MATH 3191 Exam 2 Review

1 Format of Exam

The exam will take the following format

1. Some short response questions that require a sentence or two explaining why a statement is true or false (A beginning of what a proof might look like) $\sim$ 30 mins
2. Longer response questions that will require you to compute a numerical answer and show work on how it was achieved $\sim$ 30 mins
3. Final question on lecture based content $\sim$ 15 mins

2 Written Homework Problems

You should be able to do all of the Written Homework problems from HW7 up to and including HW10. If you want help with your solutions or how to approach these problems, just let me know!

3 MyOpenMath Problems

I would pay attention to the following topics associated with each problem below

1. HW7: 1, 2, 4, 9, 10, 13, 19
   (a) Be able to describe requirements for a vector space and demonstrate its properties
   (b) Determine if a given set is a subspace of a known vector space ($\mathbb{R}^n, \mathcal{P}(\mathbb{R})$)
   (c) Describe what a null space/kernel is
   (d) Describe what a column space is
   (e) Describe what a spanning list is
2. HW8: 1, 2, 3, 6, 7, 8, 10, 13, 18
   (a) Know the requirements for a basis of a vector space
   (b) Determine a basis for a null space and column space
   (c) Determine the $\mathcal{B}$-coordinates of a given vector for a particular basis

(d) Given the $\mathcal{B}$-coordinates of a vector in a particular basis, determine the vector in the standard basis

(e) Know how the dimension of the null space and column space relate.

3. HW9: 1, 3, 4, 6, 7, 10, 11, 14, 16, 18

   (a) Determine the change of basis matrix for two given bases

   (b) Convert a coordinate vector from one basis to another

   (c) Determine if a given vector is an eigenvector

   (d) Determine the eigenvalues of a matrix

   (e) Determine the eigenvalue of a matrix power

4. HW10: 1, 2, 5, 6, 9, 11, 15. (Pending lecture on 4-03 also look at 18, 21)

   (a) Diagonalize a matrix with real eigenvalues

   (b) Compute a large power of a matrix (A^n for $n \geq 4$)

   (c) Know the requirements for a matrix to be diagonalizable and properties of diagonal matrices

   (d) Compute complex eigenvalues of a 2×2 or 3×3 matrix

   (e) These last objectives are only if we get to them on 4-03 in class

      i. Determine if a given matrix is a transition matrix

      ii. Compute the long run probabilities of Markov Chain

4 Lecture Based Problems

1. Explain what a similarity transformation is and what it does. IE: given $A = CBC^{-1}$, describe what each step of $CBC^{-1}\boldsymbol{x}$ is doing.

2. Explain why using a different basis can make some problems easier (Like computing A^n).

3. Explain what information diagonalization gives us about a matrix

4. Be able to read Python Code from Lab 3 and MarkovChains.ipynb and explain at a high level what it is doing or what we expect output to be

5. Pending lecture on 4-03 also be able to explain what a Markov chain is intuitively and algebraically