Math 4326/5322 **LINEAR ALGEBRA** Spring 2019
Dr. Duval **Homework**
Monday, February 18

Follow the separate general guidelines for Parts A,B,C. Be sure to include and label *all four* standard parts (a), (b), (c), (d) of Part A in what you hand in.

Null Spaces and Ranges (part II): Fundamental Theorem of Linear Maps

Section 3.B, pp. 63–66

A: Reading questions. Due by 2pm, Sun., 24 Feb.

1. In the proof of Theorem 3.22 (Fundamental Theorem of Linear Maps), what are m and n, and how do we know $\dim V = m + n$? How do we compute $\dim \operatorname{null} T$ and $\dim \operatorname{range} T$? [Note: Theorem 3.22 is the most important theorem of the first four chapters of the book, and also has one of the longest proofs in these chapters. You can answer these reading questions just from carefully reading and understanding the first paragraph of the proof, which is all I ask you to do, though, of course, you are welcome to read the rest of the proof.]
2. In the proof of result 3.23, there is a string of equalities and inequalities. The middle line of this string reads "$\geq \dim V - \dim W$". Explain why "$\geq$" is the correct relation here.
3. In Example 3.25, the text claims the equation $T(x_1, \ldots, x_n) = 0$ "is the same as the homogeneous system of linear equations above." Why are they the same?

B: Warmup exercises. For you to present in class. Due by the end of class Mon., 25 Feb.

Exercises 3.B: 5, 6, 13.

Matrices (part I): Representation, Addition, Scalar Multiplication

Section 3.C, pp. 70–74

A: Reading questions. Due by 2pm, Tue., 26 Feb.

1. Example 3.33 shows how to construct the matrix for a linear transformation, where the resulting matrix is 3-by-2. Make up your own example corresponding to a 2-by-4 matrix, with no 0 entries, and all entries being different. Now explain your example just as carefully as the textbook explains its example. You may use the textbook's example as a template for your own.
2. Verify result 3.36.
3. In the proof of result 3.40, the text claims that $\mathbf{F}^{m,n}$ is a vector space, and asks you to verify this. Though you may want to check all the properties of a vector space (see Definition 1.19) for yourself, please just turn in a verification of the **first** distributive property in Definition 1.19.

B: Warmup exercises. For you to present in class. Due by end of class Wed., 27 Feb.

Exercises 3.C: 2