Exam #3 Information and Topics – Fall 2022

***Recall: All exams must be proctored**

Exam #2 must be taken on Thursday, November 17 or Friday, November 18. The exam will be completed on paper and you will only be allowed to use a writing utensil, a calculator, and scrap paper (no books, notes, internet, etc…).

You will be given up to 90 minutes to complete the exam.

The deadline for signing up for Exam #3 is the end of the day on Monday, November 14.

For those of you taking the exam at MCC, use Registerblast to sign up for a day and time to take the exam. Registerblast link→ https://www.registerblast.com/monroecc/Exam/List

For those of you taking the exam with a personal proctor, you must send me an email (by the deadline above) indicating which day you have scheduled to take the exam with your proctor (I do not need to know the time). ***I will not send an exam to your proctor if you do not sign up.**

On the next page you will find a list of topics for Exam #3.

For each of the "procedural/computational" types of problems, I have identified a sample problem (in a couple of cases more than one) from the book to give you a rough idea of the kind of problem to expect. Looking at the specific problem that I have identified is not by itself intended to prepare you to solve the exam problem, so you are encouraged to look at similar problems in the book, notes, and/or videos.

Make sure you have a calculator with matrix features as some problems will require matrix operations that would be tedious to do by hand and basic errors could result in significant penalties.

Exam Topics

**Exam 3 is based on Testing Unit 3; Textbook Sections: 5.1, 5.2, 6.1 – 6.4, 7.1, 7.2

***Calculators ARE allowed on this exam though sufficient work must be shown to support your answers.**

Definitions, Theorems, and Concepts:

You are responsible for knowing the definitions, theorems, and concepts presented in class. It would be a good idea to look through all of the theorems and definitions in Testing Unit 3 (Chapter 5 (5.1 & 5.2) and Chapter 6 (6.1 – 6.4) and Chapter 7 (7.1 & 7.2) of the book) and pay close attention to those that are not obvious to you. You will be tested on these items in the following ways:

- True/False questions
- Concept questions which require very little work, but require you to understand the concepts to answer a question.

Computation/Solving/Procedural Problems:

Problems of this type will be selected from the following:

- Given an inner product space (not necessarily Euclidean), be able to calculate the inner product of two vectors, the norm of a vector, the distance between two vectors, and be able to identify whether or not two vectors are orthogonal relative to the given inner product. [Ex. 6.1 #38; 6.2 #7 & #11]
- Be able to show whether or not a given set of vectors is orthogonal or orthonormal and also whether or not the set of vectors are linearly independent. [Ex. 6.3 #2]
- Given an orthonormal basis $\mathfrak{B}$ for an inner product space, express a vector $\mathbf{v}$ in the space as a linear combination of the basis vectors and give the coordinate vector of $\mathbf{v}$ relative to $\mathfrak{B}$, i.e $[\mathbf{v}]_{\mathfrak{B}}$. [Ex. 6.3 #7 & #11]
- Given an orthogonal or orthonormal basis for a subspace W of an inner product space V, and given a vector $\mathbf{v} \in V$, find the projection of $\mathbf{v}$ onto W and the component of $\mathbf{v}$ orthogonal to W. That is, find: $\text{proj}_W\mathbf{v}$ and $\text{proj}_{W^\perp}\mathbf{v}$. [Ex. 6.3 #21]
- Use the Gram-Schmidt Process to construct an orthogonal basis for a subspace of a Euclidean Space. [Ex. 6.3 #44]
- Obtain a *Least-Squares Solution* of an inconsistent system of linear equations. [Ex. 6.4 #5]
- Determine whether or not a given matrix is orthogonal. [Ex. 7.1 #3]
- Determine the eigenvalues of a square matrix. For a triangular matrix, this can be done by inspection, for all others, you will be expected to obtain and solve the characteristic equation. [Ex. 5.1 #5 and #13]
- Given the eigenvalues for a matrix, obtain bases for the corresponding eigenspaces. [Ex. 5.1 #9]
- Determine whether or not a square matrix A is diagonalizable and/or orthogonally diagonalizable. If so, be able to find an invertible matrix P and a diagonal matrix D such that $P^{-1}AP = D$ and/or an orthogonal matrix P such that $P^TAP = D$. [Ex. 5.2 #11 & #12; 7.2 #7]