

EMIS 3360: Spring 2017

## Operations Research

TR: 09:30 - 10:50 am Caruth Hall 0179

<b>Instructor(s)</b> :	Prof. Harsha Gangammanavar	<b>TA(s)</b> :	Siavash Tabrizian
email :	harsha@smu.edu	email :	stabrizian@smu.edu
Office hours :	Caruth Hall 331	Office hours :	Caruth Hall 472
	TR 11:00 am - 12:00 pm		WF 5:00 pm - 6:00 pm
	Also by appointment		
Laboratory :	Caruth Hall 0314		
	Wed. <u>or</u> Fri. 3:30 - 5:00 pm		

**Description:** *An overview of models and optimization techniques employed in operations research and management science. Topics include linear, integer and dynamic programming with applications in resource allocation, scheduling, transportation, financial portfolio management, production planning, supply chain management etc. An introduction to computational solution approaches will also be presented.*

### Objectives:

1. Write down algebraic formulation of optimization models.
2. Use algebraic modeling language to model practical applications and solve them using a computer.
3. Understand the simplex method for linear programming.
4. Understand the relationship between a linear program and its dual, including strong duality and complementary slackness.
5. Perform sensitivity analysis to verify the changes in solutions when model parameters are varied.
6. Learn to formulate special structure linear programs in network optimization problems, particularly transportation and assignment problems.
7. Learn solution methods and optimality conditions of sequential decision problems using dynamic programming.
8. Understand how to formulate integer programs, and their solution algorithms.

**Laboratory Sessions:** This is intended to provide help with software, and homework assignments. The students must enroll in one of the two lab sessions to be held in 314 Caruth Hall. You must have a Lyle computer account to use the lab computers. Alternatively, you may use your own PC or Mac in the lab.

### Course Material:

- **Textbook:** Frederick S. Hillier and Gerald J. Lieberman, *Introduction to Operations Research*, McGraw-Hill, tenth edition, 2015, ISBN: 0073523453.  
The textbook is associated with a website which includes solutions, worked examples, articles, a test-bank, companion software, and bonus chapters as well as case studies.
- **Reference(s):** AMPL: Robert Fourer, David M. Gay, and Brian W. Kernighan, *AMPL: A Modeling Language for Mathematical Programming*, Second edition, ISBN 0-534-38809-4 (available online: <http://www.ampl.com/>)
- **Other material:** Selected lecture notes, homework exercises and their solutions, course announcements, and other course related material will be posted on the course page on Canvas.

### Course Requirement and Grading:

- **Homework:** A total of ten (tentatively) homework sets will be assigned over the semester to help you understand the concepts developed in the class. All homework assignments are weighted equally and will generally be due on Sundays at 11:59 pm (unless otherwise indicated on the homework).

The students will turn in homework electronically on Canvas. The students are encouraged to discuss the course material, including homework, with their classmates. However, they are completely responsible for their final submission. The assignments should be submitted in a **single MS Word or PDF file** (cell phone camera pictures of handwritten notes will not be accepted).

**Late homework will not be accepted for grading**, unless prior permission has been granted. Please make sure you complete the homework early to avoid any unforeseen situations (internet/electronic troubles etc.).

- **Examinations:** All exams will be “in-class” and “closed book”. You are allowed to bring one 8.5” x 11” sheet of hand written notes for use during the exam. This sheet must be turned in with the exam. Students are allowed to use their calculators in the exams.

**Scheduling conflicts:** Legitimate conflicts that prevent you from taking your exam on scheduled dates and special requests should be notified within the first two weeks of the course. Any requests after that time will be handled on case-by-case basis.

- **Project:** See project description for more detail.
- **Grade distribution:**
  - Homework: 40%
  - Project: 15% (a compulsory component)
  - Midterm-1: 10%
  - Midterm-2: 15%
  - Final Exam: 20%

### University policies:

- **Disability Accommodations:** Students needing academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit here to begin the process. Once registered, students should then schedule an appointment with the professor as early in the semester as possible, present a DASS Accommodation Letter, and make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.
- **Religious Observance:** Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)
- **Excused Absences for University Extracurricular Activities:** Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)

- **University Honor Code:** Students are reminded that the SMU Honor Code applies to this course. Honor Code violations will be dealt with in a manner determined by the instructor.
- **“Campus Carry” law:** In accordance with Texas Senate Bill 11, also known as the “campus carry” law, following consultation with entire University community SMU determined to remain a weapons-free campus. Specifically, SMU prohibits possession of weapons (either openly or in a concealed manner) on campus. For more information, please see: [link](#).

**Tentative course plan:**

Week	Mondays		Wednesdays	
1	01/24	Operations research: Introduction	01/26	Operations research: Models
2	01/31	Linear programming models - 1	02/02	Linear programming models - 2
3	02/07	Linear programming models - 3	02/09	Graphical method and solution properties
4	02/14	Simplex Method - 1	02/16	Simplex Method - 2
5	02/21	Simplex 2-phase method	02/23	Linear programming duality
6	02/28	Economic interpretation and sensitivity analysis	03/02	<b>Midterm-1</b>
7	03/07	Integer programming models	03/09	Integer programming models
8	Spring break			
9	03/21	Integer programming solutions	03/23	Integer programming solutions: B & B
10	03/28	Transportation and assignment problems	03/30	Transportation simplex
11	04/04	Network optimization: min-cost problems	04/06	Network optimization: shortest path
12	04/11	Network optimization: max-flow problems	04/13	<b>Midterm-2</b>
13	04/18	Linear programming under uncertainty	04/20	Deterministic dynamic programming
14	04/25	Probabilistic dynamic programming	04/27	Dynamic programming solution technique
15	05/02	Presentations	05/04	Presentations
-	Thursday, 05/11: Final exam, 8:00 am - 11:00 am			