Math 308: Linear Algebra **Spring 2017**

A List of Topics for the First Midterm

Here's a list of things you should be comfortable doing for the exam.

1. **Linear Systems of Equations (Section 1.1)**
   (a) Solve a linear system of equations in echelon form.
   (b) Tell when a linear system has zero, one, or infinitely many solutions.
2. **Elimination and augmented matrices (Section 1.2)**
   (a) Write a linear system of equations as an augmented matrix.
   (b) Perform Gaussian elimination to write a matrix in echelon form.
   (c) Perform Gauss-Jordan elimination to write a matrix in reduced echelon form.
   (d) Interpret the form of a reduced matrix to determine when the corresponding linear system has 0, 1, or infinitely many solutions.
3. **Applications of linear systems (Section 1.4)**
   (a) Solve traffic flow problems and balance chemical equations.
   (b) Use linear systems of equations to answer Math 126-style questions about lines and planes.
4. **Vectors (Section 2.1)**
   (a) Do addition and scalar multiplication of vectors algebraically and geometrically.
   (b) Write one vector as a linear combination of other vectors, or tell when you can't.
5. **Span (Section 2.2)**
   (a) Tell when a set of vectors spans $\mathbb{R}^n$, and when some vector is in the span of another set of vectors.
   (b) Multiply a matrix by a vector, and understand what this means about the span of the column vectors of that matrix.
6. **Linear independence (Section 2.3)**
   (a) Tell when some set of vectors is linearly independent.
   (b) Know how span, linear independence, and matrix multiplication interact, especially in the case of n vectors in $\mathbb{R}^n$ (see the "big theorem").
7. **Linear transformations (Section 3.1)**
   (a) Tell when a transformation is linear.
   (b) Write a linear transformation in the form $T(\mathbf{x}) = A\mathbf{x}$ for some matrix A.
   (c) Interpret linear transformations graphically.
   (d) Check whether a linear transformation is onto, or whether some vector is in the range of that linear transformation. In particular, know how these relate to the column vectors of the matrix A.
   (e) In the case of linear transformations from $\mathbb{R}^n$ to $\mathbb{R}^n$, apply the big theorem to relate whether T is one-to-one and whether it's onto.