LINEAR ALGEBRA

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He who controls the past controls the future. He who controls the present controls the past.

- George Orwell

1 Personal Background

I have always had an uneasy relationship with linear algebra. The first time I encountered this subject was the second semester of my senior year of high school. Having already been accepted into college, I wasn't exactly a star student in any of my classes and linear algebra was no exception. The concept of a linear transformation between two vector spaces, let alone a vector space in its own right, was totally lost on me. My only takeaway from the class was my memorizing the formula that computes the determinant of an $n \times n$ matrix.

Fast forward to my first semester at Cornell. An overzealous freshman, I enrolled in Math 2230, the theoretical linear algebra and calculus course designed for freshman math majors. Thrown right into to the world of abstraction without ever having been introduced to even the most basic mathematical proof, I quickly realized I was out of my element. Freshman stubbornness and an unchecked ego got the best of me, however, and I ended up sticking with the class for the semester. Achieving an average of 40% for my exam grades and being saved only by the generous curve, I left Cornell that semester demoralized. Linear algebra was still a blur.

Then second semester of sophomore year rolled around. Having taken a few more reasonable math classes, my self-confidence was restored. I enrolled in Math 4310, a junior-senior level course in linear algebra, with the intention of really learning the subject once and for all. It proved to be a positive experience: the course was at the right level of difficulty for me and I enjoyed studying the subject. Having put in substantial effort into the course, I walked away from Cornell that semester satisfied with what I had learned.

Fast forward to today. While I am still confident in my understanding of the major concepts in linear algebra, I can't help but feel a little bit rusty. My intention for this book (book?) is for it to serve as a linear algebra refresher, at roughly the same level as Math 4310. My hope is that it will serve as a useful reference when I need to apply concepts from this subject to other problems in the future as well. Of course, I hope that others who read this reference can find it similarly useful!

2 Motivation for Writing This

So why am I writing this? There are two reasons. The first is that I want to demystify some of the major concepts in linear algebra that first-time students encounter. Linear algebra is a deep subject and, with the exception of calculus, it is the most useful mathematical subject a person can learn. However, it's really not *that* complicated. As such I would like to try my hand at explaining its concepts in a simple, easily digestible manner. Hopefully readers who are new to the subject can gain at least a little valuable

insight from what I've written.

The second reason is that writing this book is therapeutic. I've wanted to solidify my understanding of linear algebra for a long time now, and I figure that this is the best way to do that once and for all.

3 What to Expect

My intention is for this book to be a comprehensive overview of the subject of linear algebra. It will be light on proofs and heavy on intuition. As a result, it will contain relatively informal explanations of its topics. These topics will be organized into chapters and I estimate there will be around ten chapters in total. Since there will be no exercises, this book should be used as a reference along side another more formal textbook. I will do my best to provide examples and diagrams wherever beneficial, and I will do my absolute best to explain the topics simply and clearly. If you've made it this far in this introductory section then I want to thank you personally for bearing with me and my formalities. Let's get to it.