the instructor will provide you with an opportunity to write an alternate version of the test at an alternate time. Note that this is not automatic and that a written request for alternate exam has to be made, along with the supporting documents, well ahead of the scheduled date.

Components and Weights

Quizzes	(individual)	50%
Mid-Term	(individual)	20%
Final Exam	(individual)	30%
Total		100%

NOTES:

- Any requests for a re-read of the assignments or examinations should be made within two weeks of the date of distribution of the marks.
- The use of a McMaster standard calculator is allowed during examinations in this course. See McMaster calculator policy at the following URL:

<http://www.mcmaster.ca/policy/Students-AcademicStudies/GradExamsPolicy.pdf>

Grade Conversion

At the end of the course your overall percentage grade will be converted to your letter grade in accordance with the following conversion scheme:

LETTER GRADE	PERCENT	POINTS
A+	90-100	12
A	85-89	11
A-	80-84	10
B+	75-79	9
B	70-74	8
B-	60-69	7
F	00-59	0

Communication and Feedback

Students that are uncomfortable in directly approaching an instructor regarding a course concern may send a confidential and anonymous email to the respective Area Chair or Associate Dean:

<http://mbastudent.degroote.mcmaster.ca/contact/anonymous/>

Students who wish to correspond with instructors or TAs directly via email must send messages that originate from their official McMaster University email account. This protects the confidentiality and sensitivity of information as well as confirms the identity of the student. Emails regarding course issues should NOT be sent to the Administrative Assistant.

Instructors are encouraged to conduct an informal course review with students by Week #4 to allow time for modifications in curriculum delivery. Instructors should provide evaluation feedback for at least 10% of the final grade to students prior to Week #8 in the term.

ACADEMIC DISHONESTY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at:

www.mcmaster.ca/academicintegrity

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations

MISSED ACADEMIC WORK

Missed Mid-Term Examinations / Presentations / Tests / Class Participation

Where students miss a regularly scheduled mid-term or class participation for legitimate reasons as determined by the Student Experience – Academic (MBA) office, the weight for that test/participation will be distributed across other evaluative components of the course at the discretion of the instructor. Documentation explaining such an absence must be provided to the Student Experience – Academic (MBA) office within five (5) working days upon returning to school.

To document absences for health related reasons, please provide to Student Experience – Academic (MBA) office the Petition for Relief for MBA Missed Term Work and the McMaster University Student Health Certificate which can be found on the DeGroote website at <http://mbastudent.degroote.mcmaster.ca/forms-and-applications/> Please do not use the online McMaster Student Absence Form as this is for Undergraduate students only. University policy states that a student may submit a maximum of three (3) medical certificates per year after which the student must meet with the Director of the program.

To document absences for reasons other than health related, please provide Student Experience – Academic (MBA) office the Petition for Relief for MBA Missed Term Work and documentation supporting the reason for the absence.

Students unable to write a mid-term at the posted exam time due to the following reasons: religious; work-related (for part-time students only); representing university at an academic or varsity athletic event; conflicts between two overlapping scheduled mid-term exams; or other extenuating circumstances, have the option of applying for special exam arrangements. Such requests must be made to the Student Experience – Academic (MBA) office at least ten (10) working days before the scheduled exam along with acceptable documentation. Instructors cannot themselves allow students to unofficially write make-up exams/tests. Adjudication of the request must be handled by Student Experience – Academic (MBA).

If a mid-term exam is missed without a valid reason, students will receive a grade of zero (0) for that component.

Missed Final Examinations

A student who misses a final examination without good reason will receive a mark of 0 on the examination. All applications for deferred and special examination arrangements must be made to the Student Experience – Academic (MBA) office. Failure to meet the stated deadlines may result in the denial of these arrangements. Deferred examination privileges, if granted, must be satisfied during the examination period at the end of the following term. There will be one common sitting for all deferred exams.

Failure to write an approved deferred examination at the pre-scheduled time will result in a failure for that examination, except in the case of exceptional circumstances where documentation has been provided and approved. Upon approval, no credit will be given for the course, and the notation N.C. (no credit) will be placed on the student's transcript. Students receiving no credit for a required course must repeat the course. Optional or elective courses for which no credit is given may be repeated or replaced with another course of equal credit value.

Requests for a second deferral or rescheduling of a deferred examination will not be considered.

Any student who is unable to write a final examination because of illness is required to submit the Application for Deferred MBA Final Examination and a statement from a doctor certifying illness on the date of the examination. The Application for Deferred MBA Final Examination and the McMaster

University Student Health Certificate can be found on the DeGroote website at <http://mbastudent.degroote.mcmaster.ca/forms-and-applications/> Please do not use the online McMaster Student Absence Form as this is for Undergraduate students only. Students who write examinations while ill will not be given special consideration after the fact.

In such cases, the request for a deferred examination privilege must be made in writing to the Student Experience – Academic (MBA) office within five business days of the missed examination.

Special examination arrangements may be made for students unable to write at the posted exam time due to compelling reasons (for example religious, or for part-time students only, work-related reasons):

- Students who have religious obligations which make it impossible to write examinations at the times posted are required to produce a letter from their religious leader stating that they are unable to be present owing to a religious obligation.
- Part-time students who have business commitments which make it impossible to write examinations at the times posted are required to produce a letter on company letterhead from the student's immediate supervisor stating that they are unable to be present owing to a specific job commitment.

In such cases, applications must be made in writing to the Student Experience – Academic (MBA) office at least ten business days before the scheduled examination date and acceptable documentation must be supplied.

If a student is representing the University at an academic or athletic event and is available at an overlapping scheduled time of the test/examination, the student may write the test/examination at an approved location with an approved invigilator, as determined by the Student Experience – Academic (MBA) office.

In such cases, the request for a deferred examination privilege must be made in writing to the Student Experience – Academic (MBA) office within ten business days of the end of the examination period.

Note: A fee of \$50 will be charged for a deferred exam written on campus and a fee of \$100 for deferred exams written elsewhere. In cases where the student's standing is in doubt, the Graduate Admissions and Study Committee may require that the student with one or more deferred examination privileges refrain from re-registering until the examination(s) have been cleared.

STUDENT ACCESSIBILITY SERVICES

Student Accessibility Services (SAS) offers various support services for students with disabilities. Students are required to inform SAS of accommodation needs for course work at the outset of term. Students must forward a copy of such SAS accommodation to the instructor normally, within the first three (3) weeks of classes by setting up an appointment with the instructor. If a student with a disability

chooses NOT to take advantage of an SAS accommodation and chooses to sit for a regular exam, a petition for relief may not be filed after the examination is complete. The SAS website is:

<http://sas.mcmaster.ca>

RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVATIONS (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the [RISO](#) policy. Students should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

POTENTIAL MODIFICATION TO THE COURSE

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

ACKNOWLEDGEMENT OF COURSE POLICIES

Your registration and continuous participation (e.g. on A2L, in the classroom, etc.) to the various learning activities of MBA O711 will be considered to be an implicit acknowledgement of the course policies outlined above, or of any other that may be announced during lecture and/or on A2L. **It is your responsibility to read this course outline, to familiarize yourself with the course policies and to act accordingly.**

Lack of awareness of the course policies **cannot be invoked** at any point during this course for failure to meet them. It is your responsibility to ask for clarification on any policies that you do not understand.

COURSE SCHEDULE

C01 - THU – 07:00 PM – 09:50 PM (RJC 236)

SESSION	DATE	TOPICS
1	Thu. Sep. 12	Part 0: Course Introduction and Logistics ✓ Resources, Assessments and Expectations ✓ Just Enough Excel Primer
2	Thu. Sep. 19	Part 1: Linear Optimization 1 ✓ Allocation Models ✓ Solver Reports and Sensitivity Analysis
3	Thu. Sep. 26	Part 1: Linear Optimization 2 ✓ Covering Models ✓ Blending Models
4	Thu. Oct. 03	Part 2: Network Flow Models 1 ✓ Introduction to Network Flow Models ✓ Transportation Model Quiz 1: Linear Optimization
5	Thu. Oct. 10	Part 2: Network Flow Models 2 ✓ Assignment Model ✓ Transshipment Model Quiz 2: Network Flow Models 1
Mid-Term Recess: Oct 14 to Oct 20		
6	Thu. Oct. 24	Mid-term exam: Linear Optimization and Network Flow Models
7	Thu. Oct. 31	Part 3: Integer Optimization ✓ Binary Choice Model ✓ Facility Location Model

8	Thu. Nov. 07	<p>Part 3: Non-linear Optimization</p> <ul style="list-style-type: none"> ✓ Portfolio Optimization ✓ Sensitivity Analysis of Non-linear models <p>Quiz 3: Integer Optimization</p>
9	Thu. Nov. 14	<p>Part 3 – Optimization of non-smooth models</p> <ul style="list-style-type: none"> ✓ Covering Models ✓ Blending Models <p>Quiz 4: Non-linear Optimization</p>
10	Thu. Nov. 21	<p>Part 4 – Simulation Modeling 1</p> <ul style="list-style-type: none"> ✓ Basics of Simulation ✓ Reading Simulation Reports <p>Quiz 5: Optimization of non-smooth models</p>
11	Thu. Nov. 28	<p>Part 4 – Simulation Modeling 2</p> <ul style="list-style-type: none"> ✓ Chance Constraints ✓ Recourse Decisions
12	Thu. Dec. 05	<p>Course Summary / Preparation tips for Final Exam</p> <p>Quiz 6: Simulation Modeling</p>
<p>Final Exam (take-home) may cover any topic discussed in the course</p>		