SCMA 4331&6331 Supply Chain Modeling

Instructor: Haitao Li, PhD Office: 208 ESH
Office Phone: 314-516-5890 Email: lihait@umsl.edu
Office Hours: Thursday 4pm – 5pm or by appointment

Course Overview

Supply chains are complex networks integrating suppliers/vendors, manufacturers, distribution centers, retailers and customers, to enable physical entities (raw materials, parts, components, semi-finished and finished products) to be produced and distributed at the right quantities, to the right locations, and at the right time. Effectively managing a supply chain in today's competitive and globalizing market is a challenging task, and often calls for the application of *Optimization* (also known as *Prescriptive Analytics*).

Our course provides an in-depth coverage on optimization modeling and its application in supply chain and operations management. We will focus primarily on deterministic optimization models and methods including mathematical programming (linear and integer programming), network optimization, constraint programming, and their applications in production planning, MRP, transportation, facility location, supply chain design and vehicle routing, among others.

This class features hands-on learning experience on the state-of-the-art optimization software ILOG OPL Studio, which has been applied by Fortune 500 companies such as IBM, HP, Bayer, etc.

Course Objectives

Students taking the class will be able to:

1. Construct and build various prescriptive optimization models for supply chain optimization problems;
2. Understand the solution methods of an optimization approach;
3. Implement an optimization model and the corresponding solution methods in a state-of-the-art modeling software: the IBM ILOG OPL Studio;
4. Apply optimization modeling approaches for real world applications, present and interpret solutions and recommendation.

Course Format

Course contents and materials will be delivered as class lectures. Since some topics can be mathematically demanding, students' active *in-class* participation and diligent *out-class* work are both expected for success in this class.

Required Textbook

Optimization Modeling for Supply Chain Applications, H. Li, World Scientific Publishing, Singapore, 2023.

Term Project

Students work in teams on a real-world optimization application in supply chains. Each team first identifies and describes the problem to be addressed. A one-page Project Proposal is due within six weeks into the semester. After getting approved by the instructor, the team proceeds to construct mathematical model for the addressed problem, implements the model and solution methods using appropriate modeling software, conducts detailed computational study, and interprets/summarizes results and recommendations. The team presents its project to the entire class. A Project Report (10 to 15 pages with 12 pt font size and 1.5 line spacing) and the OPL code are due in the last week of the semester.

Rubric for Term Project Evaluation

Real World Relevance: 10 points
Rigor of Model Formulation: 20 points
Presentation: 20 points
Analysis and Results: 20 points
Quality of Project Report: 30 points

Exams

Two exams will be given: Midterm and Final. An exam can be either in-class or take-home. Only under special circumstances, such as sickness, work leave or other emergencies, will a make-up exam be given. Proper documents need to be provided (e.g., doctor's prescription, hospital admission notice, employer's letter) for verification purpose.

Use of Computer

The use of a personal computer (PC) is essential for this class. It can be either a desktop or laptop of your own. A laptop is preferred as it can be used in the classroom to facilitate hands-on learning experience on the modeling software.

Grading

Class Participation: 10%
Case Studies and HW Assignments: 20%
Term Project: 35%
Exam: 35%

90 ~ 100	A
80 ~ 90	B
70 ~ 80	C
60 ~ 70	D
Below 60	F

Tentative Schedule

Modules	Dates	Lecture Topics	Assignments
Module I: Model Building in Math Programming	Jan 15 - Jan 28	Module I – 1: Introduction to Math Programming Modeling Module I–2: Building Formulation for Integer Programming	HW-1 due
Module II: Using OPL Studio for Math Programming	Jan 29 - Feb 11	Module II – 1: OPL Studio for Math Programming Module II – 2: OPL Studio Lab Exercises	HW-2 due **Case Study Assigned**
Module III: NETFORM Modeling	Feb 12 – Feb 25	Module III – 1: Introduction to NETFORM Modeling Module III – 2: NETFORM Modeling Extensions	HW-3 due **Term Project Proposal Due**
Module IV: Constraint Programming	Feb 26 – March 10	Module IV – 1: Introduction to Constraint Programming Module IV – 2: Applications of Constraint Programming	HW-4 due
Midterm Exam	March 11 – March 27	**Midterm Exam (Covers Modules I, II, III and IV)**	
Module V: Supply Chain Applications	March 18 – March 24	Module V – 1: Supply Chain Network Design	
Spring Break March 25 – March 31 (No Class)			
Module V: Supply Chain Applications (Cont.)	April 1 – April 7	Module V – 2: Production Planning	HW-5 due
Module VI: Supply Chain Applications (Cont.)	April 8 – April 21	Module VI – 1: Travelling Salesman Problem and Its Variants Module VI – 2: Vehicle Routing Problems	HW-6 due
Module VII: Supply Chain Applications	April 22 – April 28	Module VII: Supply Chain Configuation	
Term Project Help Session	April 29 – May 5	Work on Term Project	**Case Study Due**
Term Project Presentation	May 6 – May 10	**Presentation on May 10**	

Note: While we will try our best to follow the schedule, changes and/or adjustments are expected according to progress of the class.