GCU 591: **OPTIMAL FACILITY LOCATION MODELS**
Schedule Line Number 88491, Fall Semester, 2007
Room: SCOB 302, Wednesdays 1:40-4:30 PM

Professor: Dr. Michael Kuby (mikekuby@asu.edu)
SCOB 140, Phone: 480-965-6850 (until I move to COOR)
SCOB 330D (Tu/Th office hours in SCOB after I move to COOR)
COOR 5568, Phone: same as in SCOB

Office Hours: Tuesdays 1:30-3:00 PM (in SCOB)
Wednesdays 10-11 AM (in COOR)
Thursdays 11-12 AM (in SCOB)
or by appointment

Required Text: Mark S. Daskin, *Network and Discrete Location: Models, Algorithms, and Applications.* New York: John Wiley and Sons, 1995.

Supplementary references will be made available for sale as needed.

Software: Xpress-MP Student version downloadable from http://www.dashoptimization.com/. Go to *Sales* and then *Free Student Version*. The student version will be loaded on all computers in the SCOB 316 and SCOB 328 computer labs (but isn't there yet)

CLASS POLICIES

Class Attendance. Mandatory. Preparation for and participation in every seminar is expected.

Assignments: There will be a number of computer or math assignments, especially early in the semester. This is an applied math course, and if you don't *use it*, you won't *get it.* Tentative due dates are shown on the schedule (subject to change, depending on how fast we cover the material).

Discussion Leaders: Students will be asked to teach certain topics (depending on how many are in the class) and lead class discussions on those topics. It is expected that the students will develop a detailed handout, including examples, for their topics. I can make copies of your handouts prior to class.

Project: Students will work on individual or group projects/papers during the last part of the semester. This can take the form of a literature review, an application of an existing model, development of a new formulation, or implementation of a solution algorithm. I can help you come up with ideas. I have several unfinished projects that other students worked on but never finished that an individual or a group could try to finish. Students will present their projects on the last day of class.

Grades. Given that this class is a seminar, grades will be determined as follows:

Participation	10%
Presentations	15%
Homework	35%
Final Project	40%

Incompletes: Incompletes will only be given in the rarest of circumstances. As per university policy, an incomplete automatically reverts to an E after one year if the agreed upon work has not been successfully completed.

COURSE OUTLINE

Date	Topics	Readings	Assignments Due	Class Leader
Aug. 22	**Course Introduction**			
	Linear Programming (LP) Problem formulation			
	Simple Transportation Problem (Hitchcock problem)			
	Generalized LP Formulations			
Aug 29	**Linear Programming** Graphical solution	Ch. 1 Ch. 2.1-2.5 (only to p. 33)	LP Homework 1	
	Introduction to Simplex Method			
	Standard LP form			
Sept. 5	**Linear Programming** Simplex method, continued	Packet	LP Homework 2	
	Matrix algebra Simplex method			
	Taxonomy of Location Models	Ch 1.4		
	How to use Xpress-MP			
Sept. 12	**Set-Covering Problem**	Ch. 4.1 – 4.2	LP Homework 3	
	Row and Column Dominance	pp. 95-99		
	Branch-and-bound	pp. 99-105		
	Backup Coverage Model	Ch. 4.4		
Sept. 19	**Maximum Covering Problem**	Ch. 4.5, 4.7	Set Cover Problem Set	
	Greedy Adding Algorithm	Ch. 4.5.1		
	p-Center Problem	Ch. 5.1 – 5.2		
	Integer-friendly programming	ReVelle (1993)		
Sept. 26	**Fixed-Charge Problem**	Ch. 7.1 - 7.2		
	Heuristic Algorithms (Add/Drop/Exchange)	7.2.1 – 7.2.2		
	Capacitated Fixed Charge Location Problem	Ch. 7.3 (pp. 275-277 only)		

Date	Topics	Readings	Assignments Due	Class Leader
Oct. 3	**Flow-Capturing or Flow-Intercepting Problems**	Hodgson (1990)	Fixed Charge Problem Set	
	Flow-Refueling Problem	Kuby and Lim (2005) Kuby et al. (2007)		
	Generalized Flow-Intercepting Model	Zeng (2007)		
Oct. 10	**p-Median Problem**	Ch. 6.1		
	LP formulation and Hakimi's Theorem	Ch. 6.2, plus p. 226		
	Heuristic Methods for p-Median	Ch. 6.3 - 6.4		
	Heuristic Concentration	Rosing and Hodgson (2002)		
Oct. 17	**Undesirable Facility Location Problems**	Ch 8.8 Erkut and Neuman (1989)	P-Median Problem Set	
	p-dispersion problem	Erkut (1990)		
	Risk-sharing model	Ratick and White (1988)		
Oct. 24	**Multiobjective Location Problems** Constraint & Weighting Methods	Ch. 8.2		
	Toxic Waste Management in AZ	Wyman & Kuby (1995)		
	Optimal Dam Removal	Kuby, Fagan, ReVelle, and Graf (2005)		
Oct. 31	**Reserve Design Problem**	Clemens, ReVelle, and Williams (1999),	Multiobjective Programming Problem Set	
		ReVelle, Williams and Boland (2002)		
Nov. 7	To be determined			
Nov. 14	To be determined			
Nov. 21	**NO CLASS--THANKSGIVING**			
Nov. 28	**Student Presentations**			

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SUPPLEMENTARY READING LIST (Preliminary)

Clemens, Michael A., Charles S. ReVelle, and Justin C. Williams. 1999. Reserve Design for Species Preservation. *European Journal of Operational Research* 112:273-283.

Erkut, E. 1990. The discrete p-dispersion problem. *European Journal of Operational Research* 46: 48-60.

Erkut, E. and Neuman, S. 1989. Analytical models for locating undesirable facilities. *European Journal of Operational Research* 40: 275-291.

Hodgson, M. J. 1990. A flow capturing location-allocation model. *Geographical Analysis* 22: 270-279.

Kuby, Michael, and Seow Lim. 2005. The Flow-Refueling Location Problem for Alternative-Fuel Vehicles. *Socio-Economic Planning Sciences* 39(2):125-145.

Kuby, Michael, Lee Lines, Ronald Schultz, Zhixiao Xie, Jong-Geun Kim, and Seow Lim. 2007. Infrastructure planning for hydrogen refueling stations in Florida. Paper to be submitted to *International Journal of Hydrogen Energy*.

Kuby, Michael, William F. Fagan, Charles ReVelle, and William L. Graf. 2005. Multiobjective Optimization for Dam Removal: An Example Trading Off Salmon Passage With Hydropower and Water Storage in the Willamette Basin. *Advances in Water Resources* 28(8): 845-855.

Ratick, S. and White, A. 1988. A risk sharing model for locating noxious facilities. *Environment and Planning B* 15: 165-179.

ReVelle, C. 1993. Facility siting and integer-friendly programming. *European Journal of Operational Research* 65: 147-158.

ReVelle, Charles S., Justin C. Williams, and John J. Boland. 2002. Counterpart Models in Facility Location Science and Reserve Selection Science. *Environmental Modeling and Assessment* 7: 71-80.

Rosing, K.E. and Hodgson, M. John. 2002. Heuristic concentration for the p-median: and example demonstrating how and why it works. *Computers and Operations Research* 29:1317-1330.

Wyman, M. M. and Kuby, M. 1995. Proactive optimization of toxic waste transportation, location and technology. *Location Science*, 3, 167-185.

Zeng, Weiping, Ignacio Castillo, M. John Hodgson. 2007. A generalized model for locating facilities on a network with flow-based demand. Manuscript/dissertation chapter.

A useful online bibliography with thousands of location-science books and articles is at: *http://gator.dt.uh.edu/~halet/*.