ESI6314: Deterministic Methods in Operations Research

Fall 2020

Instructor:	Yongpei Guan	**Time:**	08/22/2020 - 12/05/2020
Email:	guan@ise.ufl.edu	**Place:**	Zoom Meetings
Office Hours:	Sundays and Tuesdays	8:00 -9:00pm	(Canvas chat)
TAs:	Tong Zhang	Yiruo Lu	
TA Office Hours:	Mondays and Wednesday	8:00 -9:00pm	(Canvas chat)

Class Periods

August 22, 2020 (1:00-5:00pm)
September 19, 2020 (8:00am-noon)
September 20, 2020 (1:00-5:00pm)
October 10, 2020 (1:00-5:00pm)
October 11, 2020 (8:00am-noon)
November 7, 2020 (8:00am-noon)
November 8, 2020 (1:00-5:00pm)
December 5, 2020 (1:00-5:00pm)

Course Description

Credits: 4; Introduction to basic models and their solution with modern computer packages. Emphasis on modeling, computer solution, and sensitivity analysis with minimal reference to model theory and development of algorithmic methods.

Course Pre-Requisites/Co-Requisites

Although there is no formal prerequisite for this class, students should have a knowledge of basic programming techniques, linear algebra (linear independence, solving systems of equations, basic matrix algebra) and basic knowledge of differential calculus.

Course Objectives

Operations Research (also called Management Science) is the study of scientific approaches to decision-making. Through mathematical modeling, it seeks to design, improve and operate complex systems in the best possible way. The mathematical tools used for the solution of such models are either deterministic or stochastic, depending on the nature of the system modeled. In this class, we focus on deterministic models and methods in Operations Research. You will learn very powerful modeling and solution techniques for decision-making problems that are used today by many successful companies to help them save/earn millions of dollars.

Materials and Supply Fees

N/A.

Required Textbooks and Software

Lecture notes will be provided that can be augmented with the books listed below.

Recommended Materials

1. Wayne L. Winston and Munirpallam Venkataramanan. *Introduction to Mathematical Programming*, 4th Edition, Brooks/Cole, 2002.

2. Ronald L. Rardin, *Optimization in Operations Research,* Prentice-Hall 1998.

Course Schedule

A tentative list of topics for the class is given next. This list might be shortened or lengthened depending on the pace of the class.

Chapter 1: Optimization models - an introduction (August, September)
Decision problems - Optimization models - Excel solver - Examples (distribution planning, inventory management, vehicle routing, portfolio optimization, ...).

Chapter 2: Optimization methods - an introduction (September)
Outcomes of optimization problems - Tractability - Local and global optima - Convexity - Optimality Conditions - AMPL solver

Chapter 3: Linear Optimization (October)
Linear programming models (production planning, financial planning, shift scheduling, ...) - Standard form - Basic solutions - Simplex algorithm - Two-Phase Method - Duality - Sensitivity and post-optimal analysis - Complementarity slackness.

Chapter 4: Network Optimization (November)
Networks-Network flow models (team assignments, single-crew scheduling, ...) - Shortest path - maximum flow - Assignment - Algorithms.

Chapter 5: Integer Optimization (November)
Integer variables - Enumeration - LP and rounding techniques - Branch-and-bound.

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is mandatory. Students are expected to attend class and to notify the instructor when they are not able to. Repeated unexcused absences might result in a penalty of up to 10% of the class grade. In the event a student is unable to attend the final exam because of a valid reason (UF-imposed curriculum requirement, religious holiday, jury duty, or a family/medical emergency), a make-up exam will be organized as soon as feasible for both the instructor and the student, provided that the instructor was given advanced notice of the situation. Students who miss an exam without advanced notice to the instructor (or without a valid reason for which such notice could not be given) will receive a F for the exam and will not be given a make-up exam. Make-up will not be given for homework. The instructor might extend the deadline or forgo homework for a student who has a valid reason (see above), provided that the instructor is given advanced notice.

Evaluation of Grades

Class grades will be based on: homework average grade (25%), midterm exam (25%), project (25%), and final exam grade (25%).

Homework Assignments

Five homework assignments will be given during the course of the semester. You will need to answer and turn in all problems. All homework will count equally towards your homework average grade, except that the homework with the lowest grade will be excluded from the computation. You will receive solutions to all the homework sets. The questions will range from theoretical to practical aspects. Some will be simple applications of material seen in class, some will be challenging. Some questions will involve the use of the optimization solvers that will be presented in class.

Course Project

Students will form teams to work on the project. Each team should have at most 4 team members. The project description will be distributed later during the semester.

Mideterm and Final Exams

Midterm exam will be taken in the middle of the semester and the final exam will not be cumulative.

Grading Policy

Your class grade will be the better one of the following two schemes:

1. (90-100] A, (80-90] A-, (70-80] B+, (60-70] B, (50-60] B-, (40,50] C+,(30,40] C, (0,30] F
2. Top 30% A, 30%-40% A-, 40%-60% B+, others B or below

More information on UF grading policy may be found at https://catalog.ufl.edu/graduate/regulations/#text. In order to graduate, graduate students must have an overall GPA and an upper-division GPA of 3.0 or better (B or better). Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu/evals. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

University Honesty Policy

UF students are bound by The Honor Pledge which states, We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following

pledge is either required or implied: On my honor, I have neither given nor received unauthorized aid in doing this assignment. The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Campus Resources

Health and Wellness

- **U Matter, We Care:** If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.
- **Counseling and Wellness Center:** http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.
- **Sexual Assault Recovery Services (SARS):** Student Health Care Center, 392-1161.
- **University Police Department:** at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu

Academic Resources

- **E-learning technical support:** 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.
- **Career Resource Center:** Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.
- **Library Support:** http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.
- **Teaching Center:** Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.
- **Writing Studio, 302 Tigert Hall:** 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html.