Review for Exam I

This exam will cover the following topics:

I. **Systems of linear equations.** You should be able to decide whether a system of linear equations is consistent or not. If a system is consistent you should be able to solve it using Gaussian elimination, that is transforming the system into an equivalent one whose coefficient matrix is in row echelon form. You should pay special attention to free variables.

Examples of typical problems are: Page 24, problems 5 c),d),g), j) and 6 b) and d). Observe that in 5d) interchanging the first two equations makes the computations easier.

II. **Matrix arithmetic and matrix algebra.** You must know all the operations with matrices including addition, multiplication by scalars, matrix multiplication and transpose.

Typical problems: Page 42, problems 1, 2 and 3, page 56, problems 3,4,5, 14.

III. **Elementary matrices and LU factorization.** Given a matrix A you should know how to find elementary matrices $E_1, \ldots, E_k$ such that $E_k \ldots E_1 A = U$ is an upper triangular matrix. You should also be able to find the inverses of the matrices E_i and to compute a lower triangular matrix L such that $A = LU$.

Typical problems: Pages 66, problems 6 and 8.

IV. **Computing the inverse of a matrix.** Given a nonsingular matrix A, you should be able to compute its inverse.

Typical problems are: Page 66, problem 10.

V. **Determinants** You must know how to compute the determinant of an $n \times n$ matrix and its main properties.

Typical problems are: Pages, 90-91, problems 3 c), d), h), 6, pages 97-98, problems 2, 3 e), f), 5, 6.

VI. **Adjoint of a matrix** You must kow the definition and Example I on page 99.

Typical problems: Page 105, problem 2 a) and b)

VII. **Cramer's rule** You must know how to solve linear systems using Cramer's rule. Remember that in order to apply the matrix of the system must be a square one and non-singular.

Typical problems: Page 105, problem 2 a), c), e)

VIII. **Definitions.** You will be asked some of the following definitions:

    (i)   Identity matrix of order n.
    (ii)   Inconsistent linear system.
    (iii)   Elementary matrix of order n.
    (iv)   Inverse of an order n matrix.
    (v)   Upper triangular matrix.
    (vi)   Lower triangular matrix.
    (vii)   Adjoint of a matrix.
    (viii)   If A is a nonsingular matrix, what is its inverse in terms of the adjoint?