ISE 4623/5023: Deterministic Systems Models / Systems Optimization

University of Oklahoma
College of Engineering
School of Industrial and Systems Engineering
Fall 2021

The syllabus is subject to changes/updates. Any changes/updates to the syllabus will be announced in class, and the latest version will be accessible in Canvas. Students are responsible for any changes/updates to this syllabus.

Delivery method: online (synchronous)
Learning Management System: canvas.ou.edu
Tech support: If you cannot access canvas.ou.edu, or have issues with Zoom or your email, please contact 405-325-HELP.

Course Meeting Times: Tuesdays & Thursdays, 3:00PM-4:15PM
Zoom link:https://oklahoma.zoom.us/j/92100124305?pwd=S1oyNjVsNXMwSEJBZGtIZmFyZ1NDdz09
Zoom Meeting ID: 921 0012 4305
Zoom Passcode: 47848848

Communication plan. In addition to scheduled office hours, email communication is the primary method with me and the TA in this course: To ensure a prompt response, **for all class-related inquiries (grade revisions, homework questions, etc.) send your emails to OR1@groups.ou.edu**. We will do our best to reply promptly (24 hours in weekdays, 48 hours in weekends)

Instructor: Andrés D. González
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Office Hours: TBD

Teaching Assistant	Samuel Rodríguez-González	Alireza Rangrazjeddi
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Office Hours	TBD	TBD
Zoom Meeting ID	TBD	TBD
Zoom Meeting ID	TBD	TBD
Zoom Passcode	TBD	TBD

Course Pre-requisites:

- ISE 2823 (Enterprise Engineering)

Course Description:
This course focuses on discussing diverse techniques for problem solving using analytical models, including theory, methodology, and applications. Topics include linear programming, simplex algorithm and sensitivity analysis, and integer programming. We will cover multiple practical applications in transportation networks, project management and scheduling, deterministic inventory models, decision making, and systems integration, among others. The class will also have a strong component related to solution methods using computer software.

Course Goals and Learning Objectives:

After taking this class, the students should be able to:

- *Adequately formulate an optimization problem, indicating the decision variables, objective function(s), and associated constraints, as well as the required input data.*
- *Understand the Simplex method and its applications*
- *Formulate and solve diverse optimization problems associated with transportation, network design, and inventory management, among others*

Texts and Materials:

Required:

B1. Winston, W. L. 2004. Operations Research: Applications and Algorithms. 4th Edition. https://amzn.to/34tqQcN

Note that additional readings will be placed on the course website or in the library or required for look-up when appropriate course content is being covered. These readings will be required.

Recommended:

B2. Hillier, F. S. & Lieberman, G. 2015. *Introduction to Operations Research*. 11th Edition. Ney York, NY: Mc Graw Hill https://www.mheducation.com/highered/product/introduction-operations-research-hillier-lieberman/M9781259872990.html

B3. Taha, H. A. 2017. *Operations Research: An Introduction*. 10th Edition. Boston, MA: Pearson https://www.pearson.com/us/higher-education/program/Taha-Operations-Research-An-Introduction-10th-Edition/PGM334070.html

Teaching Philosophy:

The main skills and abilities encouraged and developed in this class are related to

- Developing strong conceptual foundations and problem-solving intuition
- Expanding critical thinking and reasoning
- Enriching collaborative work proficiency
- Enhancing problem formulation and solution skills

Grading details:

Grade percentages associated with individual and group work are as follows:

Quizzes (group and individual)	20%
Assignments (individual)	30%
Exam 1 (individual)	15%
Exam 2 (individual)	15%
Final exam (individual)	20%

Grading discrepancy review:

Grades can be reviewed and possibly revised, only if requests are made within one week of the grade posting. The request must be submitted to OR1@groups.ou.edu within the permitted time window.

Grading scale:

A ← [90, 100]
B ← [80, 90)
C ← [70, 80)

D ← [60, 70)
F ← [0, 60)

Grading policy:
Homework due dates and other relevant dates will be announced well in advance. All homework assignments are due at the beginning of class on the date due. Unless indicated otherwise, all assignments should be uploaded to Canvas. Late homework assignments will be penalized as follows (unless indicated otherwise):

Submission time	*Maximum grade possible*
On time	100%
0 to 24 hours late	75%
More than 24 hours late	0%

Considering the added difficulties and unexpected events related to the current COVID-19 pandemic, and in order to accommodate for extenuating circumstances, the worst assignment and the worst quiz will not be considered in your final grade. In order to be able to qualify for the removal of the worst quiz and worst assignment, the student must have fulfilled the attendance policy, as detailed next.

Attendance policy:
Attendance to regular lectures is not mandatory, but in case a student misses a lecture, the student must prepare the associated material on his/her own from the assigned readings, the slides and materials posted, and from the lecture recordings in Canvas (which will be posted within 48 hours since the lecture took place, unless unforeseen circumstances occur). However, students that fail to attend to more than two lectures in the semester without prior permission of the instructor will not qualify for the removal of the worst quiz and worst assignment in their final grade. For your attendance to be counted, you need to be present, showing your camera, and paying attention to the lecture during the entire class time.

Attendance to Exams and Quizzes is mandatory in order to obtain a non-zero score in them. Exams and quizzes can be rescheduled only if permission is given by the instructor before their original scheduled time. Permission requests will be considered only if received well in advance (at least 24 hours before the scheduled test time) and must correspond to religious observance, reasonable accommodation, and other extenuating circumstances, as detailed in the university policies section.

Tentative Schedule:

Module	**Unit**
1. Introduction to operations research and linear programming	Introduction to operations research and model building [B1.Ch 1]
	Basic linear algebra [B1.Ch 2]
	Introduction to linear programming [B1.Ch 3]
2. Linear programming (LP) concepts and algorithms	Theory behind linear programming [B1.Ch 4.1-4.4]
	The Simplex method [B1.Ch 4.5-4.8, 4.11, 4.14]
	The Big-M method [B1.Ch 4.12]
	The Two-phase method [B1.Ch 4.13]
EXAM 1	*Includes modules 1 and 2*
3. Sensitivity analysis and duality	Goal programming [B1.Ch 4.16]
	Sensitivity analysis [B1.Ch 5, 6.1-6.4]
	Duality [B1.Ch 6.5-6.10]

4. LP models for common structures	Data envelopment analysis (DEA) [B1.Ch 6.12]
	Transportation, assignment, and transshipment problems [B1.Ch 7.1, 7.5-7.6]
	Minimum cost flow problem and variants [B1.Ch 8.1-8.3, 8.5]
EXAM 2	*Includes modules 3 and 4*
5. MILP models for common structures	Introduction to integer and mixed-integer linear programming [B1.Ch 9.1-9.2]
	Knapsack problem [Canvas material]
	Workforce, production, and inventory modeling [Canvas material]
	Network design problem [Canvas material]
	Traveling salesperson problem (TSP) [Canvas material]
FINAL EXAM	*Includes modules 1-5*

Important Dates:

- Exam 1: *Tuesday, October 5, 2021*
- Exam 2: *Tuesday, November 16, 2021*
- Final exam: *Wednesday, December 15, 2021*

University Policies:

Academic Integrity

Cheating is strictly prohibited at the University of Oklahoma. Cheating is not only unethical, but also devalues the degree you are working hard to get. As a member of the OU community it is your responsibility to protect your educational investment by knowing and following the rules. For specific definitions on what constitutes cheating, review the Student's Guide to Academic Integrity at http://integrity.ou.edu/students_guide.html

To be successful in this class, all work labeled as "individual" must be yours and yours alone. You may not receive outside help. On examinations and quizzes, you will never be permitted to use your notes, textbooks, calculators, or any other study aids, unless indicated otherwise. Should you see someone else engaging in this behavior, I encourage you to report it to myself or directly to the Office of Academic Integrity Programs. That student is devaluing not only their degree, but yours, too. Be aware that it is my professional obligation to report academic misconduct, which I will not hesitate to do. Sanctions for academic misconduct can include expulsion from the University and an F in this course, so don't cheat. It's simply not worth it. In professional and personal contexts, it is important to adequately integrate the analytical tools and abilities developed in class with strong integrity and ethics. For more information on this subject, please refer to the Student's Guide to Academic Integrity at http://integrity.ou.edu/students_guide.html

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 Any student in this course who has a disability that may prevent him or her from fully demonstrating his or 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.

Religious Observance

It is the policy of the University to excuse the absences of students that result from religious observances and to provide without penalty for the rescheduling of examinations and additional required class work that may fall on religious holidays. Please contact me in advance to ensure adequate accommodations.

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, including advocates on-call 24.7, counseling services, mutual no contact orders, scheduling adjustments and disciplinary sanctions against the perpetrator. To learn more about this or to report an incident, please contact the Sexual Misconduct Office at 405/325-2215 (8AM to 5PM, M-F) or smo@ou.edu. Incidents can also be reported confidentially to OU Advocates at 405/615-0013 (phones are answered 24 hours a day, 7 days a week). 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. Inquiries regarding non-discrimination policies may be directed to: Bobby J. Mason, University Equal Opportunity Officer and Title IX Coordinator at 405/325-3546 or bjm@ou.edu. For more information, visit http://www.ou.edu/eoo.html.

Adjustments for Pregnancy/Childbirth Related Issues

Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact me as soon as possible to discuss. Generally, modifications will be made where medically necessary and similar in scope to accommodations based on temporary disability. Please see www.ou.edu/content/eoo/faqs/pregnancy-faqs.html for commonly asked questions.

Final Exam Preparation Period

Pre-finals week will be defined as the seven calendar days before the first day of finals. Faculty may cover new course material throughout this week. For specific provisions of the policy please refer to OU's Final Exam Preparation Period policy (https://apps.hr.ou.edu/FacultyHandbook#4.10).

Emergency Protocol

During an emergency, there are official university procedures that will maximize your safety.

Severe Weather: If you receive an OU Alert to seek refuge or hear a tornado siren that signals severe weather *1. LOOK* for severe weather refuge location maps located inside most OU buildings near the entrances *2. SEEK* refuge inside a building. Do not leave one building to seek shelter in another building that you deem safer. If outside, get into the nearest building. *3. GO* to the building's severe weather refuge location. If you do not know where that is, go to the lowest level possible and seek refuge in an innermost room. Avoid outside doors and windows. *4.* GET IN, GET DOWN, COVER UP. 5. *WAIT* for official notice to resume normal activities.

Link to Severe Weather Refuge Areas , *Severe Weather Preparedness - Video*

Armed Subject/Campus Intruder

If you receive an OU Alert to shelter-in-place due to an active shooter or armed intruder situation or you hear what you perceive to be gunshots:

1. GET OUT: If you believe you can get out of the area WITHOUT encountering the armed individual, move quickly towards the nearest building exit, move away from the building, and call 911. *2. HIDE OUT*: If you cannot flee, move to an area that can be locked or barricaded, turn off lights, silence devices, spread out, and formulate a plan of attack if the shooter enters the room. *3. TAKE OUT*: As a last resort fight to defend yourself.

For more information, visit http://www.ou.edu/emergencypreparedness.html

Shots Fired on Campus Procedure - Video

Fire Alarm/General Emergency

If you receive an OU Alert that there is danger inside or near the building, or the fire alarm inside the building activates: *1. LEAVE* the building. Do not use the elevators. *2. KNOW* at least two building exits *3. ASSIST* those that may need help *4. PROCEED* to the emergency assembly area *5 ONCE safely outside,*

NOTIFY first responders of anyone that may still be inside building due to mobility issues. 6. WAIT for official notice before attempting to re-enter the building.
OU Fire Safety on Campus

Mental Health Support Services

If you are experiencing any mental health issues that are impacting your academic performance, counseling is available at the University Counseling Center (UCC). The Center is located on the second floor of the Goddard Health Center, at 620 Elm Rm. 201, Norman, OK 73019. To schedule an appointment call (405) 325-2911. For more information please visit http://www.ou.edu/ucc.