MATH 110: Linear Algebra

Midterm Study Guide

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Instructions: You will be able to use any printed or written notes, but no internet, digital notes, or textbooks.

1. Know the following definitions:
    - Vector space
    - Field
    - Subspace
    - $U + W$
    - $U \oplus W$
    - Linear combination
    - Span, spans
    - $\mathcal{P}(\mathbb{R}), \mathcal{P}_n(\mathbb{R}), \mathbb{F}^S, \mathbb{F}^{[0,1]}$
    - Linearly independent
    - Bases
    - Standard basis for $\mathbb{F}^n, \mathcal{P}(\mathbb{R})$
    - Dimension
    - Linear maps
    - $\mathcal{L}(V, W)$
    - Null space
    - Range
    - Injective
    - Surjective
    - Matrix of a linear map $\mathcal{M}(T)$
    - $\mathbb{F}^{n,m}$
    - Matrix multiplication
    - Invertible
    - Isomorphism
    - Operator
    - Linear functional
    - V'
    - U^0
    - Dual map
    - Dual basis
    - Rank
    - Eigenvalue, eigenvector
    - Invariant subspace

2. Key results and tools to review:
   (a) Subspace criteria
   (b) Conditions for direct sum
   (c) Linear dependence lemma
   (d) Lengths of linearly independent vs. spanning lists
   (e) Turning linearly independent lists and spanning lists into bases
   (f) Basis of domain
   (g) Relationship between null space and injective and range and surjective
   (h) Fundamental Theorem of Linear Maps (Rank-Nullity)
   (i) Invertible = injective + surjective
   (j) Dimension and isomorphic $\mathbb{F}$-vector spaces