CEE512 Logistics Systems Analysis

(1:00 - 2:20 p.m. MW, 2312 Newmark Civil Engineering Bldg, or online)
Website: Illinois Compass 2g (https://compass2g.illinois.edu)

Instructor

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Office hour: 2:20 – 3:20 p.m. MW, or by appointment

Guest Lecturer and Teaching Assistant

Chao Lei	Zhoutong Jiang
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By appointment	F 4:00 – 5:00 p.m.
Location: B226 Newmark	Location: B156 Newmark

Course Description

This 4-hour graduate course aims to introduce practical methods for the planning, design and evaluation of complex logistics and distribution systems. This course introduces modeling techniques and solution approaches that reduce cumbersome details of logistics systems into models with a manageable number of parameters and decision variables. It shows how the solutions to these models are interpreted into optimal rules that guide the operation, design or planning process.

In many cases, we present a variety of perspectives and techniques to certain problems and compare their performance. The course should help students develop: (i) an understanding of practical methods for formulating and solving logistics problems, and (ii) the skills needed to plan, design and evaluate a complex logistics system. Some of these mathematical optimization techniques are based on recent research findings. The course will emphasize supervised problem-solving and in-class discussion.

This course will cover the following topics: transportation, inventory, production cost interrelationships; design and operation of physical distribution systems; one-to-one, one-to-many, and many-to-many logistics systems; inventory management; vehicle routing; terminals, transshipments and terminal systems; facility locations; relevant analytical methodologies.

The online section of this course is restricted to online non-degree, online MCS, online MSME and online MS CE students. Online & Continuing Education (OCE) restrictions and assessments apply, see http://www.oce.illinois.edu.

Prerequisites:

CEE310 or IE 310 or equivalent, or consent of instructor. Solid mathematics background, basic understanding of optimization concepts, and working knowledge of at least one computer programming language will be helpful.

Textbook

- "Logistics Systems Analysis." (4th Edition) Daganzo, C.F., Springer-Verlag (2005)
- (*optional*) "Network and Discrete Location." Daskin, M.S., Wiley-Interscience (1995)
- (*optional*) "The Vehicle Routing Problem." Toth, P. and Vigo, D., Society for Industrial and Applied Mathematics (2002)

Additional References

- "Urban Operations Research." Larson, R.C., and Odoni, A.R., Prentice-Hall, Englewood Cliffs, N.J. (1981).
- "The Logic of Logistics." Bramel, J., and Simchi-Levi, D., Springer (1997).
- "Urban Transportation Networks." Sheffi, Y., Prentice Hall, Englewood Cliffs, N.J. (1985).

Grading

Homework	35%
Quizzes	30%
Project	30%
Classroom Participation	5%

Homework

Students will be graded on completion of homework problems (as listed in the course schedule). Some of them will be from the textbook, and others will be handed out in class. Each set of homework problems is worth either 10 or 20 points (based on difficulty), and all homework problem points sum up to 130. Students getting 100 points or more will receive full homework credits.

We permit and encourage intellectual collaboration on assignments. However, each student should write their own answers in their own words. Identical approaches to a problem could be expected, but word-for-word identical responses are not acceptable.

Homework is due at the start of class on the date indicated in the course schedule (see next page), and the solutions will be discussed in class. NO LATE submissions are accepted. Students are also encouraged to present solutions to homework problems in class, and participate in other in-class discussions.

Quizzes

Students will be graded on two sets of in-class closed-book quizzes that may involve true/false, multiple choice, and problem-solving questions. Each quiz will take about 40 minutes.

Term Project

Students are expected to finish a term project in groups (up to 5 students) by the end of the semester. The focus of the project may be either to evaluate an existing logistics system or to propose and design a new one, or both. The theme of the project can be either applied or theoretical. For example, students may design and evaluate a home delivery system (e.g., for Meijer, Walmart, Burger King), analyze and improve a distribution system (e.g., campus safe-ride system), or propose a new service (e.g., dial-a-ride airport shuttle, or faculty/staff carpool program). To start, students will need to decide the scope of the project, and the problem of interest. It is also important to determine what business data to collect, and how to collect it. Specific tasks in the project may include (but not limited to) inventory management, facility location and layout design, fleet management, labor management, and information infrastructure. Students may also devise a set of efficient operating rules for their system.

Student groups will not be formed until late September. Before that, students are expected to explore potential topics. They are strongly encouraged to talk with the instructor and/or teaching assistants early in the semester. Each group will make a podium presentation on their project by the end of the semester. The complete course project report will be due at 11:59 pm on the Reading Day (via Compass).

Tentative Schedule (maybe subject to change)

Week	Date	Lecture Subject	Project Guideline	HW (130 pts)	Quiz
1	26/08/2019	Syllabus, overview and introduction (Chap1)	**Introduction**		
	28/08/2019	Cost analysis, production I/O analysis (Sec. 2.1-2.3)			
2	02/09/2019	**No class - Labor Day**			
	04/09/2019	One-to-one systems, deterministic inventory & lot-sizing models (Sec2.4-			
3	09/09/2019	3.2)		1.2	
	11/09/2019	Cond'l probability, expectation, variance	**Form Groups**		
4	16/09/2019	Stoc. inventory models (Sec. 2.6)			
	18/09/2019	Optimization techniques (Sec.3.7, dynamic programming; shooting method)			
5	23/09/2019			**Handout 1***	
	25/09/2019	Continuum approx. (CA, Sec. 3.3-3.6)			
6	30/09/2019	Network basics, one-to-many systems (Sec. 4.1)		3.1	
	02/10/2019	Basic TSP and VRP formulations		3.3 (Due on 04/10)	
7	07/10/2019	VRP formulation variants			
	09/10/2019	TSP & VRP solution methods (1.5 class time)		**3.6***	
8	14/10/2019	Dimensional Analysis	**Progress report (5min)**		**#1**
	16/10/2019	Asymptotic TSP&VRP (Sec.4.1-4.2, App. A)		**Handout 2***	
9	21/10/2019	CA for VRP and inventory routing (Sec 4.3-4.7)			
	23/10/2019	Guest lecture - Selected research topics			
10	28/10/2019	Discrete facility location problems (Daskin Chp 4-7)			
	30/10/2019	Discrete facility location problems (Daskin Chp 4-7)			
11	04/11/2019	Solution methods (e.g., Lagrangian relaxation)			
	06/11/2019	Solution methods (e.g., Lagrangian relaxation)			
12	11/11/2019	Terminal system overview (Sec 5.1)		4.5	
	13/11/2019	Transshipment: location-routing-inventory (Sec 5.2)			
13	18/11/2019	Solution methods (e.g., Lagrangian relaxation)			
	20/11/2019	Discrete facility location problems (Daskin Chp 4-7)			**#2**
14	25/11/2019	**No class - Thanksgiving**			
	27/11/2019	**No class - Thanksgiving**			
15	02/12/2019	CA for transshipment problem (Sec 5.2-5.3)		**Handout 3***	
	04/12/2019	Guest lecture - Selected research topics		5.1	
16	09/12/2019	Group presentations	**Presentation**		
	11/12/2019	**Group presentations (with extra hours)**	**Presentation**		
	12/12/2019	mid-night	**Final report**		

* Boldfaced homework problems are worth 20 points each, while all others are worth 10 points each.

* Shaded lectures will be given by a Guest Lecturer.