Reading Assignment 15

Read Sect. 6.1

1. What is the objective of Section 6.1?
2. What is the definition of an inner product on a vector space.
3. Give an example of an inner product and check that the defining properties hold.
4. Why is the '"product" in exercise #8(a) not an inner product?
5. If I say: "standard inner product on F^n", what am I talking about?
6. What is the adjoint of a matrix? Give an example of a 3×2 matrix with complex numbers as entries and find A^*.
7. Explain what it means to say that V is real inner product space. What about a complex inner product space?
8. What does it mean to say that the inner product is "conjugate linear in the second component"?
9. How do we define the length (or norm) of a vector?
10. State the triangle inequality.
11. Verify the Cauchy-Schwarz inequality and the triangle inequality for $x = (2, 1-i, 3i)$ and $y = (2-i, 1, 1-2i)$.
12. How do we define orthogonal (or perpendicular) for vectors in an inner product space?
13. Give an example of two orthogonal vectors in C^n using the standard inner product.
14. Give an example of a unit vector in C^n using the standard inner product.
15. If I ask you to "normalize" x, what am I asking you to do?

Practice Problems: 6.1 # 1, 2, 3, 4, 5, 8

Read Sect. 6.2

1. What are the objectives of Section 6.2?
2. Define an orthonormal basis and give an example for R^2 different than the ones in the book.
3. Can you tell me in your own words what Theorem 6.3 is saying?
4. Read Corollary 1 in page 342, why is the denominator in the coefficient of v_i left out in this case?
5. What does Corollary 2 in page 342 say about orthogonal sets?
6. Why is Theorem 6.4 important? What does it allow us to do?
7. Write Theorem 6.4 and explain what it says.
8. Let $S = \{(1,0,0),(1,1,0),(1,1,1)\}$ use Theorem 6.4 to compute an orthonormal basis for R^3 using S.
9. What is the Gram-Schmidt process?
10. What does Theorem 6.5 say about finite-dimensional inner product spaces?
11. Read the Corollary in page 347, what are the entries of the matrix representation of a linear operator with respect to an orthonormal basis?
12. Give an example of a linear operator in R^2 and compute the matrix representation using the basis in Example 2 in your book. Verify that the entries are indeed what the Corollary claims.
13. How are Fourier Coefficients defined?
14. Define the orthogonal complement of a subset S of an inner product space.
15. Let $S = \{(1,2)\}$, find $S^{\perp}$ in R^2.
16. What does Theorem 6.6?

17. How is the orthogonal projection of a vector y defined?

Practice Problems: 6.2 # 1, 2, 4