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MIDTERM PORTFOLIO

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Commentary

Throughout the course so far, I have gained a strong understanding of linear algebra and scientific computing. The concepts of vectors and matrices were critical as they form the foundation for more complex topics. I found the ideas of Vector and Matrix Norms and Condition Numbers especially enlightening, as they provided a way to evaluate the error and stability of algorithms.

Additionally, the course covered several key topics that significantly impacted my understanding of linear algebra. Topic such as, Lower and Upper Triangular Linear Systems, Gauss Elimination, and LU Factorization were instrumental in solving systems of linear equations and computing matrix inverses efficiently. I have also gained valuable insights into alternative techniques such as Householder transformation and Gram-Schmidt orthogonalization, which provided a different approach to calculating matrix factorizations and orthonormal bases.

Overall, I feel that I have gained a solid understanding of the key concepts covered in the course so far. I am excited to try out some of the concepts that I have learned so far in a personal project or to solve some kind of real-world problems, and I am also excited to continue learning more during the upcoming weeks. I am confident that the knowledge and skills I will gain by the end of this course will be instrumental in my future professional pursuits.

Self Reflection

Throughout this course, I have encountered various challenges and factors that have impacted my learning experience. One of the most significant factors that I have faced is the technical nature of the course material. The topics covered in the course, including programming, numerical analysis skills, and mathematical concepts, have required a considerable amount of time and effort to understand and apply. However, the challenges posed by the technical nature of the course

have also pushed me to think critically and logically about the problems at hand. Additionally, the feedback that I received from my instructor was instrumental in helping me identify areas where I needed to improve and provided valuable insights for future assignments. The projects and assignments, such as implementing Forward and Backward substitution, Gauss Elimination, and Householder transformation, have provided me with a practical understanding of these concepts and their applications in real-world scenarios. Overall, my experience in this course has been challenging but rewarding, and has helped me to develop valuable skills and knowledge.

One of the most surprising realizations I had during this course was how relevant and applicable the concepts of linear algebra and scientific computing are in solving real-world problems. Although I was initially intimidated by the technical nature of the course, the assignments and projects helped me realize the practicality and usefulness of linear algebra-based algorithms and concepts in tackling complex problems. I discovered that even small tweaks in the code could have a significant impact on the efficiency and accuracy of the algorithms. Moreover, the course has given me a deeper understanding of the significance of linear algebra in various fields, such as machine learning, physics, and engineering, and how it can be utilized to tackle diverse and challenging problems. Overall, I have been impressed by the practicality and versatility of linear algebra in solving real-world problems.

I believe that the insights I gained in this course can be integrated and applied to both my educational and professional practice. For example, the programming skills I acquired can be used in a wide range of fields, including data science, machine learning, and computational physics. Additionally, the understanding I developed about the applications of linear algebra can be useful in designing and optimizing algorithms for various tasks. For instance, in the challenge project 1, I learned how to generate a Hilbert matrix and use it to solve a system of equations using the Gauss Elimination algorithm. This knowledge can be applied to solve

similar problems in various domains, such as image processing, signal analysis, and financial modeling.

Appendix: Assignments and Projects

Assignment 1: Introduction to Matrices and Vectors.

- In this assignment, I learned how to calculate matrices and vectors, which provided a foundation for your subsequent coursework.

Assignment 2: Solving Linear Systems of Equations with Gaussian Elimination

- In this assignment, I have implemented forward and backward substitution, as well as the Gaussian elimination algorithm, to solve a system Ax=b for a total rank n x n matrix.

Assignment 3: Householder Transformations for QR Factorization

- In this assignment, I have implemented the Householder transformation algorithm that applies the Householder transformation to an m x n matrix A.

Challenge Project 1: Solving the Hilbert Matrix with Gaussian Elimination

- In this project, I have generated a Hilbert matrix and used concepts that I learned in Assignment 2 to solve the matrix and obtained residual inf norm, error norm, and percentage of errors.

Overall, these projects and assignments have impacted my learning in this course by providing me with a practical understanding of linear algebra and its applications. I was able to gain insight into solving complex problems using different methods and algorithms, and these projects have helped me improve my analytical, programming, and computational skills, along with giving me insight into new ideas and knowledge. I am grateful for everything that I have managed to learn so far and I am looking forward to learning a lot more from the remaining term.