

Operations Research 1

ESI 3312 Section 1

Class Periods: Monday and Wednesday, Period 3 - 4 (9:35 AM - 11:30 AM)

Location: Online/FLG 0230/Weil 0406

Academic Term: Spring 2021

Instructor:

Name: Yang, Yu

Email Address: yu.yang@ise.ufl.edu

Office Phone Number: (352) 294-7727

Office Hours: Monday and Wednesday, 2:00 PM - 3:00 PM, Weil Hall 401C

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website

Grader: Toney, Alexander T, Email: a.toney@ufl.edu.

Course Description

This is a 4-credit course that serves as an introduction to Operations Research, the study of scientific approaches to decision-making, which seeks to design, improve and operate complex systems in the best possible way under practical constraints. This course will be focused on linear programming models, algorithms and optimization software to aid in the analysis and solution of complex, large-scale decision problems.

Course Pre-Requisites / Co-Requisites

You need to have a working knowledge of linear algebra (basic matrix algebra, linear independence, solving systems of equations), differential calculus, and some basic programming techniques in Python.

Course Objectives

In this course, you will learn to solve deterministic decision problems arising from real-world applications.

Upon the completion of this course, you should be able to:

1. model real-world decision problems mathematically
2. implement linear optimization models in Python and call Gurobi for solution
3. understand the simplex method theoretically and apply it to solve small-sized linear programs
4. understand the linear programming duality theory
5. understand the interior point method and its complexity
6. perform sensitivity analysis for small changes in the input data
7. understand the solution framework for integer programs and have a sense of the solution challenges
8. understand and apply specialized algorithms to solve network models
9. understand general non-linear optimization models
10. understand gradient-based algorithms and local-search-based heuristics

These are lofty goals. To be successful in this class, you will need to invest a lot of your time and be ready to carry a lot of work. It will be rewarding because the techniques you will learn can facilitate your understanding of other classes in the IE curriculum and enhance your problem-solving skills significantly.

Materials and Supply Fees

No fees.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	High
3. An ability to communicate effectively with a range of audiences	
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Medium
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

Textbook: *Optimization in Operations Research*, 2nd Ed. by Ronald Rardin, Prentice Hall (ISBN 9780134384559).

Software: Python and Gurobi.

Recommended Materials

Introduction to Linear Optimization, by Dimitris Bertsimas and John N. Tsitsiklis, Athena Scientific 1997 (ISBN 10: 1886529191, ISBN 13: 9781886529199).

Course Schedule

Week 1: Brief Introduction to Operations Research (Chapter 1)

Week 2: Linear Optimization Models (Chapters 4 & 11), Quiz 1 (Jan 20th)

Week 3: Linear Optimization Models (Chapters 4 & 11),

Week 4: Numerical Solution of Linear Programs (Chapter 2), HW 1 (Jan 31st), Quiz 2 (Feb 3^h)

Week 5: Numerical Solution of Linear Programs (Chapter 2)

Week 6: Simplex Method (Chapter 5), HW 2 (Feb 14st), Quiz 3 (Feb 17th)

Week 7: Simplex Method (Chapter 5), Midterm 1 (Feb 22nd)

Week 8: Duality Theory and Sensitivity Analysis (Chapter 6), HW 3 (Feb 28st), Quiz 4 (Mar 3rd)

Week 9: Duality Theory and Sensitivity Analysis (Chapter 6)

Week 10: Integer Programming Methods (Chapter 12), HW 4 (Mar 14th), Quiz 5 (Mar 17th)

Week 11: Integer Programming Methods (Chapter 12), Midterm 2 (Mar 22nd)

Week 12: Network Algorithms (Chapters 9 & 10), HW 5 (Mar 28th), Quiz 6 (Mar 31st)

Week 13: Network Algorithms (Chapters 9 & 10)

Week 14: Nonlinear Optimization (Chapter 3), HW 6 (Apr 11nd), Quiz 7 (Apr 14th)

Week 15: Nonlinear Optimization (Chapter 3),

Week 16: HW 7 (Apr 25th), Final Exam (Apr 26th)

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

F2F Course Policy in Response to COVID-19

We will have face-to-face instructional sessions to accomplish the student learning objectives of this course. In response to COVID-19, the following policies and requirements are in place to maintain your learning environment and to enhance the safety of our in-classroom interactions.

- You are required to wear approved face coverings at all times during class and within buildings. Following and enforcing these policies and requirements are all of our responsibility. Failure to do so will lead to a report to the Office of Student Conduct and Conflict Resolution.
- This course has been assigned a physical classroom with enough capacity to maintain physical distancing (6 feet between individuals) requirements. Please utilize designated seats and maintain appropriate spacing between students. Please do not move desks or stations.
- Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class.
- Follow your instructor's guidance on how to enter and exit the classroom. Practice physical distancing to the extent possible when entering and exiting the classroom.
- If you are experiencing COVID-19 symptoms (Click here for guidance from the CDC on symptoms of coronavirus), please use the UF Health screening system and follow the instructions on whether you are able to attend class. Click here for UF Health guidance on what to do if you have been exposed to or are experiencing Covid-19 symptoms.
- Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work. Find more information in the university attendance policies.

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance: Although you will not receive credit for it, participation in class is highly recommended. It will make the learning experience better and more enjoyable for everybody.

Class Expectations: To ensure a classroom environment conducive to success for everyone, please turn off cell phones before class starts. Please make an effort to arrive to class on time. If you must enter the classroom late, be considerate and be as quiet as possible. Refrain from leaving early. If you need to do so, be as quiet as

possible. Examples of a positive contribution to the class include asking questions that clarify any confusion you might be experiencing, constructively challenging the assumptions of a model, communicating your opinion about an open problem or sharing your personal experience. Examples of a negative contribution to the class include trying to slow down the class with irrelevant questions or making other students feel “stupid”. Individuals whose behavior is detrimental to a good class atmosphere will be notified. Persistent disruptive behavior will result in **grade deductions**.

Make-Up Policy: Any homework submissions after 5:00 PM of the due date will not be accepted. There will be no make-ups for missed quizzes and exams. The homework and the quiz with the lowest score will be dropped. That is, 6 highest homework and 6 highest quiz scores will be included in the student’s overall grade.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (7)	100 each	15%
Quizzes (7)	100 each	15%
Midterm Exams (2)	100 each	40%
Final Exam	100	30%
		100%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and

respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-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.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

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.

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: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

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 Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

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 Complaints Campus: <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.