SA305 – Linear Programming
Asst. Prof. Nelson Uhan

Spring 2015

Syllabus

Last updated: 5 January 2015

Course description Operations research (OR) is a broad field which, loosely speaking, investigates how mathematical techniques can be used to solve "real-life" decision-making problems. This course provides an introduction to linear programming, a fundamental technique used in OR. In particular, the course focuses on formulating mathematical optimization models (also called *mathematical programs*), and understanding the mathematical underpinnings of linear programming algorithms.

Textbook D. Rader, *Deterministic Operations Research: Models and Methods in Linear Optimization*, Wiley, 2010.

Schedule This schedule is subject to change.

Unit	Week	Topic	Readings
Overview	1	Introduction to operations research	1.1
	7 Jan – 9 Jan	Introduction to optimization modeling	1.2
	2	Graphical solution of optimization models, sensitivity analysis	1.2
	12 Jan – 16 Jan	Classification of optimization models	1.3
Modeling		Introduction to GMPL and GUSEK, resource allocation models	2.1
	3	Work scheduling models	2.2
	19 Jan – 23 Jan	Blending models	2.4
	4	Production process models	2.5
	26 Jan – 30 Jan	Multiperiod models	2.6
	5	Sets, summations, for statements	2.3
	2 Feb – 6 Feb	Resource allocation models, revisited	2.1
		Blending models, revisited	2.4
	6	Multiperiod models, revisited	2.6
	9 Feb – 13 Feb	Review	
		Exam 1	

Unit	Week	Topic	Readings
	7	Work scheduling models, revisited	2.2
	16 Feb – 20 Feb	Production process models, revisited	2.5
Algorithms		Introduction to algorithm design	5.1–5.2
	8	Improving search: finding better solutions	6.1–6.2
	23 Feb – 27 Feb	Improving search: convexity and optimality	6.3
		Improving search: review	6.1–6.3
	9	Geometry and algebra of corner points	7.1
	2 Mar – 6 Mar	Fundamental theorem of LP	7.2
		Linear programs in canonical form	2.8, 7.3
	10	Basic solutions in canonical form LPs	7.3
	9 Mar – 13 Mar	The simplex method	8.1
	11	Spring Break	
	16 Mar – 20 Mar		
	12	The simplex method: review	8.1
	23 Mar – 27 Mar	Degeneracy, convergence, multiple optimal solutions	8.3
		The two-phase simplex method	8.4
Duality	13	Bounds and the dual LP	9.1, 9.2
	30 Mar – 3 Apr	Review	
		Exam 2	
	14	Weak and strong duality, complementary slackness	9.3
	6 Apr – 10 Apr	An economic interpretation of LP duality	9.6
		Maximin and minimax objectives	2.7
	15	LP duality and game theory	handout
Modeling revisited	13 Apr – 17 Apr	Introduction to networks and the shortest path problem	2.9
		Modeling with the shortest path problem	2.9
	16	Modeling with the shortest path problem, cont.	2.9
	20 Apr – 24 Apr	Review	
	17	Review	
	27 Apr – 29 Apr		