MAS 3105 – LINEAR ALGEBRA FLORIDA INT'L UNIV

REVISION FOR TEST #2

REMEMBER TO BRING AN 8x11 BLUE EXAM BOOKLET

KEY DEFINITIONS & MAIN CONCEPTS: (3.1-3.6, 4.1- 4.3, 5.1-5.3, 5.5, 5.6) --- (6.1 & 6.3)

Abstract Vector spaces, Subspace of a vector space, Linear combinations, Span of a set of vectors, Spanning set of a subspace, Linearly independent & linearly dependent set of vectors, Basis of a vector space, Finite-dimensional vector spaces, Dimension of a vector space, Standard basis of n, Coefficients of a vector with respect to an ordered basis, Row vectors and row space R(A) of a matrix A, Column vectors and column space C(A) of A, Rank of a matrix A, Null space N(A) of A, CoNull space CN(A) of A, Rank & Nullity theorem, Linear transformations, Kernel & Image of a linear transformation, Matrix representations of a linear transformation, Similarity& matrices representing the same linear transformation, Transition Matrix from one ordered basis to another ordered basis, Inner (dot) product in Rn, Angle between two vectors, Projections of a vector in the director of another vector, Vector equations of lines & planes, Orthogonal vectors & Orthogonal subspaces, Least squares Problems, Best least squares fit problems, Inner product spaces, Orthonormal sets & Orthonormal bases.

------ Eigenvalues (characteristic values), Eigenvectors, Trace of matrix, Diagonalizable matrices, Powers & Exponential of matrix A, Markov Chains. (Sections 6.1, 6.3).

MAIN PROBLEM SOVING TECHNIQUES AND ALGORITHMS:

1. Determining whether or not a set of vectors span a given vector space or subspace.

2. Finding bases for R(A) & N(A) when A is an m by n matrix. Finding bases for CN(A) & C(A) when A is an m by n matrix.

3. Proving properties of linear transformations & proving a given set is a subpace.

4. Proving results about matrix representations of linear transf. and of similar matrices.

5. Finding the coefficient of a vector with respect to an ordered basis and finding the transition matrix from one ordered basis to another ordered basis.

6. Finding the least squares solution to an over-determined system of linear equations.

7. Finding the best least squares solution to a set of data by a linear function.

8. Finding an orthonormal bases from a given basis of n by the Gram-Schmidt process.

-----9. Finding the eigenvalues & the corresponding eigenvectors of a square matrix A.

10. Finding a matrix Q which diagonalizes a given matrix A by using the eigenvectors of A.]

MAIN THEOREMS & FORMULAS:

1. Theorem on the properties of abstract vector spaces (Theorem 3.1.1)

2. If B is a basis of V with n elements, then all bases of V must also have n elements.

3. dim [R(A)] = dim [C(A)], Rank(A) + Nullity(A) = Number of columns in A.

4. If A is an m by n matrix, then [R(A)]T = N(A) , the subspace of n orthog. to N(A).

5. If A is an m by n matrix, then [CN(A)]T = C(A), the subspace of m orthog. to C(A).

6. Relationship between A & AT : C(AT) = [R(A)]T and N(AT) = [CN(A)]T

7. If L is a linear transformation from V to W & S is a subspace of V, then ker(L) is a subspace of V and Im(L) & L[S] are subspaces of W.

8. A is similar to B iff A & B are different representations of the same linear transformation.

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-----9. Trace(A) = 1 + 2 + 3 + . . . + n , det(A) = 1 . 2 . 3 . . . . . n .

10. An n by n matrix A is diagonalizable iff A has n linearly independent eigenvectors.