ISE/OR501-001-601 – INTRODUCTION TO OPERATIONS RESEARCH
SPRING 2024

Course objectives/description

The course aims to introduce the various types of operations research models and techniques. We will address how to formulate a wide range of decision problems using an appropriate mathematical programming model and solve them using an appropriate algorithm or solver. The emphasis will be given to Linear Programming, Network Models, and Integer Programming. Some example applications of mathematical programming to be covered in this class include production planning, network analysis, project scheduling, logistics network design, fixed charge problems, set covering problem, etc.

Course Topics
- Introduction to Model Building and the Use of Computer Tools (LINDO, Excel Solver, GAMS)
- Operations Research Techniques
  - Linear Programming
    - Model building
    - Simplex algorithm, Sensitivity analysis
    - Application areas: Production Planning, Network analysis (Shortest Path, Project Scheduling, Max Flow, Minimum Cost Network Flow, etc.)
  - Integer Programming
    - Model building
    - Branch and bound algorithm
    - Application areas: Capital allocation, Logistics Network Optimization, Fixed charge production-location problems, set covering problems

Learning outcomes

By the end of this course, students will be able to:

1. Learn the characteristics of the various types of mathematical programming models,

2. Build concise and accurate mathematical models for various real-life situations,

3. Apply the basic algorithms for solving linear and integer programming problems,

4. Use appropriate computer tools for solving the mathematical programming formulations,

5. Recognize, formulate and solve the decision-making problems in a wide range of applications using operations research tools.

Class Time: Tuesday-Thursday 11:45am-1:00pm
Teaching mode: face to face, in the classroom (section 001), online asynchronous (section 601)
Classroom: 4134 Fitts-Woolard Hall

Instructor: Semra Sebnem AHISKA KING
Office Location: 4179, Fitts-Woolard Hall
Office hours: Mon-Wed, 1:00-2:30pm, or Friday by appointment (available in-person in my office and online with Zoom)
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TA Office hours: Thursday-Friday, 10:00am-11:00am
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Prerequisites
An undergraduate course in calculus math, linear algebra

Textbook (optional for the student, no purchase is required)
Operations Research: Applications and Algorithms, Wayne L. Winston, 4th edition, 2004, Thomson Brooks/Cole, ISBN-13: 978-0534380588, ISBN-10: 0534380581

Course requirements/Grading

Assignments	Percentage of Final Grade
Homework Assignments (around 10)[a]	**20%**
Project	**10%**
Exam 1 (around 6th week, lectures 1-8)	**20[b]%**
Exam 2 (around 10th week, lectures 9-17)	**25%**
Exam 3, Final Exam (Apr 30, 12-2:30pm, lectures 18-26)	**25%**

[a]Students are required to submit at least **eight** HW assignments. The students' average HW grade will be computed considering their best eight HW grades.
[b]The exam with lowest grade among the three exams will be assigned 20%, and the other two will be assigned 25% each.

Software needed*
Excel Solver, LINDO and GAMS (demo versions)
*No prior knowledge of the software is required, the use of software will be taught in class.

Lecture mode and Class attendance policy: The instruction mode is "*face to face (F2F) in the classroom*". In case it becomes impossible to teach F2F for any reason, the lectures will be delivered online. The on-campus (section 001) students are required to attend at least 70% of the lectures in the classroom unless they have a medical excuse. Up to 8 missed lectures can be tolerated given this attendance policy. **Your overall grade will be reduced by 3 points (equivalent to one letter grade) for any additional lecture missed over 8.** Students must sign the attendance sheet by the end of each lecture to prove their presence. The Engineering Online (EOL) students (section 601) are expected to watch the lecture recordings on a timely basis, ideally as soon as they are posted.

Course structure

The lectures will be delivered by the instructor. Many in-class examples will be provided to the students for learning the introduced concepts/techniques. The active participation of the students in solving these in-class examples is strongly recommended. The students will then have the opportunity to enhance their knowledge through challenging HW assignments and project.

Course policy

The use of computers and communication devices for personal purposes (cell phone, tablet, computer, texting, email, internet) and eating/drinking are not allowed during the lectures in the classroom.

Course Moodle page

The Moodle page will be used for posting all the course materials and for HW/project submissions.

Moodle page for the course is accessible at:
https://wolfware.ncsu.edu/courses/my-wolfware/

OTHER IMPORTANT NOTES ON HW SUBMISSIONS AND EXAMS:

- HW/project submissions will be done online using Moodle by midnight of their due date.

- All the homework/project assignments must be submitted by their due date. Late submissions will receive 0 grade. In case you need more time to complete the work, you must talk with the instructor at least 1 day before the due date, in which case you may be granted an extended deadline if you have an acceptable excuse such as medical.

- All three exams will be **IN-CLASS exams** to be taken in the classroom for the on-campus students (section 001). For the Engineering Online (EOL) students (section 601), they will be **in-person proctored exams** at an approved testing center.

- On-campus students are required to attend the exams on their scheduled date and time. The EOL students will be provided with an exam window (that consists of a few days) around the exam date scheduled for the on-campus students. No make-up for the exams will be provided unless the student had a medical emergency on the test day. An official note from the doctor will be demanded in this case as proof of the medical excuse.

ACADEMIC INTEGRITY POLICY

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at http://policies.ncsu.edu/policy/pol-11-35-01. The Code of Student Conduct (NCSU POL11.35.01) serves as the basis for student conduct at NC State. It contains information related to the university's jurisdiction over student behavior, academic and non-academic violations, sanctions available when a violation occurs, and information regarding

interim suspension. **Academic violations include cheating, plagiarism, or aiding another to cheat or plagiarize.** Non-academic violations include rules concerning alcohol, drugs, infliction or threat of bodily harm, vandalism, disorderly conduct, harassment, interpersonal violence, and more). All students are strongly encouraged to read and understand the Code of Student Conduct (https://studentconduct.dasa.ncsu.edu/code/).

Academic integrity is the cornerstone of education. Plagiarism and cheating are attacks on the very foundation of academic life and cannot be tolerated within universities. All students are strongly encouraged to review the university policies on academic integrity at https://studentconduct.dasa.ncsu.edu/academic-integrity-overview/.

The students who are suspected for violating the academic integrity in the tests, HW and project assignments will be reported to the Office of Student Conduct for academic misconduct. Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02) (https://studentconduct.dasa.ncsu.edu/procedures/). The procedure followed when a student is accused of violating academic integrity is described at https://studentconduct.dasa.ncsu.edu/students/procedures-overview/.

A student who violates the academic integrity policy in HW, project or exam assignments will fail the course, and lose his/her good academic standing status, which may mean losing several opportunities including TA/RA positions, scholarships, CPT (working off-campus), etc. The student may also be suspended or even terminated from the program.

GRADING SCALE

The following is the standard NCSU grading scale. Based on the overall class performance, the minimum grade required for a particular letter grade may be decreased in favor of the students.

Grade range	Letter grade
97-100	A+
93-96	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
67-69	D+
63-68	D
60-62	D-
<60	F