

**Linear Algebra Practice Midterm 1**  
**Spring 2019**

1. Let

$$A = \begin{pmatrix} -2 & 3 & -3 & -1 \\ 4 & 1 & 13 & -5 \end{pmatrix}$$

and consider the homogeneous system  $A\mathbf{x} = \mathbf{0}$ , where  $\mathbf{x} \in \mathbb{R}^4$  and  $\mathbf{0} \in \mathbb{R}^2$ .

(a) Compute  $\text{rref}(A \mid \mathbf{0})$ .

*Solution:*

$$\text{rref}(A \mid \mathbf{0}) = \left( \begin{array}{cccc|c} 1 & 0 & 3 & -1 & 0 \\ 0 & 1 & 1 & -1 & 0 \end{array} \right)$$

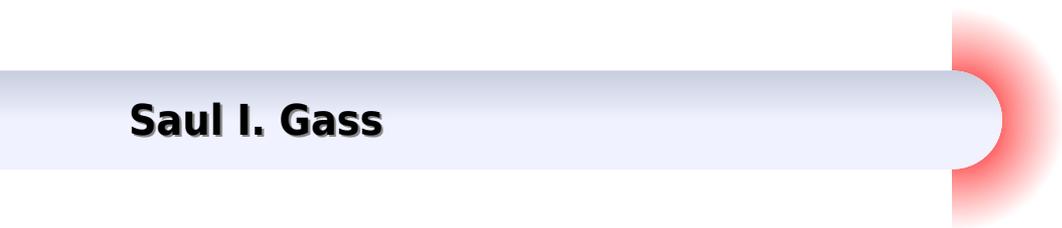
(b) Identify the pivot columns  $\mathbf{b}_j$  in  $B = \text{rref}(A \mid \mathbf{0})$ .

*Solution:* Let  $B = \text{rref}(A \mid \mathbf{0})$ . Then the pivot columns of  $B$  are

$$\mathbf{b}_1 = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad \text{and} \quad \mathbf{b}_2 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

# Math 5593 Linear Programming Midterm Exam Uc Denver

**Saul I. Gass**



## **Math 5593 Linear Programming Midterm Exam Uc Denver:**

*Math 5593 Linear Programming Lecture Notes* Alexander Engau, 2014-11-25  
*Math 5593 Linear Programming Lecture Notes* By Alexander Engau     **Linear Programming: Mathematics, Theory and Algorithms** M.J. Panik, 2013-12-01  
Linear Programming provides an in depth look at simplex based as well as the more recent interior point techniques for solving linear programming problems Starting with a review of the mathematical underpinnings of these approaches the text provides details of the primal and dual simplex methods with the primal dual composite and steepest edge simplex algorithms This then is followed by a discussion of interior point techniques including projective and affine potential reduction primal and dual affine scaling and path following algorithms Also covered is the theory and solution of the linear complementarity problem using both the complementary pivot algorithm and interior point routines A feature of the book is its early and extensive development and use of duality theory Audience The book is written for students in the areas of mathematics economics engineering and management science and professionals who need a sound foundation in the important and dynamic discipline of linear programming     *Linear Programming Using MATLAB®* Nikolaos Ploskas, Nikolaos Samaras, 2017-10-28 This book offers a theoretical and computational presentation of a variety of linear programming algorithms and methods with an emphasis on the revised simplex method and its components A theoretical background and mathematical formulation is included for each algorithm as well as comprehensive numerical examples and corresponding MATLAB code The MATLAB implementations presented in this book are sophisticated and allow users to find solutions to large scale benchmark linear programs Each algorithm is followed by a computational study on benchmark problems that analyze the computational behavior of the presented algorithms As a solid companion to existing algorithmic specific literature this book will be useful to researchers scientists mathematical programmers and students with a basic knowledge of linear algebra and calculus The clear presentation enables the reader to understand and utilize all components of simplex type methods such as presolve techniques scaling techniques pivoting rules basis update methods and sensitivity analysis     **Linear Programming with MATLAB** Michael C. Ferris, Olvi L. Mangasarian, Stephen J. Wright, 2007-01-01 This textbook provides a self contained introduction to linear programming using MATLAB software to elucidate the development of algorithms and theory Early chapters cover linear algebra basics the simplex method duality the solving of large linear problems sensitivity analysis and parametric linear programming In later chapters the authors discuss quadratic programming linear complementarity interior point methods and selected applications of linear programming to approximation and classification problems Exercises are interwoven with the theory presented in each chapter and two appendices provide additional information on linear algebra convexity nonlinear functions and on available MATLAB commands respectively Readers can access MATLAB codes and associated mex files at a Web site maintained by the authors Only a basic knowledge of linear algebra and calculus is required to understand this textbook which is geared toward junior

and senior level undergraduate students first year graduate students and researchers unfamiliar with linear programming

**Elementary Linear Programming with Applications** Bernard Kolman, Robert E. Beck, 1980 The disk that comes with the book contains the student oriented linear programming code SMPX written by Professor Evar Nering of Arizona State University The authors also recommend inexpensive linear programming software for personal computers More review material on linear algebra Elementary linear programming covered more efficiently Presentation improved especially for the duality theorem transportation problems the assignment problem and the maximal flow problem New figures and exercises Computer applications updated Added disk with the student oriented linear programming code SMPX written by Professor Evar Nering of Arizona State University New guide to inexpensive linear programming software for personal computers

**Linear Programming 2** George Bernard Dantzig, Mukund N. Thapa, 2003 In this second volume the theory of the linear programming items discussed in the first volume is expanded to include such additional advanced topics as variants of the simplex method interior point methods GUB decomposition integer programming and game theory **An Introduction to Linear Programming and the Theory of Games** Abraham M. Glicksman, 2001-01-01 Simple exposition of linear programming and matrix games covers convex sets in the Cartesian plane and the fundamental extreme point theorem for convex polygons the simplex method in linear programming the fundamental duality theorem and its corollary von Neumann's minimax theorem more Easily understood problems and illustrative exercises 1963 edition *Numerical Linear Algebra and Optimization* Philip E. Gill, Walter Murray, Margaret H. Wright, 2021-05-13 This classic volume covers the fundamentals of two closely related topics linear systems linear equations and least squares and linear programming optimizing a linear function subject to linear constraints For each problem class stable and efficient numerical algorithms intended for a finite precision environment are derived and analyzed While linear algebra and optimization have made huge advances since this book first appeared in 1991 the fundamental principles have not changed These topics were rarely taught with a unified perspective and somewhat surprisingly this remains true 30 years later As a result some of the material in this book can be difficult to find elsewhere in particular techniques for updating the LU factorization descriptions of the simplex method applied to all inequality form and the analysis of what happens when using an approximate inverse to solve  $Ax = b$  Numerical Linear Algebra and Optimization is primarily a reference for students who want to learn about numerical techniques for solving linear systems and or linear programming using the simplex method however Chapters 6 7 and 8 can be used as the text for an upper division course on linear least squares and linear programming Understanding is enhanced by numerous exercises [Conical Approach to Linear Programming](#) P D'Alessandro, 1997-10-29 The conical approach provides a geometrical understanding of optimization and is a powerful research tool and useful problem solving technique for example in decision support and real time control applications Conical optimality conditions are first stated in a very general optimization framework and then applied to linear programming A complete theory along with primal and dual algorithms is

given and solutions and algorithms are also provided for vector and robust linear optimization The advantages of parameter dependence of conical methods are fully discussed In addition to numerical results the book provides source codes and detailed documentation of a Modula 2 implementation for the main algorithms Linear Programming Michael J. Best, Klaus Ritter, 1985 **Linear Programming** Saul I. Gass, 1975 **Linear Programming Computation** Ping-Qi Pan, 2014-04-30 *Mathematical Programming and the Numerical Solution of Linear Equations* Bert W. Rust, Walter R. Burrus, 1972 **Linear Programming** Kathleen Trustrum, 1971-01-01 *Linear Programming and Applications* Will McLewin, 1980 Topics in Discrete Math Perham, 1993 **Elementary Linear Programming** Bernard Kolman, Robert E. Beck, 1980-01-01 **ELEMENTARY MATHEMATICS OF LINEAR PROGRAMMING AND GAME THEORY** EDWARD G. BENNION, 2018

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