Course Description: The Management Science Workshop focuses on quantitative techniques from management science relevant to applied economics and agribusiness management problems, emphasizing applications of linear and nonlinear programming to decision problems of firms and other organizations. The economic foundations of the models and the economic interpretations of their solutions are emphasized. Specific topics include production planning, logistics, scheduling, inventory management, and network models. The course will employ active learning techniques through the use of in-class, small group, model-building exercises and discussions. Students will develop advanced Excel skills, including the use of the Solver add-in and other more-specialized optimization modeling software. Two credits.

This workshop is for students interested in business management and students who want to develop quantitative skills relevant to policy analysis and organizational planning. Thus, the course would be of broad interest to students in Applied Economics, Agricultural and Food Business Management, and other majors. The prerequisite for the workshop is ApEc 3001: Applied Microeconomics – Consumers, Producers and Markets; an equivalent course; or the consent of the instructor.

Course Workload: The course will meet March 19 – May 4. 4.5 hours/week lecture, active learning and discussion. 7-8 hours per week reading, model-building and report-writing. 40-50 pages/week of reading and weekly assignments. Midterm and final examinations.

Objectives:
- To develop a thorough understanding of the concepts of optimization and other management science tools
- To become proficient in the application of optimization techniques to managerial and policy problems using Excel and the Excel Solver
- To develop problem definition and analysis skills
- To become effective in interpreting and communicating the results of optimization analyses

Instructor:
Jeffrey Apland, 332c Ruttan Hall
Email: japland@umn.edu Phone: 625-1353;

References: Optimization Modeling with Spreadsheets by Kenneth R. Baker is the required textbook. Third Edition. Wiley. 2016. Additional readings will be announced during the semester. Other books that cover topics in this workshop as well as other management science topics are listed below.


Grading: Final grades will be determined by the scale in the table below, based on the weighted average of scores on assignments, in-class exercises and participation, and examinations. The weight will be applied to the score as a percentage of possible points on each item. The total weight for assignments is 30%, and the total weight for in-class exercises and participation will be 30%. The weights for the midterm and final examination are 20% for each.

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<tr>
<th>Weighted Ave</th>
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<tbody>
<tr>
<td>93.0-100</td>
<td>A</td>
<td>80.0-82.9</td>
<td>B-</td>
<td>67.0-69.9</td>
<td>D+</td>
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<tr>
<td>90.0-92.9</td>
<td>A-</td>
<td>77.0-79.9</td>
<td>C+</td>
<td>60.0-66.9</td>
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<tr>
<td>87.0-89.9</td>
<td>B+</td>
<td>73.0-76.9</td>
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<td>0-59.9</td>
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<td>83.0-86.9</td>
<td>B</td>
<td>70.0-72.9</td>
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Unless otherwise noted, assignments must be turned in at the beginning of class on the due date. Except in cases of a valid health or family-related excuse, credit for late assignments will be reduced by ten percent per day. Late assignments will not be accepted after the assignment has been graded and returned or the answers have been discussed in class. In-class individual and small group exercises will be credited during class or collected the same day, and absences will be excused only after documented proof of illness or emergency is provided. Make-up examinations will be given only after documented proof of illness or emergency is submitted.

Under the S/N grade base, an S is equivalent to a C- or better. For answers to frequently asked questions about grades and grade policies, go to Student One Stop.

Student Learning Outcomes: The University of Minnesota – Twin Cities has developed the following set of student learning outcomes that define what students will be able to do when they have completed any undergraduate degree, regardless of major:

• Can identify, define, and solve problems
• Can locate and critically evaluate information
• Have mastered a body of knowledge and a mode of inquiry
• Understand diverse philosophies and cultures within and across societies
• Can communicate effectively
• Understand the role of creativity, innovation, discovery, and expression across disciplines
• Have acquired skills for effective citizenship and life-long learning.

While all seven of these learning outcomes are addressed in ApEc 3xxx, the course emphasizes the learning outcomes listed above in bold type.

Students with disabilities that affect their ability to participate fully in class or to meet all course requirements are encouraged to bring this to the attention of the instructor so that appropriate accommodations can be arranged. Further information is available from Disabilities Resources (180 McNamara).

University policy prohibits sexual harassment as defined in the December 1998 policy statement, available at the Office of Equal Opportunity and Affirmative Action. Questions or concerns about sexual harassment should be directed to this office, located in 274 McNamara.

For assistance with any University-based conflicts or complaints, please contact the Student Conflict Resolution Center at sos@umn.edu or call 612.624.7272.
Course Outline:

A. Introduction to Management Science
   1. Overview of Management Science
   2. What is an Economic Model?
   3. Optimization Models in Economics
   4. Optimization with Spreadsheets and Other Software
   Reference for Section A: Chapter 1; Baker.

B. Introduction to Linear Programming Concepts
   1. Parts of a Linear Program and Its Solution
   2. Graphical Analysis of Linear Programs
   3. Solving Linear Programs with the Excel Solver
   4. Sensitivity Analysis in Linear Programming
   5. A Glimpse Forward at Nonlinear Programming
   Reference for Section B: Chapter 2 and Appendix 2; Baker.

C. Applications of Linear Programming I
   1. Allocation Problems
   2. Covering Problems
   3. Blending Problems
   4. Summarizing Solutions to Linear Programs
   5. Modeling Errors in LP
   Reference for Section C: Chapter 2; Baker.

D. Production Economics and Applied Linear Programming
   1. Modeling Technology, Resource Availability and Markets
   2. The Factor-Factor Model
   3. The Product-Product Model
   4. Cost of Production

E. Network Models in LP
   1. The Transportation Model
      a. Single Mode Transportation Problems Without Capacity Constraints
      b. Capacitated and Multi-Mode Transportation Problems
   2. The Assignment Model
   3. The Transshipment Model
   4. Multi-Plant Planning Problems with Logistics
   5. Other Network Models
   Reference for Section E: Chapter 3; Baker.
F. Sensitivity Analysis in Linear Programming
   1. Parameter Analysis
   2. The Sensitivity Report and Ranging
   3. Degeneracy and Alternative Optima
   4. Patterns in Linear Programming Solutions
   Reference for Section F: Chapter 4; Baker.

G. Data Envelopment Analysis (DEA) With Linear Programming
   1. Graphical and Algebraic Interpretations of DEA
   2. Examples of DEA
   3. Indexing
   Reference for Section G: Chapter 5; Baker.

H. Integer Programming Applications
   1. A Graphical Interpretation of Integer Programming
   2. Solving Integer Programs
   3. Integer Programming With the Excel Solver
   4. Applications of Integer Programming
      a. Project Analysis and Capital Budgeting
      b. Fixed Cost Problems
      c. Facility Location
   Reference for Section H: Chapters 6 and 7; Baker.

I. Extensions of the Linear Programming Models
   1. Multi-Period Decision Problems
   2. Non-Linear Programming Problems
   Reference for Section I: TBA.