

Information for Exam II

This exam will consist of 100 points. The format will be T/F, computation questions, proofs, and an essay. To study for this exam I recommend:

- Going over old homework problems. I assigned a lot of problems and if you can answer all of them you should be in good shape.
- Be familiar with definitions. A good studying tip is to make flashcards of important definitions and then review them periodically.
- I try to emphasize concepts, see how a concept relates to another and explain (at the very minimum mentally) why a particular concept is important and useful. Quiz your friends and loved ones over dinner about concepts, or see if you can explain it to them in non-technical terms.
- Reviewing proofs that we discussed in class and proofs in homework. Chapter 5 had a lot of theoretical concepts (Cauchy-Schwarz inequality, orthogonal complement, etc). Be sure to know them and others.
- For the essay I will ask you to write about a specific topic. What I am looking for is a logical, reasoned explanation that shows you understand and have mastered the material. While I won't give you the specific topic beforehand, I will say that you will be asked about orthogonality in \mathbb{R}^n (Chapter 5).
- If you are still confused by Chapter 4, its big ideas were isomorphisms, and that n -dimensional linear spaces are isomorphic to \mathbb{R}^n . If you know the steps to find a basis for the image and kernel of a linear transformation in a linear space, you are in good shape.

For a more specific list of topics/motivating questions:

- What is a linear space? What are some examples of linear spaces? How do you find a subspace of a linear space?
- How do the concepts of span, linear independence, basis, and coordinates translate to a linear space.
- For a given linear space, can you find a basis for it?
- What is an isomorphism? Why are they useful? (See Fact 4.2.3, page 166).
- How can you show that something is an isomorphism? (Diagram on page 169).
- What is the B matrix of a linear transformation from a space V to V ? How can you write its columns? How can you use this to find a basis for the image and the kernel of a linear transformation?
- How do you find the change of basis matrix? Do you understand the diagram on page 179? Can you explain the different matrices involved and how you form them?
- What are some properties of orthonormal vectors?
- How do you find an orthogonal projection of a vector in \mathbb{R}^n onto a subspace V ? What is the formula? What is the matrix of this projection?
- What is the orthogonal complement of a subspace V ?
- What is the Pythagorean Theorem and the Cauchy-Schwarz inequality?
- What is the Gram-Schmidt process and the QR Factorization? (I expect you to know the Gram-Schmidt process.)

- What is an orthogonal transformation? What are its properties?
- What is the transpose of a matrix and what are its properties?
- What is a Least Squares solution to $Ax = b$? How do we find it through the normal equations?
- What is an inner product space and how do we find the projection onto a subspace W ?