

LOUISIANA STATE UNIVERSITY
DEPARTMENT OF CONSTRUCTION MANAGEMENT & INDUSTRIAL ENGINEERING
IE-7541: LINEAR PROGRAMMING ALGORITHMS

Fall 2008

Instructor: Bhaba R. Sarker
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Phone: (225) 578-5370

CATALOG STATEMENT:

7541 Linear Programming Algorithms (3). *Prerequisite:* IE-4510 or equivalent. Optimization of linear objective functions subject to linear constraints; vector spaces, convex analysis and polyhedral sets; matrix versions of simplex, revised simplex, bounded variables, duality theory and primal-dual simplex algorithms, post-optimal and parametric analysis; decomposition, and cutting plan algorithms.

Course Summary:

Basic structure and solution procedures for simplex methods, revised simplex, LP with bounded variables, duality theorem, sensitivity and parametric analysis and Dantzig-Wolfe decomposition will be covered. Advanced topics such as separable convex programming, integer programming, branch & bounding technique, complexity of linear programming will also be discussed. Identifying the structure and devising the solution procedures for these problems with simple LP methods will be included.

Applications:

Linear programming (LP) is an important core area of industry and many branches of arts, science, engineering and social sciences. Many real life optimization problems can be formulated as and/or solved through LP. Applications of such problems are seen in industry, agriculture, hospital administration, human resource planning, economic planning, space research, transportation, etc.

Prerequisite: Introduction to Operations Research.

Textbooks: *Linear Programming and Network Flows*, 2005 edition
By M.S. Bazaraa, J. J. Jarvis & H. D. Sherali, John-Wiley & Sons

References:

1. *Linear Programming* by Katta G. Murty,
2. *Operations Research: An introduction*, By Hamdy A. Taha,
3. *Discrete Optimization* By R. G. Parker and R. L. Rardin,
4. *Introduction to Operations Research* by J. G. Ecker and M. Kupferschmid, John-Wiley & Sons, Inc.

Basis for Evaluation:	<i>Homework or Quiz (2)</i>	15%
	<i>Test (3):</i>	60%
	<i>Final Exam</i>	25%
		----- 100%

Attendance Policy: *-1% per absence and late attendance in class or LAB.*

Grading Policy†: *$0 \leq F < 60 \leq D < 70 \leq C < 80 \leq B < 90 \leq A \leq 100$.*

† Read the General Remarks.

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Topics of Discussion:

- Convex and Polyhedral Sets
- Simplex Methods
- Matrix Version of Simplex
- Revised Simplex and Product Form
- Bounded Variables
- Duality and Complementary Slackness
- Parametric Analysis
- Decomposition Principle
- Separate Convex Programming
- Integer Programming
- Branch & Bounding Technique
- Khachian/Karmarkar's Algorithm
- & Complexity of linear programming

Prerequisite:

The students who wish to take IE-7541 are supposed to be aware of the following basic course materials. Questions may be set from these background materials even if they are not taught in this class.

Topics on IE-4510:

1. Linear Programming Formulation and Graphical solution
2. Linear Programming and Algebraic Solution:
 - Extreme points
 - Basic feasible solution
 - Entering & leaving variable
 - Optimality condition
 - Pivot operation
 - Gaussian elimination
 - Slack/Artificial variable
 - M-Technique (Method of Penalty)
 - Two-Phase Technique
 - Degeneracy, Alternative optima, Unboundedness, and Infeasibility (or non-existing)
3. Duality and Sensitivity Analysis
 - Primal-Dual relationships
 - Economic interpretation of dual variables
 - Sensitivity or postoptimality analysis

Other Topics on Linear Algebra:

1. Understanding of vector and matrix
2. Matrix multiplication, transpose and inversion, etc.
3. Matrix representation of a system of equations
4. Solution of a system of equations

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Instructor: *Bhaba R. Sarker*
Class Schedule: MW 01:00-02:30 3133 Taylor Hall
Office Hrs: MWF 10:30-11:30 Taylor-3134A Phone: 578-5370 Email: *bsarker@lsu.edu*

LECTURE PLAN					
<i>Week</i>	<i>Dates</i>		<i>Chapter*</i>	<i>Topics of Discussion</i>	<i>Remarks</i>
	<i>Month</i>	<i>Wk of</i>			
1	Aug	25	BJS/Taha	Linear Algebra/Vector Spaces	
2	Sept	01	-	Labor Day Holiday (Monday)	
-	-	01	BJS	Convex Analysis & Polyhedral Sets	
3	-	08	BJS	Simplex Method: Matrix Version	
4	-	15	BJS	Simplex Method: Algebra & Convergence	Test-1
5	-	22	BJS	Special Simplex: Revised Simplex	
6	-	29	BJS	Special Simplex: Product Form	
7	Oct	6	BJS	Special Simplex: Bounded Variables	
-	-	-	-	Fall Holiday (10: Thursday-Sunday)	
8	-	13	BJS	Theory of Duality/Complementary Slackness	Test-2
9	-	20	BJS	Post-optimality & Parametric Analysis	
10	-	27	BJS	Decomposition Principle	
11	Nov	3	Taha	Separable Convex Programming	
12	-	10	Taha	<i>Integer Programming/Cutting Plane</i>	Test-3
13	-	17	EM	<i>Branch & Bounding Technique</i>	
14	-	24	F: 6-7	<i>Computational Complexity</i>	
-	-	-	-	Thanksgiving Holiday (27-28)	
15	Dec	1	BJS	<i>Khachian/Karmarkar's Algorithms</i>	
16	-	-	Final	Thursday: December 10, 2008 (10:00 – Noon)	Final Exam

GENERAL REMARKS:

- (1) Students are advised to keep all materials and handouts in an organized folder. The students are advised to do the assignment since it may be helpful for the tests.
- (2) Read the textbook and handout or referenced materials; there may be questions from the materials that may not be covered in the lectures. Assigned homework is recommended for quizzes or tests. Copying program assignments or other's homework will be considered academic dishonesty and will be dealt accordingly.
- (3) Quiz/test date will be announced in class in advance. No late sitting in test or quiz will be allowed in normal circumstances. You will lose 20% of the total points of the test each day (including the test day) for the make-up test if you are allowed to take the test beyond the scheduled time.
- (4) The instructor reserves the right to change any test pattern, test dates, homework, and class rules, with prior in-class announcement.
- (5) It is student's responsibility to keep track of scheduled dates for test, any changes in these dates, materials covered in the class and all announcements made in the class/LAB.
- (6) Students are advised to follow the attendance policy carefully. Excuses must be documented.
- (7) **Cell Phone/Calculators:**
Students using cellular phone or beeper/pager in the classroom are advised to keep them at 'off' or 'vibrating' mode. Only a basic calculator can be used in exams—electronic equipment that is capable of using data stored prior to the test schedule is not allowed during the test. Electronic equipment that is capable of communicating between other equipment inside or outside the classroom is not allowed too.

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INSTRUCTION FOR HOMEWORK

TA: None

Taylor-3415

Phone: 578-9186, e-mail: no1nozit@lsu.edu

GROUP FORMATION & HOMEWORK SUBMISSION/CORRECTION POLICY:

1. Homework assignment may be submitted by an individual or by a group of no more than two persons. It is students' responsibility to find the partner for homework. Homework submitted by more than two persons will worth zero point to each.
2. No copy of someone else's homework in any form (handwritten, typed, xerox, or photocopy-- partial or complete copy) is acceptable. Such an attempt falls under plagiarism, and will be dealt accordingly.

HOMEWORK SUBMISSION FORMAT:

3. *Only* the following should appear in the middle of the cover page:

<p><i>Homework Number: ??</i></p> <p><i>Partner Names: LAST NAME, First Name, MI</i></p> <p><i>Total Number of Partners: ??</i></p>

4. **Question Number** should be legibly written *in the left margin*. No other information should appear in the margin.
5. You must use **one side of 8.5" x 11"** paper. Torn-out and/or perforated paper pulled out from notebooks will not be accepted.
6. **Homework must be stapled.** Paper clips or any other method of fixing pages together will not be accepted.
7. Questions should be answered **systematically (in a cluster) in the order they appear** in the homework. Specific answer(s) to the question(s) posed should be *boxed* and easily visible. All work should be shown. *No hidden answer* or mental calculations without showing the proper steps will be honored for full credit. Points will be distributed over the expected complete answer of the question.
8. **Computer Output:**
 - (a) The microcomputer output pages should be **separated and arranged** in the same order of the output.
 - (b) Other computer output should be *cut to 8.5" x 11"* size if possible. *Do not* submit folded or separated pages.
 - (c) Locate the specific answer(s) and *circle or indicate* them by *box* sign.
9. Once submitted, homework will be treated as complete and **no addition(s)** to it will be accepted later on.
10. **No late homework** will be accepted. Failure to follow any of the above instructions will result in loss of *considerable* points.

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PRACTICE PROBLEMS AT HOME
Spring 2008

Chapter	Assigned problems
2	Time Value of Money
	1,2,3,4,5,6
	8,10,12,14,16,18,20,22,24
	25,27,29,31,33,35,37,39,41,43,45,47, 48,49,50,51,52,53,54,55,56,57, 61
3	Understanding Money Management
	3,5,7,9,11
	14,18,20,22
	40,42,44,46,48,50, 51,59,61
4	Equivalence Calculations under Inflation
	1, 4, 5, 7 12, 14, 16,
	18, 19, 21
5	Present Worth Analysis
	1,3,5,7,9,11
	12,14,16,18,20
	25,36,38,40,44
6	Annual Equivalence Analysis
	1,4,6,8
	15,16,18,19
	25,26,36, 40
7	Rate of Return Analysis
	1,2,3,4,5
	15,17,19,21,23,25,27, 31,33, 35, 37, 40
8	Accounting for Depreciation and Income Taxes
	3,5, 9, 11, 17, 19, 25, 28, 30, 33, 35, 37, 42
9	Project Cash Flow Analysis
	1, 3, 6, 10, 18, 19, 21, 23, 25, 27, 28
11	Replacement Decisions
	2, 3, 6, 8, 10, 17, 20, 28, 31
12	Benefit-Cost Analysis
	1, 4, 5, 6, 8,

Wise sayings:

- (a) *Ode of Sa'adi:* *A good disciple never complains—he just listens and acts,*
 (b) *Murphy's law:* *If something goes wrong, it will.*

FINAL EXAM: WEDNESDAY, DECEMBER 10, 2008 (10:00 – NOON)

Good luck

STUDENT'S CONTACT INFORMATION
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Fall 2008

No	LASTNAME, First Name	Complete Mailing Address	Phone Number and <i>e-mail</i>
<i>1</i>			
<i>2</i>			
<i>3</i>			
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