

IE 5301 - 001, 002, 003
Operations Research
Spring 2018
MW 5:30 – 6:50 p.m.
402 Woolf Hall

Instructor: Dr. Bill Corley

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Office Hours: M 1:30 - 3 p.m.

GTA: Azam Boskabadi (azam.boskabadi@mavs.uta.edu)

Office Hours: TBA

Description of Course Content: A survey of quantitative methods to develop modeling and decision-making skills. Topics include linear programming, the simplex and dual simplex algorithms, integer programming, transportation and assignment problems, goal programming, nonlinear programming, network analysis, decision trees, game theory, Markov chains, and queueing theory. Course software is used.

Student Learning Outcomes: This course is designed to develop modeling skills and an ability to apply deterministic quantitative optimization methods to the decision-making process. At the end of this course, students should be able to understand the basic concepts of operations research and to apply these methods to representative deterministic real-world problems. These outcomes will be evaluated with three in-class quizzes.

Required Textbook: *Operations Research* by Taha, tenth edition, 2017.

Teaching Philosophy: My underlying teaching philosophy consists of four goals: (1) to present the basic principles of course material and their applications in a clear and understandable way; (2) to foster in students a capacity for independent thought, curiosity, and openness to new ideas; (3) to help students acquire an ability to educate themselves since most their learning comes after college; (4) and more generally to make students realize that they are ultimately responsible for themselves and their decisions. Objective (4) is strongly emphasized to prepare the students for life after college.

Attendance: At The University of Texas at Arlington, taking attendance is not required, but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based

on evidence such as a test, participation in a class project or presentation, or an engagement online via Blackboard. This date is reported to the Department of Education for federal financial aid recipients.

For this class, I have established the following attendance policy:

- (1) Class attendance is required for the first two weeks of class. Afterward, attendance is not required except on days noted in the schedule. However, attendance is strongly encouraged.
- (2) You are responsible for all information given in class. It will not be repeated outside class since you also have access to a video of each class as noted below. Students not attending class regularly average roughly nearly a grade lower than those attending.
- (3) Students will be assigned permanent class seats in the first two weeks. Choose a seat and sit there on the third period. That seat will become your assigned seat. In this way, further data can be acquired to correlate class attendance and grades.

Homework: Homework problems will be assigned and must be submitted to the GTA by class time every Monday. Individual problems will not be graded, but one point per problem will be subtracted from the sum of test scores for the semester for each problem not submitted. In other words, your semester average will be affected. Moreover, failure to work these assigned problems will likely lead to poor grades. Solutions to the homework problems will be provided after the due date.

Videos: You will have access on Blackboard to a video of each class unless there is a technical issue. The availability of videos is thus not guaranteed. Moreover, most students do not learn well from videos, probably from lack of focus. The videos are provided as a means to review the material presented in class. I do expect you to view the video if you do not attend a lecture.

Expectations for Out-of-Class Study: Beyond the time required to attend each class meeting, students enrolled in this course should expect to spend at least an additional 6 hours per week of their own time in course-related activities. Studying for exams will require further time.

Class Courtesy: To enhance learning, the instructor insists on a quiet classroom. Silence cell phones before class and refrain from talking during class. Students who come to class late should enter the classroom as discreetly as possible. If students consistently arrive late, the classroom will be locked 10 minutes after class begins, in which case a student will not be allowed to enter. In general, students who are disruptive in class will be asked to leave.

Schedule:

- Wednesday, January 17 – overview
- Monday, January 22 – modeling with linear programming
- Wednesday, January 24 – simplex algorithm
- Monday, January 29 – simplex algorithm
- Wednesday, January 31 – simplex algorithm
- Monday, February 5 – duality and dual simplex algorithm
- Wednesday, February 7 – NO CLASS
- Monday, February 12 – integer programming
- Wednesday, February 14 – integer programming, modeling with IP, TORA LP problems due

- Monday, February 19 – review period, ATTENDANCE REQUIRED
- Wednesday, February 21 – test 1
- Monday, February 26 – network analysis (see also <http://optlab-server.sce.carleton.ca/POAnimations2007/MaxFlow.html>), test 1 returned, ATTENDANCE REQUIRED
- Wednesday, February 28 – decision trees
- Monday, March 5 – decision trees, TORA network problems due
- Wednesday, March 7 – game theory
- Monday, March 12 – spring break
- Wednesday, March 14 – spring break
- Monday, March 19 – nonlinear programming
- Wednesday, March 21 – nonlinear programming
- Monday, March 26 – nonlinear programming
- Wednesday, March 28 – dynamic programming,
- Monday, April 2 – dynamic programming
- Wednesday, April 4 – review period, ATTENDANCE REQUIRED, computer NLP problems due
- Monday, April 9 – test 2
- Wednesday, April 11 – Markov chains, test 2 returned
- Monday, April 16 – Markov chains
- Wednesday, April 18 – Markov chains
- Monday, April 23 – queueing theory
- Wednesday, April 25 – queueing theory
- Monday, April 30 – queueing theory, TORA queueing problems due, Student Feedback Survey
- Wednesday, May 2 – review period, ATTENDANCE REQUIRED
- Monday, May 7, 5:30 - 8:00 p.m. – test 3,

Review Classes: In the above schedule, certain classes have been designated as review classes - but only as time permits. During these classes, the instructor or GTA will go over homework problems and practice exam questions, plus answer reasonable student questions on the test material.

Changes to Syllabus: The instructor reserves the right to make reasonable modifications to this syllabus as needed during the semester when circumstances arise. Students will be notified in advance of such changes both in class and by email. All students are responsible for such changes.

Student Feedback Survey: About two weeks before the end of the semester, each student will receive an email invitation to participate in this anonymous Student Feedback Survey (SFS) reflecting the student's experience in this course. For IE 5301-001, 002, 003, any student participating in the SDS will have 5 points added to the sum of the student's test scores as an incentive to participate. Further details will given later.

Late Submissions: Late submissions of any type will not be accepted, including evidence of taking the SFS.

Description of Major Assignments and Examinations:

1. There will be three in-class tests on the dates as noted in the schedule above. They will be closed-book as noted below in Exam Protocol below. The problems on each test will be equally weighted even though some may be easier or harder than others. Test grades are NOT curved. Test 2 will include a simple linear programming problem as well as problems over the material since test 1. Test 3 will include both a simple linear programming problem and a simple nonlinear programming problem as well as problems over the material since test 2.
2. Six linear programming problems solved by Tora (or some other LP solver) are due February 14 at the beginning of class. Anyone not submitting these problems ON TIME will have 1 point per problem deducted from his total test points for the semester. Some form of computer printout of the solution is required. In all cases, simply apply Tora to the mathematical linear programming problems and ignore the directions. In the tenth edition of Taha, these problems are:
 - page 122 - #3-32
 - page 126 - #3-50
 - page 126 - #3-52
 - page 129 - #3-59
 - page 129 - #3-62
 - page 363 - #9-60.
3. Five nonlinear programming problems solved by Lingo, Matlab, or some other standard software are due on March 20 at the beginning of class. These problems must be formulated by the student, so each student will have different problems. A trial version of Lingo can be obtained at www.lindo.com. Anyone not submitting all these problems ON TIME will have 1 point per problem subtracted from his/her sum of test scores for the semester. A copy of your problems and some form of computer printout of the solution are required.
4. Two network problems solved by TORA are due March 5 at the beginning of class. Anyone not submitting all these problems ON TIME will have 1 point per problem subtracted from his/her sum of test scores for the semester. Some form of computer printout of the solution is required. In the ninth edition of Taha, these problems are:
 - page 263 - #6-18 (a)
 - page 265 - #6-30.
5. Five queueing problems assigned in the notes must be solved by Tora and turned in May 1.

Make-up Exams: Make-up exams will NOT be given unless an illness or emergency is thoroughly documented. Whenever, possible, you should contact the instructor before the exam in such cases. A missed final exam will result in an F in the course unless (i) the instructor is contacted and (ii) the illness or emergency is documented by the end of finals week.

Exam Protocol:

1. The test is closed book. The only materials that you can have at your desk are the "cheat sheets" provided by the instructor.
2. Your cell phone and computer, plus all books and your own class notes, must be placed at the side of the room, front of the room, or back of the room. It is suggested that you not bring them.

3. You must sit in the seat on the seating chart shown on the door and at the front of the room. No exceptions. This seat will differ from your permanent class seat.
4. Bring your UTA IDs for possible checking.
5. Arrive EARLY to put your books, etc., away and to find your assigned seat. Anyone arriving late will not receive extra time.
6. Talking to anyone during the test or having a cell phone on your person during the test is defined to be cheating in this class.
7. The instructor will quickly go over the test at the beginning of the period. No questions will be answered for anyone about the test while you are taking it.
8. Students are not permitted to leave the room during the exam. Suspicious activity will be noted on the seating chart. The University of Texas System has approved videotaping a test. This will be done if possible.
9. Five points will be deducted on a test for EACH minute, rounded, that a student continues working on a test after the instructor calls for them to be turned in.
10. The exams will ONLY be given back and explained during the next period. They will not be given back at any other time without a documented illness or emergency. Class attendance is compulsory on that day.

Exam Grading Complaints: If you disagree with your grade on any test problem when the exam is returned, you must submit after that class a written statement on the back of the returned exam that indicated the problem to be regraded. I will regrade that particular problem as well as the entire exam. Remember that ONLY what you systematically wrote on the exam paper while taking it can be considered in grading a problem – not what you meant or claim to know. Moreover, answers that are submitted without supporting written work will receive NO credit. Simply putting down an answer is quite suspicious. Even if you can do problems in your head, still show your work.

Course Grade:

- Grading: A = 90 - 100, B = 80 - 89, C = 70 - 79, D = 60 - 69, F = 0 - 59.
- The three examinations will be equally weighted as 1/3 of your grade.
- Grades are not curved.
- No extra work will be given to improve a grade.
- No exam can be retaken to improve a grade.
- Grades will not be negotiated.

Online Education Policy:

- Information about distance learning may be found at <http://www.uta.edu/engineering/future-students/engineering-online/current-students.php>.
- Online students are required to communicate with the faculty before the second class period and let the instructor know that you are viewing the lectures.
- For any problems viewing ClassRev (Echo360) recordings, contact classroomsupport@uta.edu, not the instructor.

- Online students living in the DFW area will be required to take all exams in class during the designated exam period.
- Online students living outside the DFW area must set up a proctor as noted at <http://www.uta.edu/engineering/future-students/engineering-online/proctor-information.php>. It is the responsibility of the student, not the instructor, to do this as soon as possible.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to withdraw officially if they do not plan to attend after registering. Students will not be automatically dropped for non-attendance. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://www.uta.edu/aao/fao/>).

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including The Americans with Disabilities Act (ADA), The Americans with Disabilities Amendments Act (ADAAA), and Section 504 of the Rehabilitation Act. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of a letter certified by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting: The Office for Students with Disabilities, (OSD) www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

Non-Discrimination Policy: The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.

Title IX Policy: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. For information regarding Title IX,

visit www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.

Academic Integrity: Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. Additional information is available at <https://www.uta.edu/conduct/>.

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include [tutoring](#), [major-based learning centers](#), developmental education, [advising and mentoring](#), personal counseling, and [federally funded programs](#). For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at <http://www.uta.edu/universitycollege/resources/index.php>.

University Tutorial & Supplemental Instruction (Ransom Hall 205): UTSI offers a variety of academic support services for undergraduate students, including: 60 minute one-on-one tutoring sessions, Start Strong Freshman tutoring program, and Supplemental Instruction. Office hours are Monday-Friday 8:00am-5:00pm. For more information visit www.uta.edu/utsi or call 817-272-2617.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit <http://www.uta.edu/news/info/campus-carry/>

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory shall be directed to complete a Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

Final Review Week: A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities

such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exits, which are located on the first floor down the stairs at the either end of the hallway. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.

Inclement Weather Policy: If the University is closed, this class will not meet. Any scheduled assignments or examinations will be rescheduled to the next class period that the class meets. You can get information by dialing 972-601-2049 or checking the main website at www.uta.edu.