Optimization is used in virtually all business decisions!

COURSE OBJECTIVES

The course will teach students how to convert data into models, and most importantly, how to use the models to make effective decisions through optimization. Students will learn about optimization concepts and tools, and see how it can be applied to a broad range of applications. The class will provide students with extensive hand-on optimization practices.

KEY CONCEPTS

- Linear programming (LP)
- Shadow prices
- LP under uncertainty
- Multi-period LP
- Nonlinear programming
- Integer programming
- Dynamic optimization over time
- Applications of optimization in aviation, supply chain, manufacturing, finance, and retail

WHY TAKE THIS COURSE?

This course is designed for students who wish to go beyond the standard business analytics course! You will learn about “getting an edge” -- how to make effective decisions using data and models through optimization. The skills and tools learned in this course will give you a unique analytics and competitive edge, and they can be applied to a broad range of careers, including finance, consulting, marketing, operations, and technology.

COURSE DESCRIPTION

You will learn how to build models from data, and how to translate these models into effective decisions through optimization, providing you with a unique analytics and competitive edge. We will study four modules:

- Framework for effective decision-making
- Dealing with uncertainty: Fundamentals of probability
- From data to models: Building blocks of optimization
- Putting everything together: Effective decisions through optimization.
Contact Information

Instructor: Paat Rusmevichientong

Course E-mail: paat.dso570@gmail.com Note: θ is the number zero, and o is the letter. To ensure a quick response, please send your questions about the course to paat.dso570@gmail.com

Office Hours: In-Person and Online: Tuesday 11am – 4pm @ BRI 400F

The Zoom link for office hours is available on Blackboard

Note: I want to accommodate as many students as possible, so I would be happy to hold additional office hours based on the students’ requests.

Class Schedule: Monday and Wednesday 5 – 6:20pm @ JKP 102

Course Description:

Companies routinely collect large volumes of data on customer profiles, point of sales transactions, and operating performance at different units. How can companies use these data to make effective decisions? How do organizations covert these data into business intelligence and insights? This course will give you the tools and methods to answer these questions, providing you with a unique analytics edge in an increasingly data-centric global business environment.

The goal of this course is to teach students how to build sophisticated models from raw data, and how to translate these models to make effective business decisions. Specifically, we will study the following modules:

- Framework for effective decision-making under uncertainty
- Fundamentals of discrete and continuous probability
- Putting everything together: Effective decisions under uncertainty through optimization

Prerequisites: Students are assumed to have taken a basic course in statistics such as GSBA 524. Every student is assumed to have access to and be able to use regularly, efficiently, and effectively a word processor, e-mail, a web browser, and a spreadsheet software package.

**Instructional Methods:** The class will consist of lectures and case-based discussion. The lecture notes in PowerPoint will summarize all of the theory and concepts needed for this class. The lecture notes will be posted on Blackboard.

**Grading:** The course grade, which will be curved, is based on a midterm, a cumulative final exam, homework assignments, case analysis, and class participation according to the following weights:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Class Participation</td>
<td>10%</td>
</tr>
<tr>
<td>Assignments</td>
<td>50%</td>
</tr>
<tr>
<td>Exams (Midterm and Final)</td>
<td>40%</td>
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</tbody>
</table>

*Class Participation:* It is very important for each student to actively participate in the class discussion. Read the assigned material before the class and make sure you are familiar with the main issues to be discussed in class. You will be cold-called. Your participation is evaluated mainly on the quality of your contribution and insights. I will make every effort to call on as many students who wish to speak up as possible.

*Assignments:* During the course, you will be given 6 assignments. The assignment with the lowest score will be dropped. Students must complete the assigned readings, homework assignments, and case studies prior to coming to class. Assignments are due on the indicated due date before the start of the class and no late work will be accepted. You can work on the cases and assignments individually or in a team. Each team will consist of at most 2 students. Three of the assignments (Assignments #2, #3, and #4) will involve case questions. On these assignments, I will ask students to present their results to the class.

*Exams:* We have two exams in the course: a midterm and a final exam. We will give more weight to the exam with the higher score. The overall score for the exam will be computed based on the following formula:

\[(80\% \times \text{maximum score among the two exams}) + (20\% \times \text{minimum score among the two exams})\]

**Academic Conduct**
Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” [https://policy.usc.edu/scampus-part-b/](https://policy.usc.edu/scampus-part-b/). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, [http://policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

**Support Systems**
Students whose primary language is not English should check with the American Language Institute [http://dornsife.usc.edu/ali](http://dornsife.usc.edu/ali), which sponsors courses and workshops specifically for international graduate students.

*Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call*
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. [https://engemannshc.usc.edu/counseling/](https://engemannshc.usc.edu/counseling/)

*National Suicide Prevention Lifeline - 1-800-273-8255*
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. [http://www.suicidepreventionlifeline.org](http://www.suicidepreventionlifeline.org)

*Relationship & Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call*
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. [https://engemannshc.usc.edu/rsvp/](https://engemannshc.usc.edu/rsvp/)
Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: http://sarc.usc.edu/

Office of Equity and Diversity (OED)/Title IX compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. https://equity.usc.edu/

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. https://studentaffairs.usc.edu/bias-assessment-response-support/

Student Support & Advocacy – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. https://studentaffairs.usc.edu/ssa/

Diversity at USC
Tabs for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, Resources for Students. https://diversity.usc.edu/

USC Emergency Information
Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime. Provides overall safety to USC community. dps.usc.edu

Students with Disabilities
USC is committed to making reasonable accommodations to assist individuals with disabilities in reaching their academic potential. If you have a disability which may impact your performance, attendance, or grades in this course and require accommodations, you must first register with the Office of Disability Services and Programs (www.usc.edu/disability). DSP provides certification for students with disabilities and helps arrange the relevant accommodations. Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in GFS (Grace Ford Salvatori Hall) 120 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776. Email: ability@usc.edu.

Course Disclaimer
This syllabus is an invitation to students to engage in an exciting and interactive study of operations management. The intention of the instructor is to provide you with information, offer practice with skill sets, and enhance your capacity to use fundamental concepts to build your repertoire of analytics tools and make sound decisions. The learning environment will be collaborative and supportive; we will learn from one another both in and out of the classroom. To that end, modifications to this syllabus might be warranted as determined by the instructors as we assess the learning needs of this particular class of students. In addition, class participation grade is under the sole discretion of the instructor.
COURSE OUTLINE

Session 1 – 1/9/23 (Monday): Course overview  
**Question:** What is optimization? Why do we need it?  
**Learning outcomes:** You will discover a broad range of business applications where optimization models are applicable. We will also introduce a framework for effective decision-making and the Chocolate Game.  
- Define and recognize opportunities for optimization in business situations  
- Understand how we can use data to develop good models that drive effective decision-making  
- Recognize and formulate decision problems  
**Required reading:** Chapters 1.1 - 1.3 in the textbook

Session 2 – 1/11/23 (Wednesday): Introduction to linear programming and the NBT problem  
**Question:** What is a linear program?  
**Learning outcomes:** You will be able to formulate a linear program (LP) and solve small LP problems using Excel Solver.  
- Understand the components of a linear program  
- Formulate linear programs and solve it using Excel solver  
**Required reading:** Chapters 7.1 – 7.4 in the textbook

Session 3 – 1/16/23 (Monday): NO CLASS --- Martin Luther King’s Birthday

Session 4 – 1/18/23 (Wednesday): The Chocolate Game and introduction to refinery optimization  
**Question:** How can firms make effective decisions over time? How can linear program be used in oil refinery optimization?  
**Learning outcomes:** Through the Chocolate Game simulation, you will experience firsthand the challenge of making effective decisions over time. Introduce the concept of a policy. We will introduce how linear program can be used to optimize the refinery operations.  
- Understand the challenge of making decisions over time  
- Recognize how linear programs can be use to help oil refineries optimize their operations  
**Required reading:** Handout on the LP Refinery problem on Blackboard

Session 5 – 1/23/23 (Wednesday): Application of LP to refinery optimization  
**Question:** An oil refinery firm needs to decide how much of crude oil to distill, reform, crack, and blend to create different types of fuels. Given the complexity of the refinery process, how can we use the LP formulation to determine the optimal operations for the refinery?  
**Learning outcomes:** You will acquire a hand-on experience in formulating a complex LP to maximize profitability, using actual data from a business operations.  
- Formulate complex LP to optimize business operations  
- Structure complex LP in Excel  
- Interpret the Excel outputs for business insights  
- Application of LP to refinery optimization  
**Required reading:** Handout on the LP Refinery problem on Blackboard

** 1/25/23: Assignment #1 is due. **
Session 6 – 1/25/23 (Wednesday): Introduction to sensitivity analysis

**Question:** Can we use the LP techniques to solve real business problems? What are the typical business problems where LP techniques can be applied? How does the objective value of a linear program change with the problem parameters?

**Learning outcomes:** You will practice more advanced LP formulation and learn how to use the sensitivity report, which shows how the solutions change if the conditions vary.

- Understand the impact of changes in the problem’s parameters

**Required reading:** Chapters 7.5 – 7.6 in the textbook

Session 7 – 1/30/23 (Monday): Geometry of LP, shadow prices, and sensitivity analysis

**Question:** What is the geometry of LP? What are shadow prices? How can we interpret the sensitivity report from Excel Solver?

**Learning outcomes:** You will learn the geometry of linear program, understand the concept of shadow prices, and learn how to interpret the sensitivity report generated by Excel Solver

**Required reading:** Chapters 7.5 – 7.6 in the textbook

Session 8 – 2/1/23 (Wednesday): Multi-period LP formulation: Using OpenSolver to deal with many decision variables

**Question:** How can we use LP to develop an optimal production schedule that involves thousands of variables? How to extend the capability of Excel Solver through OpenSolver add-in package?

**Learning outcomes:** You will learn about the multi-period LP formulation and how to handle LPs with large number of variables. The lecture will also introduce OpenSolver, which is a powerful open-source optimizer that extends the capability of the Excel Solver.

- Formulate the multi-period LP for production scheduling
- Structure the multi-period LP in Excel
- Use OpenSolver to address large-scale optimization problems with many variables

**Required reading:** Handout on the Factory Planning problem on Blackboard

Session 9 – 2/6/23 (Monday): LP under uncertainty

**Question:** How to formulate LP when there is an underlying uncertainty? How to extend a LP to allow for multi-period decision-making?

**Learning outcomes:** You will learn how to formulate a two-stage LP, and apply the formulation to multi-stage decision-making problems. You will learn how the concept of probability distributions from Session #5 can be incorporated into a linear optimization problem.

- Recognize linear optimization problems where there is an underlying uncertainty
- Understand how to formulate multi-period decision-making as a two-stage LP

**Required reading:** Chapter 7.7 in the textbook

**2/8/23: Assignment #2 (Westvaco) is due before the class starts.** Please upload your work through Blackboard before the class starts. Case description and case questions are available on blackboard. Please answer all the case questions. **

Session 10 – 2/8/23 (Wednesday): Westvaco Case presentation by students

**Question:** How can Westvaco use linear program to minimize the total cost of assigning truckloads to carriers while meeting all the strategic constraints?
**Learning outcomes:** You will learn how to formulate linear program to help companies optimize their logistic operations. You will learn about outputs of LP and sensitivity report can be used to help in setting prices, determining capacity expansion, and evaluating strategic acquisition opportunities.

- Formulate an LP for a logistic problem
- Use sensitivity report to analyze business opportunities

**Session 11 – 2/13/23 (Monday):** Introduction to nonlinear programming (NLP)

**Question:** What is a nonlinear programming problem? What are potential applications?

**Learning outcomes:** You will learn about NLP and its applications to portfolio optimization.

- Recognize nonlinear optimization problems
- Formulate the portfolio problem as a nonlinear optimization problem
- Learn how to use Excel Solver to solve general nonlinear optimization problems

**Required reading:** Chapters 8.1 – 8.3 in the textbook

**Session 12 – 2/15/23 (Wednesday):** Additional applications and Geometry of NLP

**Question:** What are additional applications of NLP? What is a Lagrange multiplier in NLP? How do we interpret the sensitivity report under NLP? What is the geometry of NLP? How do we visualize NLP?

**Learning outcomes:** You will learn about the geometry and additional applications of NLP. We will discuss graphical analysis of nonlinear optimization problem and review solution methods based on Solver.

- Analyze simple nonlinear optimization problems using graphical methods
- Understand the outputs of the Solver and provide appropriate interpretation

**Required reading:** Chapter 8.5 in the textbook

**Session 13 – 2/20/23 (Monday):** NO CLASS --- President’s Day

** 2/22/23: Assignment #3 (Endurance Investor Case) is due before the class starts.** Please upload your work through Blackboard before the class starts. Case description and questions are on pages 436 – 442 in the textbook and they are also available on Blackboard. Please answers all questions. **

**Session 14 – 2/22/23 (Wednesday):** Endurance Investor case presentation by students

**Question:** How can we use nonlinear optimization problem to determine the optimal portfolio allocation?

**Learning outcomes:** You will learn how NLP can be used to formulate the portfolio allocation optimization problem? You will learn how to incorporate transaction costs as constraints in the NLP.

- Formulate NLP for portfolio optimization
- Understand how variance of a portfolio is computed
- Translate transaction costs into constraints in the NLP

**NOTE:** I will have extra office hours on Monday (2/28), Tuesday (3/1) and Wednesday (3/2) to help with the midterm preparation.

**Session 15 – 2/27/23 (Monday):** Review for Midterm

**Session 16 – 3/1/23 (Wednesday):** Midterm
Session 17 – 3/6/23 (Monday): Introduction to discrete optimization

*Question:* Can we apply optimization tools when the decision variables are not divisible?

*Learning outcomes:* Optimization is more than linear and nonlinear programming. The firms cannot hire half of a person or fly a quarter of an airplane. You will be able to formulate an integer program (IP) and solve small IP problems using Excel Solver.

- Understand the components of an integer program
- Formulate an integer program and solve it using Excel solver
- Understand how to use binary decision variables to model constraints in integer programming

*Required reading:* Chapters 9.1 – 9.2 in the textbook

Session 18 – 3/8/23 (Wednesday): Strategic relocation problem

*Question:* How to identify problems that can be solved using IP? How to use IP to solve the strategic relocation problem?

*Learning outcomes:* You will learn about additional applications of IP, including locating shelters, matching, and scheduling.

- Identify problems that can be formulated as an IP
- Convert business problems into an IP using appropriate variables
- Create a model for the strategic relocation problem using IP

*Required reading:* Chapters 9.3 in the textbook

**Spring Break: 3/12/23 – 3/19/23**

Session 19 – 3/20/23 (Monday): Applications of discrete optimization in logistics

*Question:* How can we use IP in logistics problems?

*Learning outcomes:* You will have an opportunity to formulate a large-scaled IP for a logistic problem based on an actual business operation of a firm.

- Learn about the traveling salesman problem (TSP)
- Understand how to formulate the TSP and its variants

*Required reading:* Handout on the Logistics problem on Blackboard

Session 20 – 3/22/23 (Wednesday): Wrap-up discrete optimization in logistics

*Question:* How can we use subtour elimination in the traveling salesman problem?

*Learning outcomes:* You understand how to add valid inequalities to rule out infeasible solutions and implement the large-scaled IP for a logistic problem using Excel

*Required reading:* Handout on the Logistics problem on Blackboard

Session 21 – 3/27/23 (Monday): Discrete optimization in corporate restructuring

*Question:* How can we use discrete optimization to help with corporate restructuring?

*Learning outcomes:* The International Industries, Inc. Case is a nice application of discrete optimization in strategic planning. It demonstrates the value of discrete optimization in finding a good investment strategy. You will have an opportunity to apply integer programming to an actual business problem.

- Learn how to formulate strategic decisions in terms of discrete optimization problems
- Set up the spreadsheet for complex integer programs.

*Required reading:* The International Industries, Inc. Case on pages 471 – 473 in the textbook
** 3/29/23: Assignment #4 (AirMart Case) is due before the class starts. Please upload your work through Blackboard before the class starts. Case description and questions are available on Blackboard. Please answer all the case questions. **

Session 22 – 3/29/23 (Wednesday): AirMart case presentation by students
Question: How can AirMart Inc. use IP to optimize their supply chain network and fulfillment operations?
Learning outcomes: You will formulate an IP to help companies optimize their supply chain network, determine the optimal fulfillment strategy.
• Formulate an LP for an inventory and transportation problem
• Translate the fixed cost requirement into a constraint in the IP

Session 23 – 4/3/23 (Monday): Solving Sudoku using discrete optimization
Question: How can we use discrete optimization to solve the game of Sudoku and its variants?
Learning outcomes: You will learn how to formulate a discrete optimization model to solve the classical game of Sudoku and its variants. This is a great opportunity to learn how translate constraints into the mathematical language of optimization.
Required reading: The Sudoku problem handout.

Session 24 – 4/5/23 (Monday): Branch-and-bound method
Question: What is a branch-and-bound method? How can we use it to solve discrete optimization problems?
Learning outcomes: Branch-and-bound method is one of the most commonly used techniques for solving discrete optimization problems. You will learn the underlying principle of the method.
• Understand the branch-and-bound method and its connection to linear programs
• Understand how the branch-and-bound method allows us to determine the optimality gap
• Be aware of the pitfalls and issues associated with the method
Required reading: Chapter 9.4 in the textbook

Session 25 – 4/10/23 (Monday): Introduction to dynamic optimization
Question: What is a dynamic optimization? What are the important features of such problems?
Learning outcomes: Many business problems require a multi-period optimization framework. How to recognize such problems? What are the important features of these problems?
• Recognize a dynamic optimization problem
• Understand the principle for solving such problems.
• Understand the concept of value function and the dynamic programming formulation

** 4/12/23: Assignment #5 is due. **

Session 26 – 4/12/23 (Wednesday): Solving the Chocolate Game problem
Question: How can we implement dynamic programming and solve the dynamic optimization problem in Excel?
Learning outcomes: You will learn about the value function and how it can be used to solve the dynamic programming equation. You will also implement dynamic programming on Excel
• Understand the concept of value function
• Solve for the value function in Excel for the Chocolate Game from Session #1.
Required reading: Note on the Chocolate Game problem on Blackboard
Session 27 – 4/17/23 (Monday): Additional applications of dynamic programming

*Question:* What are additional applications of dynamic programming?

*Learning outcomes:* You will learn about the variety of applications that can be formulated as a multi-period optimization problem and the associated dynamic programming equation.

- Recognize the variety of problems that can be formulated using dynamic programming
- Be able to write the dynamic programming equations for these problems

Session 28 – 4/19/23 (Wednesday): Applications of dynamic optimization to retail pricing

*Question:* How should a retailer set the price of its products over time in face of random demands, in order to maximize the total profit over an entire selling season?

*Learning outcomes:* In this session, we will discuss an application of dynamic optimization to retail pricing. We will show how to formulate the business problem as a dynamic program.

- Apply dynamic programming framework to a problem in retail industry
- Recognize other applications of dynamic optimization

Session 29 – 4/24/23 (Monday): Applications of management science tools to Money Tree Mortgage.

*Question:* Putting everything together. We will demonstrate how can we use all of the tools in the course to analyze a business case related to mortgage investments.

*Learning outcomes:* We will discuss applications of management science models and tools to a business case involving mortgage lending.

- Learn how an actual business problem requires all of the tools and models covered in this class.
- Recognize how to use optimization models in actual business problems.

** 4/26/23: Assignment #6 is due. **

Session 30 – 4/26/23 (Wednesday): Review for the Final Exam

Following the university schedule, the final exam is on

**Wednesday, May 3, 4:30 – 6:30pm**

No early finals are allowed by University policy.

A summary of the class schedule and due dates are given on the next two pages.
## Summary of the Schedule of Classes

<table>
<thead>
<tr>
<th>Week</th>
<th>Session</th>
<th>Date</th>
<th>Topics and Instructional Methods</th>
<th>Activities to Complete before Coming to Class and Assignments Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>01</td>
<td>M 01/09</td>
<td>Course overview and introduction to the Chocolate Game</td>
<td>Please complete the course survey and submit your bid for the chocolate game by Wednesday (1/12) at 8pm.</td>
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<tr>
<td></td>
<td>02</td>
<td>W 01/11</td>
<td>Intro to linear programming (LP): The NBT Problem</td>
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<tr>
<td>2</td>
<td>03</td>
<td>M 01/16</td>
<td>NO CLASS --- Martin Luther King’s Birthday</td>
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<tr>
<td></td>
<td>04</td>
<td>W 01/18</td>
<td>Play the Chocolate Game. Intro to refinery optimization</td>
<td>Study the refinery problem before coming to class</td>
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<tr>
<td>3</td>
<td>05</td>
<td>M 01/23</td>
<td>Refinery optimization wrap-up</td>
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<td>06</td>
<td>W 01/25</td>
<td>Xtreme Sands Inc. Introduction to sensitivity analysis.</td>
<td>Assignment #1 is due</td>
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<tr>
<td>4</td>
<td>07</td>
<td>M 01/30</td>
<td>Geometry of LP, shadow prices, and sensitivity analysis</td>
<td>Study the factory planning problem before coming to class</td>
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<tr>
<td></td>
<td>08</td>
<td>W 02/01</td>
<td>Multi-period LP: Using OpenSolver to deal with a large number of decision variables</td>
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<td>5</td>
<td>09</td>
<td>M 02/06</td>
<td>LP under uncertainty</td>
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<td>10</td>
<td>W 02/08</td>
<td>Case Presentation by students (Westvaco)</td>
<td>Assignment #2 (Westvaco Case) is due</td>
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<tr>
<td>6</td>
<td>11</td>
<td>M 02/13</td>
<td>Introduction to nonlinear programming (NLP)</td>
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<td></td>
<td>12</td>
<td>W 02/15</td>
<td>Additional applications and geometry of NLP</td>
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<td>7</td>
<td>13</td>
<td>M 02/20</td>
<td>NO CLASS --- President’s Day</td>
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<td>14</td>
<td>W 02/22</td>
<td>Case Presentation by students (Endurance Investor)</td>
<td>Assignment #3 (Endurance Investor Case) is due</td>
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<td>8</td>
<td>15</td>
<td>M 02/27</td>
<td>Review for Midterm</td>
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<td>16</td>
<td>W 03/01</td>
<td>Midterm Exam</td>
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<td>9</td>
<td>17</td>
<td>M 03/06</td>
<td>Introduction to discrete optimization (DO)</td>
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<td>18</td>
<td>W 03/08</td>
<td>Strategic relocation problem</td>
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<tr>
<td>Date</td>
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<td>Activity</td>
<td>Notes</td>
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<td>M 03/20</td>
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<td>W 03/22</td>
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<td>Wrap-up DO in logistics</td>
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<td>M 03/27</td>
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<td>DO in corporate restructuring</td>
<td>Study the International Industries problem before coming to class</td>
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<tr>
<td>W 03/29</td>
<td>22</td>
<td>Case Presentation by students (AirMart)</td>
<td>Assignment #4 (AirMart Case) is due</td>
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<tr>
<td>M 04/03</td>
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<td>Branch-and-bound method</td>
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<td>W 04/12</td>
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<td>Solving the Chocolate Game Problem</td>
<td>Assignment #5 is due</td>
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<tr>
<td>M 04/17</td>
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<td>Additional applications of dynamic optimization</td>
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<tr>
<td>W 04/26</td>
<td>30</td>
<td>Review for final exam</td>
<td>Assignment #6 is due</td>
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Final Exam: Wednesday, May 3, 4:30 – 6:30pm