REVIEW SHEET FOR FIRST EXAM-C

The exam will cover the material we have discussed in class and studied in homework, from Sections 1.1–1.8, and 1.10. The following list points out the most important definitions and theorems.

Definitions

The definition of $A\mathbf{x}$ in both words and symbols.
Span$\{\mathbf{v}\}$, Span$\{\mathbf{u}, \mathbf{v}\}$ and geometric interpretation in $\mathbb{R}^2$ or $\mathbb{R}^3$.
Span$\{\mathbf{v}_1, \dots, \mathbf{v}_p\}$.
Linearly independent and linearly dependent.
Linear transformation.

Theorems

Chapter 1:
Theorem 2 (Existence and Uniqueness Theorem).
Theorem 3 (Matrix equation, vector equation, system of linear equations).
Theorem 4 (When do the columns of A span $\mathbb{R}^m$?).
Theorem 5 (Properties of the Matrix-Vector Product $A\mathbf{x}$).
Theorems 6, 7, 8 (Properties of linearly dependent sets).

Important Skills (partial list)

Determine when a system is consistent. Write the general solution in parametric vector form as a linear combination of vectors using the free variables as parameters.
Determine values of parameters that make a system consistent, or make the solution unique. Describe existence or uniqueness of solutions in terms of pivot positions. Determine when a homogeneous system has a nontrivial solution.
Determine when a vector is in a subset spanned by specified vectors. Exhibit a vector as a linear combination of specified vectors.
Determine whether the columns of an $m \times n$ matrix span $\mathbb{R}^m$.
Use linearity of matrix multiplication to compute $A(\mathbf{u} + \mathbf{v})$ or $A(c\mathbf{u})$.
Determine when a set of vectors is linearly independent. Know several methods that can sometimes produce an answer "by inspection" (without much calculation).

Applications

Construct an exchange table for a closed economy. Write the system of equilibrium equations. (See Example 1 in Section 1.6.)
Use linear combinations of vectors to describe various problems. (See Example 7 and Exercises 27–28 in Section 1.3, and Example 6 in Section 1.8.)
Set up a migration matrix and write the difference equation $\mathbf{x}_{k+1} = M\mathbf{x}_k$ that describes population movement in a region (assuming no births/deaths and no migration).