OM 338: Supply Chain Modeling and Optimization
Spring 2020
Unique No. 04420

Professor Anant Balakrishnan

Classroom: UTC 1.116
Office: CBA 6.486
Class time: MW 9:30 to 11:00 am
Hours: Wed. 11:00 am to noon
or by appointment

Teaching Assistant: Parshu Hotkar, parshuram@utexas.edu, CBA 5.334Q
Office hours: Tues. 4:30 to 6 p.m. or by appointment

Course Description and Objectives

Effective management of operations and supply chains requires principled and data-driven planning and decision-making approaches to acquire, allocate, and deploy resources so as to improve efficiency and profitability. These decision problems often involve many inter-related issues, with complex tradeoffs, that must also satisfy various policy requirements and constraints. Due to these characteristics, manual or intuitive decision-making can be ineffective (sub-optimal), cumbersome, and time-consuming. So, supply chain and operations managers at leading companies in many different industries, ranging from manufacturing and transportation to retailing and services, have come to rely heavily on advanced decision technologies that are based on quantitative models and techniques to guide and improve their decisions. These models, from the field of management science, have become particularly important as companies invest in systems to exploit the increasing availability and accessibility of “big data.”

Quantitative models, and the associated computer algorithms, serve as the “intelligence” needed for data-driven decisions and as the underlying “engine” in business analytics. This course seeks to teach students the basic principles and applications of mathematical and computer-based models that are most commonly used for designing, planning, and managing supply chains, both for product fulfillment and service operations.

Specifically, the goals of the course are to:

- introduce students to the main modeling approaches – optimization, queueing, and simulation – that are widely used and relevant to supply chain and operations management;
- illustrate the use of these models to address operations planning and decision problems;
- enable students to frame and structure managerial decision problems, decide which model to apply, and how to formulate and create an appropriate model;
- outline some basic principles underlying the methods to analyze and solve these models; and,
• provide practice in creating and solving models using spreadsheets and other software. The course is particularly relevant for students interested in supply chain management, operations, logistics, and management consulting. Models and their applications covered in the course include:
  • Linear optimization (also called Linear Programming);
  • Network models;
  • Integer and Non-linear optimization;
  • Stochastic models, Simulation, and Queueing.

Pre-requisite: OM 335 or OM 335H

Quantitative Reasoning Flag: This course carries the Quantitative Reasoning flag. “The Quantitative Reasoning requirement helps you build skills necessary for understanding quantitative arguments in your adult and professional life. Courses carrying the Quantitative Reasoning Flag ask you to interpret quantitative models and apply quantitative reasoning to real-world problems.” (http://www.utexas.edu/ugs/flags/students/about/quantitative-reasoning). So, a substantial portion of the course emphasizes how to represent managerial decision and planning problems as quantitative models, solve these models, and interpret their results.

Course materials
The following textbook is very highly recommended:


This textbook (abbreviated as WA in the course schedule) emphasizes the use of Excel for modeling and solving supply chain and operations problems. In class, we will also emphasize mathematical modeling, in addition to using Excel to represent and solve these models. The book contains chapters corresponding to most of the topics covered in this course; we will use examples from these chapters for class discussions. Each chapter also contains exercises and practice problems. The course schedule contains the book sections that are relevant for each session. Going through this material and working out the practice problems/exercises will be very useful to reinforce your learning and supplement class discussions. So, although the book is not designated as a ‘required’ textbook, students who need additional resources to learn the material covered in the course should get this book; it is very highly recommended. Getting access to an edition earlier than the current version, and without the publisher’s student resources, should be adequate.

Later in the course, we may use chapters from a book on Simulation (by Kelton, Smith, and Sturrock), and students may also be required to purchase one or two cases (directly from Harvard Business School Publishing or Ivey Publishing) for case discussion and group assignments. Announcements regarding these additional materials will be made in class during the semester.

The class discussions and homework assignments require extensive use of Microsoft Excel. The course assumes that students know how to use Excel, and are very familiar with common
features, commands, and operations in Excel. Students are strongly encouraged to refresh their Excel skills by going through the many Excel tutorials available online, especially on LinkedIn Learning (previously called Lynda.com). UT Austin students have free access to this material—visit https://hr.utexas.edu/oe/ut-staff-professional-development/linkedin-learning to learn how to use LinkedIn Learning. Then click on the link called “UT Portal” and log in with your UT EID to search for and go through the various available courses. One very useful and popular course on this site is “Excel 2016 Essential Training.” The textbook by Winston and Albright also provides a good introduction to Excel. Class discussions will cover some of the advanced and special features of Excel that are especially needed for our modeling and optimization work.

Course preparation and student evaluation
Before each class, students should review the material covered in previous sessions and are encouraged to go through the relevant book sections (listed in the course schedule). You will find that attending classes regularly and taking good notes will be very valuable to deepen your understanding, be prepared for the homework assignments and tests, engage in the discussions, and interact with classmates. Active class participation—responding to questions, raising interesting issues, and contributing to better understanding the material—is strongly encouraged. The course requirements include regular homework assignments (see schedule) and three tests during the semester.

The main purpose of the Homework assignments is to reinforce and build upon the concepts and techniques discussed in class, and to provide practice in applying, implementing, and interpreting the results of various models. For Individual Homework (abbreviated as IHW) assignments, students are permitted to discuss with classmates the broad approach for solving the homework problems, but each student must work out the details and write up the assignment on their own (e.g., formulating mathematical models, implementing the models using Excel, working out numerical answers, interpreting the results). All questions in each assignment must be answered, but we may fully grade only selected problems. DO not copy answers or computer models for IHW from other students (current or past) or other sources, and do not share your completed assignment with others. In addition to IHW assignments, there may be one or two (group) Case assignments that entail preparing a brief report to address some questions about the case. For these assignments, students are permitted to work in groups of up to four students; each group needs to submit only one written report. Homework grades will be based on clarity of work (including explanations), completeness, and correctness. Students who make a sincere attempt to answer a question and clearly explain their answer (even if incorrect) will receive at least 50% of the points allocated to that question. Additional points (above 50%) will be given based on the extent to which the student has understood and applied the learnings from class and the textbook, progressed towards solving the problem, and followed the appropriate approach.

The course Exams consist of three tests during the semester. These tests will have some overlapping coverage of topics (the scope of each test will be announced in class, prior to the test). For each test, students are permitted to bring one 8.5 x 11 inch sheet (two-sided) of handwritten notes, and a business calculator (use of computers and other electronic devices is not
permitted during tests). All tests will be held in the evening (from 7 p.m. to around 9 p.m.) on
the dates specified in the course schedule. Students who have legitimate and unavoidable
academic conflicts should inform the instructor at least two weeks before the test, and may be
required to provide supporting documentation for the conflict.

Class participation performance will be assessed based on regular attendance, preparedness for
class (e.g., answering questions), quality of comments, and participation in in-class exercises.

Grades for the course will be based on a weighted sum of scores for tests, homework, and class
participation, with the following weights for each component:

- Tests (3 @ 25% each)  75%
- Homework  13%
- Class participation  12%

Grading scheme and policies

- Unless otherwise specified, homework assignments must be turned in (submitted via Canvas)
  before the specified due date and time. No credit will be given for late homework
  submissions. Please submit your answers as a PDF file, together with any required
  spreadsheets. For hand-written answers, scan the document and submit as PDF file; do not submit photos of your hand-written work.
- The lowest homework assignment score among all assignments will be dropped when
determining the overall homework score at the end of the semester.
- All homework assignments have equal weight, and each test has a weight of 25%. The total
  actual points for each homework assignment and test varies (e.g., may not be out of 100), but
  the score for each assignment and test will be first converted to a % (i.e., out of 100) before
  computing the overall (weighted) final score and course grade.
- Canvas does not calculate the cumulative and average (weighted) scores properly. Use
  Canvas only to check your actual score on each assignment and test. Do not rely on any
  cumulative or average scores shown in Canvas.
- The distribution of grades will follow the guidelines provided by the Undergraduate program.
The instructor may “curve” the scores before deciding the letter grades.

Academic Integrity and Honor Code

By enrolling in this class, you agree to abide by the University’s and McCombs School’s code of
professional conduct (see also “Policy on Scholastic Dishonesty” below), and the following
important professional code of conduct and protocols for this course.

- Turn off cell phones. Do not text, chat, check e-mail, use web, etc. during class.
- During class you are permitted to use a laptop/tablet only for activities related to this class,
i.e., to take notes or to follow the instructor in developing and solving computer models.
During class, do NOT check e-mail, surf the web, send messages, or conduct work unrelated
to this course.
- Do NOT copy (from other students or other sources) on tests, exams, and individual
  homework assignments.
Use of Class Materials
The materials provided and used in this class, including lecture materials, tests, and homework assignments, are copyright protected works. Any unauthorized copying of these materials is a violation of federal law and may result in disciplinary actions being taken against the student. Additionally, the sharing of class materials without the specific, express approval of the instructor may be a violation of the University's Student Honor Code and an act of academic dishonesty, which could result in further disciplinary action. This includes, among other things, uploading class materials to websites for the purpose of sharing those materials with other current or future students.

Feedback
Your feedback is valuable, and facilitates continuous course improvement. I welcome your suggestions throughout the semester on how to improve the course and the learning experience it provides.

Students with Disabilities
Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 512-471-6259, http://diversity.utexas.edu/disability/.

Diversity and Inclusion
It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students’ learning needs be addressed, and that the diversity that students bring to this class can be comfortably expressed and be viewed as a resource, strength, and benefit to all students. Please contact me if you have any concerns about related issues in class.

Religious Holy Days
By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Policy on Scholastic Dishonesty
The McCombs School of Business has no tolerance for acts of scholastic dishonesty. The responsibilities of both students and faculty with regard to scholastic dishonesty are described in detail in the BBA Program’s Statement on Scholastic Dishonesty at http://my.mccombs.utexas.edu/BBA/Code-of-Ethics. By teaching this course, I have agreed to observe all faculty responsibilities described there. By enrolling in this class, you have agreed to observe all student responsibilities described there. If the application of the Statement on Scholastic Dishonesty to this class or its assignments is unclear in any way, it is your responsibility to ask me for clarification. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since dishonesty harms the individual, all students, the integrity of the University, and the value of our academic brand, policies on scholastic
dishonesty will be strictly enforced. You should refer to the Student Conduct and Academic Integrity website at http://deanofstudents.utexas.edu/conduct/ to access the official University policies and procedures on scholastic dishonesty as well as further elaboration on what constitutes scholastic dishonesty.

**Campus Safety**
Please note the following key recommendations regarding emergency evacuation, provided by the Office of Campus Safety and Security. More info at https://preparedness.utexas.edu/.

- Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings and assemble outside when a fire alarm is activated.
- Familiarize yourself with all exit doors of each classroom and building you may occupy.
- If you need evacuation assistance, inform the instructor in writing as soon as possible.
- In the event of an evacuation, follow the instruction of faculty or class instructors.
- Do not re-enter a building unless given instructions by Austin or UT police or fire authorities.

Behavior Concerns Advice Line (BCAL): 512-232-5050 or on-line.

In case of emergency, further information will be available at http://www.utexas.edu/emergency.
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<tr>
<th>Session #</th>
<th>Date</th>
<th>Day</th>
<th>Topic</th>
<th>Required Readings ¹</th>
<th>Assignments Due ²</th>
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<tr>
<td>1</td>
<td>Jan. 22</td>
<td>Wed</td>
<td>Course Introduction</td>
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<tr>
<td>2</td>
<td>Jan. 27</td>
<td>Mon</td>
<td>Introduction to Modeling Spreadsheet Models 1</td>
<td>WA, Chapter 1, WA Sec. 2.1 to 2.3 WA, Ex. 12.1 in Sec. 12.4</td>
<td>Submit completed Name tent via Canvas by 5 p.m.</td>
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<td>3</td>
<td>Jan. 29</td>
<td>Wed</td>
<td>Spreadsheet Models 2</td>
<td>WA, Sec. 2.4, 2.5</td>
<td>IHW1</td>
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<td>4</td>
<td>Feb. 3</td>
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<td>Spreadsheet Models 3</td>
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<td>5</td>
<td>Feb. 5</td>
<td>Wed</td>
<td>Spreadsheet Models - wrap-up Introduction to Optimization</td>
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<td>IHW2</td>
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<td>6</td>
<td>Feb. 10</td>
<td>Mon</td>
<td>Linear Programming 1</td>
<td>WA, Sec. 3.1 to 3.3, 3.5 Case 3.1 Shelby Shelving</td>
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<td>7</td>
<td>Feb. 12</td>
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<td>Linear Programming 2</td>
<td>WA, Sec. 3.4, 3.6, 3.7</td>
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<td>Other LP Models 1</td>
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<td>Other LP Models 2</td>
<td>WA, Sec. 4.3, 4.7</td>
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<td>Feb. 24</td>
<td>Mon</td>
<td>Linear Programming -- wrap-up</td>
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<td>11</td>
<td>Feb. 26</td>
<td>Wed</td>
<td>TEST 1 ¹ (7 to 9 p.m., Room TBA)</td>
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<tr>
<td>12</td>
<td>Mar. 2</td>
<td>Mon</td>
<td>Case discussion ³ Intro to Network Optimization</td>
<td>Case to be announced</td>
<td>GHW1</td>
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<tr>
<td>13</td>
<td>Mar. 2</td>
<td>Wed</td>
<td>Network Models 1</td>
<td>WA, Sec. 5.1 to 5.3</td>
<td>IHW5</td>
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<td>Mar. 9</td>
<td>Mon</td>
<td>Network Models 2</td>
<td>WA, Sec. 5.4, 5.5</td>
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<td>15</td>
<td>Mar. 11</td>
<td>Wed</td>
<td>TBA</td>
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Mar. 16 - 21 SPRING BREAK
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<td>Mar. 23</td>
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<td>Network Models 3</td>
<td>WA, Sec. 15.1, 15.2</td>
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<td>17</td>
<td>Mar. 25</td>
<td>Wed</td>
<td>Integer Optimization 1</td>
<td>WA, Sec. 6.1 to 6.3</td>
<td>IHW7</td>
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<td>Mar. 30</td>
<td>Mon</td>
<td>Integer Optimization 2</td>
<td>WA, Sec. 6.4, 6.5</td>
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<td>19</td>
<td>Apr. 1</td>
<td>Wed</td>
<td>Case discussion ³ Integer Optimization -- wrap-up</td>
<td>Case to be announced</td>
<td>GHW2, IHW8</td>
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<td>20</td>
<td>Apr. 6</td>
<td>Mon</td>
<td>Non-linear Optimization 1</td>
<td>WA, Sec. 7.1 to 7.3</td>
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<td>21</td>
<td>Apr. 8</td>
<td>Wed</td>
<td>TEST 2 * (7 to 9 p.m., Room TBA)</td>
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<td>22</td>
<td>Apr. 13</td>
<td>Mon</td>
<td>Non-linear Optimization 2</td>
<td>WA, Sec. 7.4</td>
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<tr>
<td>23</td>
<td>Apr. 15</td>
<td>Wed</td>
<td>Non-linear Optimization 3</td>
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<td>IHW9</td>
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<td>24</td>
<td>Apr. 20</td>
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<td>Modeling Randomness</td>
<td>WA, Sec. 10.1, 10.2, 10.5</td>
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<td>25</td>
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<td>Simulation</td>
<td>WA, Sec. 10.3 to 10.5</td>
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<td>26</td>
<td>Apr. 27</td>
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<td>Queueing Models 1</td>
<td>WA, Sec. 13.1 to 13.4</td>
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<tr>
<td>27</td>
<td>Apr. 29</td>
<td>Wed</td>
<td>Queueing Models 2 Discrete-event Simulation</td>
<td>WA, Sec. 13.5, 13.6</td>
<td>IHW11</td>
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<td>28</td>
<td>May 4</td>
<td>Mon</td>
<td>Stochastic Models - wrap-up Course Review</td>
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<tr>
<td>29</td>
<td>May 6</td>
<td>Wed</td>
<td>TEST 3 * (7 to 9 p.m., Room TBA)</td>
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* All tests are in the evening, starting at 7 p.m.  Q&A session will be held during regular class time on test dates

¹ WA = Winston-Albright “Practical Management Science”

² IHW = Individual Homework, GHW = Group Homework.  All HW to be submitted via Canvas

³ Case discussion and related GHW assignment are tentative