

**IE 5351 – Linear and Combinatorial Optimization Methods
Spring 2023**

Meeting time: Mondays 6:00 pm – 8:50 pm

First meeting: January 23

No class March 13 (Spring Break)

Last regular class meeting: May 1

Assigned Final Exam time: May 8, 7:00 – 9:50 pm

Location: Chemistry and Computer Science Building Rm 1.0204

Instructor: Lori Houghtalen, Ph.D.

Office: E-226F

Office Hours: Tues 10:00 – 11:00 am, Thurs 8:30 – 10:30 am, and by appointment

Email: lmhoughtalen@utep.edu

Course Description:

This course will introduce students to the theory, algorithms, and applications of linear, integer programming and combinatorial optimization. The course will be useful to the students in engineering, management, computer science, and mathematics. *Prerequisite: Department Approval*

Course Objectives:

1. Provide an in-depth understanding of the underlying theory of linear programming, integer programming and combinatorial optimization
2. To present general and state-of-the-art algorithms available to solve such problems
3. To present a wide range of applications of linear programming and combinatorial optimization problems in different scientific domains
4. To give exposure to the diversity of applications of these problems in engineering
5. To help each student develop his/her intuition about logical thinking, algorithm design, development and analysis.

Required Textbook:

Bazaraa, M., Jarvis, J. and Sherali, H. “Linear programming and network flows.” Wiley-Interscience, fourth edition.

Note: This course will cover some material not in the textbook, and not all material in the book will be covered in the course.

Additional Required Resources:

Access to a computer (preferably a laptop that can be brought to class), reliable internet, and Blackboard. The use of specialized programs may be necessary for coursework; access to these will be discussed throughout the course as the need arises.

Topics to be covered throughout the course will include:

1. Introduction, Modeling
2. Graphic method, Simplex method
3. Revised Simplex Method
4. Duality and Sensitivity Analysis
5. Lower and Upper Bound Algorithm
6. Integer Programming
7. Network Optimization
8. Introduction to Metaheuristic Optimization

Additional Course References:

Winston, W. and Venkataramanan, M. "Introduction to Mathematical Programming." Duxbury Press; fourth edition, 2003.

Wolsey, L. A. and Nemhauser, G. L. "Integer and Combinatorial Optimization." Wiley Interscience; 1999.

Course communication:

I will communicate to the class through Blackboard announcements and through UTEP email. Microsoft Teams will also be used to facilitate discussion and answer questions outside of class.

Course Grading:

Each of the following grade categories is discussed in more detail below.

Homework assignments	20%
Exam 1	20%
Exam 2	25%
Presentation on selected topic	10%
Course project	25%

Calculation of Final Course Grade

90% and above	A
80% - 89%	B
70% - 79%	C
60% - 69%	D
59% and below	F

Homework

There will be problem sets and other assignments throughout the semester. All assignments and due dates will be communicated through Blackboard. Late assignments will not be accepted; turn in what you have completed by the due date and time.

Homework is intended to be a learning tool. Each assignment will have instructions, including whether collaboration with classmates is allowed. In general, when collaboration is allowed it will be to facilitate peer-to-peer learning. Students are encouraged to attempt each problem/task on their own, and then collaborate with peers to compare approaches. Even when collaboration is allowed, every student must turn in his/her own work.

Exams

There will be two exams given in class. The dates of the exams are below. Exam format, content coverage, and additional instructions for each exam will be provided prior to each exam date.

Exam 1: **March 6**

Exam 2: **May 1**

Presentation on selected topic

Each student will select a topic of interest related to the course content to research and prepare a brief presentation for the class. A written summary will also be required in advance of the presentation. The research should include at least one paper from a peer-reviewed journal as well as examples of real-world applications (or potential applications). A detailed assignment description will be forthcoming on Blackboard, topics will be selected by **March 6**, and presentation dates will be assigned to occur throughout the second half of the term.

Course project

The purpose of the term project is to provide an opportunity to apply and/or further explore a topic area related to the course. Students will be permitted to choose from two options:

- (1) Provide a literature review of one famous optimization problem, how optimization techniques have been used to solve that problem, and the development of a didactic tool (a presentation, a software tool, a game, etc.) for others to use to understand the problem and possible solutions, or
- (2) Develop an application or adaptation of one of the models learned in class for an industry setting, including a preliminary implementation (simulated if necessary).

Students will be required to identify a topic of interest and submit a brief project abstract for approval before **March 27**. A written report and project presentation will be due on **May 8**. A detailed project description will be forthcoming on Blackboard.

Course Policies

Administrative drops

At the discretion of the instructor, a student may be dropped from a course because of excessive absences, neglect or lack of effort. A grade of “W” will be assigned before the course drop deadline and a grade of “F” after the course drop deadline. A grade of “F” received due to disciplinary action imposed by the University overrides a grade of “W” received through a student-initiated or faculty drop.

Furthermore, the instructor reserves the right to remove from the course any student whose behavior is disruptive to the learning environment for students or faculty.

Class attendance and participation

Attendance at all class sessions is strongly recommended. Students are responsible for anything covered in class as well as on Blackboard. Our class time will be a mix of lecture, discussion, and individual and small group activities. My commitment is to make our class time meaningful; I expect each student to come prepared to think and to engage, and to behave in a professional manner. For the purposes of this course, professional behavior means that each student will treat peers and the instructor with respect (both verbally and in written communication) and will not engage in disruptive classroom activities. Disruptive activities include, but are not limited to, inappropriate use of technology, “sidebar” conversations during lecture, class discussions or presentations, arriving late, leaving or packing up early, and repeatedly exiting and entering the classroom.

In the event you are experiencing symptoms of sickness you are encouraged to stay home and communicate with me as soon as you are able. We will work together to determine alternate participation options to keep you up-to-speed on course content.

Excused absences for University-recognized activities

Students who will be absent while representing the University in officially recognized University activities must notify the Dean of Students not less than ten (10) days prior to the absence. The Dean of Students will provide the student with a letter of excuse for the professors. It is the student’s responsibility to give the letter to the professors prior to the official recognized activity. Students following these procedures will be permitted to make up both assignments and examinations in consultation with faculty.

Expectations regarding the use of Chegg and similar online resources:

Please be aware that while there are many websites claiming to offer study aids to students, but in using such websites, students could find themselves in violation of academic conduct guidelines. These websites include (but are not limited to) Chegg, Coursicle, Quizlet, and Course Hero.

Using any of these products in an unethical manner could lead to a violation of the university’s academic integrity policy. Sites such as these encourage students to upload course materials, such as test questions, individual assignments, and examples of graded material. Such materials are the intellectual property of instructors, the university, or publishers and **may not be distributed** without prior authorization. Students

who engage in such activity could be found in violation of academic conduct standards and could face course and/or University penalties, as well as copyright infringement legal ramifications. Please let me know if you are uncertain about the use of a website so I can determine its legitimacy.

Accommodations Policy

The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs, services and activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University. Students requesting an accommodation based on a disability must register with the [UTEP Center for Accommodations and Support Services](#).

Academic Integrity

The University of Texas at El Paso prides itself on its standards of academic excellence. In all matters of intellectual pursuit, UTEP faculty and students must strive to achieve excellence based on the quality of work produced by the individual. In the classroom and in all other academic activities, students are expected to uphold the highest standards of academic integrity. Any form of academic dishonesty is an affront to the pursuit of knowledge and jeopardizes the quality of the degree awarded to all graduates of UTEP.

Any student who commits an act of academic dishonesty is subject to discipline. Academic dishonesty includes, and is not limited to: cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, and any act designed to give unfair advantage to a student or the attempt to commit such acts. Proven violations of the detailed regulations, as printed in the [Handbook of Operating Procedures \(HOP\)](#), can result in sanctions ranging from disciplinary probation, to a failing grade on the work in question, to a failing grade in the course, to suspension or dismissal, among others.

If academic dishonesty is suspected or observed, please report it to the instructor -- this will be kept in the strictest confidence.

The instructor reserves the right to modify this document. The most up-to-date version of the document will be available on Blackboard, and changes will be announced in class and/or communicated via Blackboard announcement.