Matrix Algebra

Pedro P. Sanchez
Eastern Michigan University

Instructor’s E-mail address: pedrosanchez11@comcast.net

This lecture series will provide a background in basic matrix algebra skills for participants in ICPSR workshops. The lectures are designed to serve both as a refresher for those previously exposed to matrix algebra and as a quick introduction for those new to the material. Proficiency in basic mathematics, including fundamental algebra, is assumed.

Recommended (but not required) text:
  Namboodiri, Krishnan
  Matrix Algebra: An Introduction
  Sage Publications, #07-038, 1984

This book is available for purchase at Ulrich's Bookstore. It can also be checked out from the Summer Program Library.

I will distribute pencil-and-paper worksheet, with exercises, throughout the course.

Tentative Outline of Matrix Algebra Lectures

1. Introduction to Matrices
   Rectangular Arrays
   Equality of Matrices
   Row Vectors and Column Vectors
   Transpose of a Matrix
   Square Matrices
      Diagonals
      Trace
      Symmetric matrices
      Triangular matrices
      Diagonal matrices
   Scalar Matrices
   Identity matrices
   Partitioned matrices
2. Matrix Operations
   Addition and Subtraction
   Conformability Conditions
   Adding and Subtracting Partitioned Matrices
   Multiplication
   Scalar and Matrix Multiplication
   Matrix Multiplication. Introduction.

3. Matrix Multiplication continued
   Conformability Conditions
   The Product Matrix
   Lack of Commutativity
   The Matrix and its Transpose
   The Identity Matrix
   Powers of a Matrix

4. Representing Systems of Linear Equations with Matrices
   The Coefficient Matrix
   The Variable Matrix
   The Solution Matrix
   Inner Products

5. The Inverse Matrix
   Definition
   Existence of the Inverse of a Matrix
   Singular and Nonsingular Matrices
   Matrix Multiplication Involving an Inverse Matrix
   Inverse of a Diagonal Matrix
   Gaussian Elimination
   Applications:
   Solutions to Systems of Equations
   Input-Output Analysis

6. More About Simultaneous Linear Equations
   Rank of a Matrix
   Definition of Rank
   Linear Dependence and Independence
   Full Rank Matrices
   Rank of Square Matrices
   Determinants revisited
7. Eigenvalues and Eigenvectors
   Definition of the Eigenvalues and Eigenvectors of a Matrix
   Positive Definite Symmetric Matrices
   The Singular Values and Singular Vectors of a Matrix
   The Product of a Matrix and its Transpose revisited

8. Applications
   Using Matrices to Represent Linear Regression Models
   Other applications.