Math 224
Daily Objectives
Class Session 3
Tuesday, September 4, 2007

A. **1.4: Solving Systems of Linear Equations**

- $Ax = b$; coefficient matrix A
- Augmented matrix
- 3 Elementary row operations
- Invariance of solution sets under elementary row operations (Thm. 1.6)
- Row-echelon form (2 conditions, Def. 1.12)
- Pivot: the first nonzero entry in a row in row-echelon form
- Procedure for row-reducing a matrix A (by hand) to row-echelon form H (3 steps, p. 60)
- Know how to solve a linear system by hand using Gauss reduction with back substitution (reducing the coefficient matrix A to row echelon form and back-substituting)
- Consistent and inconsistent linear systems
- Free variables
- Reduced-row echelon form
- Gauss-Jordan method
- Know how to solve a linear system (with Maple) using the Gauss-Jordan method (reducing the coefficient matrix A to reduced-row echelon form)
- Characterization of solutions of $Ax = b$ (Thm. 1.7); $[A|b] \sim [H|c]$, where H is in row-echelon form
  (a) The system $Ax = b$ is **inconsistent** if and only if the augmented matrix $[H|c]$ has a row with all entries 0 to the left of the partition and a nonzero entry to the right of the partition. See Example 3, p. 58.
  (b) If $Ax = b$ is consistent and every column of H contains a pivot, then the system has a **unique solution**. See Example 6, p. 61.
  (c) If $Ax = b$ is consistent and some column of H has no pivot, then the system has **infinitely many solutions**, with as many free variables as there are pivot-free columns of H. See Example 4, p. 59.
- Let A be an $m \times n$ matrix. The linear system $A\mathbf{x} = \mathbf{b}$ is consistent if and only if the vector $\mathbf{b}$ is in the span of the column vectors of A.
- Elementary matrix (Def. 1.14)

- Use of elementary matrices (Thm. 1.18)
- Know how to solve linear systems in Maple and interpret the results mathematically.

B. **1.5: Inverses of Square Matrices**

- Definition of inverse matrix; uniqueness of an inverse
- Definition of an invertible matrix
- Inverse of an elementary matrix
- Inverses of products (Thm. 1.10)
- $AC = I$ if and only if $CA = I$
- Equivalent conditions for A^{-1} to exist (Thm. 1.12)