Optimization Analytics
ISE 5970
Fall 2016-Onlne Course

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Office hours: Monday and Wednesday, 2:00p-3:00 pm

Textbooks

Other course material
Interfaces, a bimonthly journal of the Institute for Operations Research and the Management Sciences (INFORMS) focusing on the practice and implementation of analytics in commerce, industry, government, education, etc.

Course description
Advanced computing technology along with the state-of-the-art optimization methods enable us to quickly solve many classes of large-scale decision problems. This graduate course will focus on modeling and solving complex real-world problems using commonly available software tools such as Excel Solver and IBM ILOG CPLEX Optimization Studio. Linking the CPLEX library with a C++ project to build and solve optimization problems will be demonstrated. The emphasis of the course is on model formulation of deterministic optimization problems and interpretation of results. The course will cover models that are widely used in diverse industries, including finance, operations, and marketing.

Course Objectives:

1. Develop mathematical models that can be used to improve decision making within an organization.
2. Sharpen the ability to structure problems and to perform logical analyses.
3. Practice translating descriptions of decision problems into formal models, and investigate those models in an organized fashion.
4. Identify settings in which models can be used effectively and apply modeling concepts in practical situations.
5. Strengthen computer skills, focusing on how to use the computer to support decision-making.
6. Recognize the major capabilities and limitations of deterministic operations research modeling as applied to problems in manufacturing industry or government
7. Be able to perform sensitivity analysis in analyzing a system
8. Quantify the cost of constraints
9. Understand of the theory behind the models and the importance of simplifying assumptions. (Linear, integer, network & nonlinear)
10. Build a broader understanding of the types of mathematical models and their appropriate context.

Learning Outcomes:

• Select an OR tool for a particular production/operations management application
• Formulate deterministic optimization models by defining objective, decisions and constraints
• Write symbolic models and implement them using optimization software,
• Do duality analysis and use Excel data table functions to conduct sensitivity analysis
• Read and interpret sensitivity tables and generate simplex tableaus
• Prepare a presentation for a typical application of OR methods

Grading
Percentages of course grading requirements are as follows.
Quizzes.........................5%
Homeworks....................25%
Case studies..............20%
Article review..............10%
Term exam 1 ............ 20%
Final exam .............. 20%

Guidelines for assigning grades: 90% >= A, 80% >= B, 70% >= C, 60% >= D. Grades may be curved at the end of the semester.

Case Study and Homework
Problems will be assigned each week. Homework and case study write-ups are due in a week.

Article Review
The objective of the article review presentations is to allow students to study a wide range of real world applications that rely on analytics and optimization techniques. Each student is required to select and analyze an article from a recent journal (last two years preferably from Interfaces) that describes a practical application of analytics. Each student will make a fifteen-minute online presentation and submit presentation slides and a one-page outline of comments, observations and lessons learned that are to be appended to the presentation material to be turned in.

Presentation 8-10 slides

1-2 Problem Context
3-4 Model Structure or Content in words (no mathematical formula)
- Decision Variables, Objectives, Constraints
- Planning Horizon
- System Scope

5-6 Model Usage
- What issues did it address?
- Who were the model users?
- What was its impact?

7 Implementation Issues & Concerns if discussed in paper
8-9 Your lessons learned & analogies
10 Future research directions

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<th>Week</th>
<th>Topic</th>
<th>Notes</th>
<th>HW &amp; Case Studies (assigned dates)</th>
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<td>Orientation &amp; Introduction</td>
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<td>29-Aug</td>
<td>Management Science</td>
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<td>5-Sep</td>
<td>LP Model Formulation &amp; Graphical Solution</td>
<td>Article selection from course resources</td>
<td>HW1</td>
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<td>Labor Day</td>
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<td>12-Sep</td>
<td>LP Solver and Sensitivity Analysis</td>
<td>Interfaces presentation dates</td>
<td>HW2 &amp; Case 1</td>
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<td>19-Sep</td>
<td>Linear Programming Examples</td>
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<td>26-Sep</td>
<td>Large scale optimization</td>
<td>Interfaces 1, 2</td>
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<td>3-Oct</td>
<td>CPLEX OPL &amp; C++ CPLEX Optimizer &amp; C++</td>
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<td>HW3</td>
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<td>10-Oct</td>
<td>Integer Programming</td>
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<td>17-Oct</td>
<td>Branch-and-Bound Method</td>
<td>Interfaces 5, 6</td>
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<td>24-Oct</td>
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<td>31-Oct</td>
<td>Network Flow</td>
<td>Interfaces 8, 9</td>
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<td>7-Nov</td>
<td>Multicriteria Decision Making</td>
<td>Interfaces 10, 11</td>
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<td>14-Nov</td>
<td>Non-linear Optimization</td>
<td>Interfaces 11, 12</td>
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<td>21-Nov</td>
<td>Decision Analysis</td>
<td>Interfaces 13, 14</td>
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<td>Thanksgiving</td>
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<td>28-Nov</td>
<td>Queuing Analysis</td>
<td>Interfaces 15, 16</td>
<td>Case 5</td>
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5-Dec  | Game Theory
12-Dec | Final Exam

**Academic honesty**
Cheating, plagiarism, or any act of dishonesty will NOT be tolerated. This policy applies to all parties involved in the incident. Never take credit for anyone else’s intellectual property, be it on an exam or homework assignment. This includes, but is not limited to, copying from another student’s paper, copying from a paper from a previous semester, using forbidden information on exams, and copying from published writings. Students are responsible for knowing the requirements of the Academic Misconduct Code at the University of Oklahoma, available at [http://integrity.ou.edu/](http://integrity.ou.edu/).

**Participation**
Since this is a fully online class, you are expected to view all videos and complete all reading assignments. Also, you will be expected to participate in online discussions and attempt all Self-Check Quizzes.

**Reasonable accommodation policy**
Students requiring academic accommodation should contact the Disability Resource Center for assistance at (405) 325-3852 or TDD: (405) 325-4173. For more information, please see the Disability Resource Center website [http://www.ou.edu/drc/home.html](http://www.ou.edu/drc/home.html). Any student in this course who has a disability that may prevent him/her from fully demonstrating his/her abilities should contact me personally as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate your educational opportunities.

**Title IX Resources and Reporting Requirement**
For any concerns regarding gender-based discrimination, sexual harassment, sexual misconduct, stalking, or intimate partner violence, the University offers a variety of resources. Also, please be advised that a professor/GA/TA is required to report instances of sexual harassment, sexual assault, or discrimination to the Sexual Misconduct Office. For more info, please see [http://www.ou.edu/eoo](http://www.ou.edu/eoo).

**Technical Support**
The instructor and teaching assistant will not be able to help with issues related to the Janux platform. Requests for platform assistance should be directed to the NextThought Help Center at [janux@ou.edu](mailto:janux@ou.edu). For OU IT support, please phone (405) 325-HELP.

Students are responsible for any changes/additions to this syllabus announced over the course of the semester.