Course Syllabus

EM/ISE 357 - Elements of Operations Research

School of Systems and Enterprises

Spring 2023

Instructor: A. Emrah Bayrak

Canvas Course Address: **https://sit.instructure.com/courses/46988/ (https://sit.instructure.com/courses/46988/)**

Course Schedule: Mon 10:00-11:50AM, Wed 12:00-12:50PM (Eastern Time)

Class Location: McLean 104

Contact Info: ebayrak@stevens.edu

Office Hours: Mon 12PM-2PM (Babbio 513 + Zoom)

Prerequisite(s): EM365 or MA227

COURSE DESCRIPTION

This course emphasizes building analytical skills for developing mathematical models for decision-making and optimization. The course provides an introduction to deterministic operations research (OR) concepts and analysis techniques for mathematical programming and decision making. Basic computers skills (Excel) and knowledge of statistics are necessary to solve the problems discussed in the lectures and assigned for homework. The course emphasis is on problem formulation, model building, data analysis, solution techniques, and evaluation of alternative designs/processes in complex systems. Modeling techniques and methods for decision analysis including linear and integer programming, transportation and network models, dynamic programming, goal programming, classical optimization theory, and non-linear programming.

STUDENT LEARNING OUTCOMES

The purpose of this course is to provide the students with the following capabilities:

- Develop analytical problem solving and decision-making thinking
- Build operations research based models of management problems
- Apply readily available software packages for solution of management problems
- Understand the results of computer modeling
- Select the appropriate analytical technique to real world problems
- Summarize and present analysis of results in a clear and a coherent manner

After successful completion of this course:

- You are able to understand the steps for translating a real-world problem into a mathematical model and use optimization methods to evaluate engineering management alternatives.
- You are able to judge the suitability of solutions and adapt mathematical models for typical problems in manufacturing and service industries, and other engineering management areas.
- While modeling an engineering management decision problem, you are able to produce final specifications and models to determine optimal design solutions
- You are able to identify variables that impact the model structure and analyze various alternatives using quantitative software packages and languages.

COURSE FORMAT AND STRUCTURE

This course is on-campus. To access the course, please visit **stevens.edu/canvas (http://stevens.edu/canvas)** . For more information about course access or support, contact the TRAC by calling 201-380-6599 or 201-216-5500.

Course Logistics

This course will consist of a 110-min lecture on Mondays and a 50-min lecture on Wednesdays on-campus.

- During lectures the class will work on problems as a group or in multiple groups. Solving some of these problems will require Microsoft Excel's Solver Add-in and Python, so you will need a computer with Microsoft Excel and Python installed on it in each session.

- Problem sets will be assigned every week. The assignments will be assigned 11:59PM (ET) on Wednesdays and will be due by 11:59PM (ET) on Wednesday the following week. Due dates will be listed on each assignment on Canvas.
- Deadlines are an unavoidable part of being a professional and this course is no exception. Course requirements must be completed and posted or submitted on or before specified due date and delivery time deadline. Due dates and delivery time deadlines are defined as Eastern Time (as used in Hoboken, NJ). Avoid any inclination to procrastinate. See the late submission policy below for the assignments submitted after the due date.
- Assignments are individual, and collaboration among students (i.e., giving or receiving aid) is not allowed. You will be required to write the honor pledge on each assignment.
- For all problem sets assigned on Canvas, there will be a single **discussion board (https://sit.instructure.com/courses/63910/discussion_topics/339664) for you to ask your questions** about the assignment. You are encouraged to check that board and use it as much as possible. Avoid contacting the instructor via email about HW questions unless you have a personal issue.

Homework & Exam Submissions

- Homework assignments and exams will be posted on Canvas. You need to submit your assignments as a single PDF file with your name, the honor pledge, your answers and work on it. Some assignments will ask you to submit an additional xlsx or py/ipynb file to show your work on Excel or Python.
- Two exams will be take-home to be submitted online at the scheduled date. The exams will be posted at 10:00am and will be due by midnight the same day.
- **It your responsibility to download your submissions immediately after your submit your assignments/exams on Canvas to make sure that you submitted the correct files**. Realizing such mistakes after the due date will be subject to the late submission policy below.
- Solutions to the assignments and exams will be posted before your grades are announced. Once your grade is posted on Canvas, you will have exactly 10 days after the grades are posted for objections. Any objections after 10 days will not be accepted.

Instructor's Online Hours

I will be available online during business hours (9am-5pm). For the online discussions, I will check in at least 3 times per week. Keep in mind that it is not possible for me to respond to every single posting every week (nor is it pedagogically appropriate), but I will be sure to respond to a variety of postings and students each week and attempt to assure equality in terms of responses to

students. Furthermore, there is a specific discussion forum that you can use to ensure that you have my attention – to ask questions or to call my attention to a particular discussion you are engaged in that you would like me to take a look at. If you feel you are being neglected in any way, please contact me.

Office Hours

Office Hours are dedicated sessions to discuss questions related to weekly readings and/or assignments. Office hours will be held **Mondays from 12:00-2:00 PM** (Eastern Time). You can show up in-person (without appointment) at the instructors office (Babbio 513) or schedule an online meeting on Zoom in advance with the instructor.

Online Etiquette Guidelines

Your instructor and fellow students wish to foster a safe online learning environment. All opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. You are encouraged to comment, question, or critique an idea but you are not to attack an individual. Our differences, some of which are outlined in the University's inclusion statement below, will add richness to this learning experience. Please consider that sarcasm and humor can be misconstrued in online interactions and generate unintended disruptions. Working as a community of learners, we can build a polite and respectful course ambience. Please read the Netiquette rules for this course:

- Do not dominate any discussion. Give other students the opportunity to join in the discussion.
- Do not use offensive language. Present ideas appropriately.
- Be cautious in using internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular and/or slang language. This could possibly lead to misinterpretation.
- Keep an open mind and be willing to express even your minority opinion.
- Think and edit before you push the “Send” button.
- Do not hesitate to ask for feedback.

TENTATIVE COURSE SCHEDULE

The following courses schedule is tentative and subject to change. You will be informed with any changes in this schedule during the lectures.

Week	Topic(s)	Assignment
#1	Course Introductions	Course Quiz
#2	Modeling OR Problems Introduction to Linear Programming	None
#3	Excel's Solver Python's Solver	HW#1
#4	Simplex Method	HW#2
#5	Simplex Special Cases	HW#3
#6	Computational Issues (on Feb. 23 Wednesday)	None
#7	Midterm Exam on Feb. 27 (Online, take-home) Midterm Solutions and Examples	HW#4
#8	Duality	HW#5
	Spring Break	
#9	Integer Programming	HW#6
#10	Transportation Problems	HW#7
#11	Network Problems	HW#8

#12	Unconstrained Nonlinear Optimization	HW#9
#13	Constrained Nonlinear Optimization	HW#10
#14	Multi-Criteria Decision Theory	HW#11
#15	TBD	
#16	Final Exam (Online, take-home)	

COURSE MATERIALS

Textbook(s): Taha, Hamdy A. *Operations Research*, An Introduction, 10th Edition, Pearson Press, 2017, ISBN: 978-0-13-444401-7

COURSE REQUIREMENTS

Homework: Problem sets will be assigned every week. The assignments will be assigned 11:59PM (ET) on Wednesdays and will be due by 11:59PM (ET) on Wednesday the following week. Due dates will be listed on each assignment on Canvas. The assignments are individual and collaboration among students (giving or receiving any aid to/from other students) is not allowed. **Students will receive 0 points from that exam if any collaboration is detected**. You will submit your assignments on Canvas.

Exams: There will be a midterm and a final exam both of which will be open book take-home exams. The exams will be individual and collaboration among students (giving or receiving any aid to/from other students) is not allowed. **Students will receive 0 points from that exam if any collaboration is detected.**

TECHNOLOGY REQUIREMENTS

Baseline technical skills

- Basic computer and web-browsing skills

- Navigating Canvas

Required Equipment

- Computer: current Mac (MacOS) or PC (Windows 10+) with high-speed internet connection

Required Software

- Current or first previous major release of Chrome, Firefox, Edge, or Safari browser
- Microsoft Word
- Microsoft Excel with Solver Add-in
- Anaconda with Python 3

GRADING PROCEDURES

Grades will be based on:

Homework*	60%
Midterm Exam	20%
Final Exam	20%

* There will be 11 homework assignments throughout the semester. Homework grades will be based on 10 assignments. The last assignment grade will replace the worst grade among the first 10 assignments.

Late Policy

If you need to resubmit an assignment for any reason, you may do so any time PRIOR to the due date. Once the due date has passed, the following late submission policy applies:

"10% of the total points will be deducted for assignments received 1-3 days late for each day they were submitted late; assignments received more than 3 days late will receive 0 points."

Make-up Exams and Assignments

Make up exams and assignments will only be granted under exceptional circumstances such as a verified medical or family emergency or official Stevens business. Students will be required

contact the instructor with the necessary documentation demonstrating the exceptional circumstances for make-up exam or assignment.

Academic Integrity

Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the Honor System Constitution. More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at **http://web.stevens.edu/honor/ (http://web.stevens.edu/honor/)**

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

"I pledge my honor that I have abided by the Stevens Honor System."

Reporting Honor System Violations

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at **www.stevens.edu/honor (http://www.stevens.edu/honor)** .

EXAM CONDITIONS

The following procedures apply to quizzes and exams for this course. As the instructor, I reserve the right to modify any conditions set forth below by printing revised Exam Conditions on the quiz or exam.

1. Students may use the following materials during exams. Any materials that are not mentioned in the list below are not permitted.
   - Computers, calculators, lecture slides, hand-written notes, textbook, Microsoft Excel, Python.

2. Students are **not** allowed to work with or talk to other students during exams.

LEARNING ACCOMMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

For more information about Disability Services and the process to receive accommodations, visit **https://www.stevens.edu/student-diversity-and-inclusion/disability-services.** **(https://www.stevens.edu/student-diversity-and-inclusion/disability-services)** If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at **pgehman@stevens.edu (mailto:pgehman@stevens.edu)** or by phone 201-216-3748.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

INCLUSIVITY

Name and Pronoun Usage

As this course includes group work and class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students

to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

Inclusion Statement

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). CAPS is open daily from 9:00 am – 5:00 pm M-F. Evening hours are available by appointment in the Fall / Spring semesters and up-to-date information regarding the availability of evening appointments can be found by visiting **www.stevens.edu/CAPS (http://www.stevens.edu/CAPS)**. To schedule an appointment, call 201-216-5177.

Due to the pandemic, in-person appointments may be limited until further notice. Up-to-date information about the availability of in-person services can be found at **www.stevens.edu/CAPS (http://www.stevens.edu/CAPS)**. Teletherapy (therapy via secure video platform) is available to registered students physically located in the states of New York or New Jersey. Students located outside of NY / NJ are encouraged to pursue local treatment through their personal health insurance. To learn more about the process of finding a therapist please visit the CAPS webpage on **Seeking Help Off-Campus (https://www.stevens.edu/counseling-pshychological-services/seeking-help-off-campus)**.

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about the safety of yourself or someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year round. For students who do not reside near the campus and require emergency support, please contact your local emergency response providers at 911 or via your local police precinct. Other 24/7 national resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text “Home” to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at **care@stevens.edu (mailto:care@stevens.edu)** . A member of the CARE Team will respond to your concern as soon as possible.