International Islamic University Chittagong

Department of Computer Science and Engineering

Presentation on

System of Linear Equations

Course Title- Numerical Methods Sessional

Course Code: CSE-4746

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Introduction

Linear equations form the backbone of numerous scientific and engineering disciplines. Solving systems of these equations often requires efficient numerical techniques, particularly for large and complex systems. This project focuses on exploring four key numerical methods for solving such systems, honing our problem-solving skills and gaining valuable insights into their practical applications.

Objectives

- **Comprehensive Understanding:** Develop a thorough understanding of Matrix Inversion, Cramer's Rule, Gauss Elimination, and Jacobi Iterations for solving linear systems.
- **Performance Evaluation:** Evaluate each method in terms of accuracy, computational cost, and convergence properties.
- **Comparison and Analysis:** Compare and contrast the advantages and disadvantages of each method, identifying their suitability for different scenarios.
- **Documentation and Reporting:** Document the project's findings, methodologies, and results in a clear and organized manner.

Project Scope

This project focuses on the following four numerical methods:

- **Matrix Inversion:** Solve systems by directly inverting the coefficient matrix.
- **Cramer's Rule:** Solve systems by calculating determinants and ratios of determinants.
- **Gauss Elimination:** Solve systems by systematically eliminating unknowns through row operations.
- **Jacobi Iterations:** Solve systems iteratively by updating each unknown based on the latest values of other unknowns.

Key Features of The Project

- **Solves systems of linear equations:** The application can solve systems of equations with up to three variables.
- **Multiple methods:** The application provides four different methods for solving the equations: Cramer's rule, Gauss elimination, inverse matrix method, and Jacobi method.
- **Iteration and time analysis:** The application displays the number of iterations and the time taken for each method.
- **Visualization:** The application displays the solutions in a table and a chart.

Methodology

1. **Conceptual Understanding:** Gain a thorough understanding of the chosen methods through theoretical study and analysis.
1. **Implementation:** Develop and implement code for each method, ensuring accuracy and efficiency.
2. **Method Comparison:** Apply each method to a set of diverse linear systems and compare their performance in terms of accuracy, computational cost, and convergence properties.
3. **Testing and Validation:** Rigorously test and validate the implemented methods using various test cases.

Language & Tools

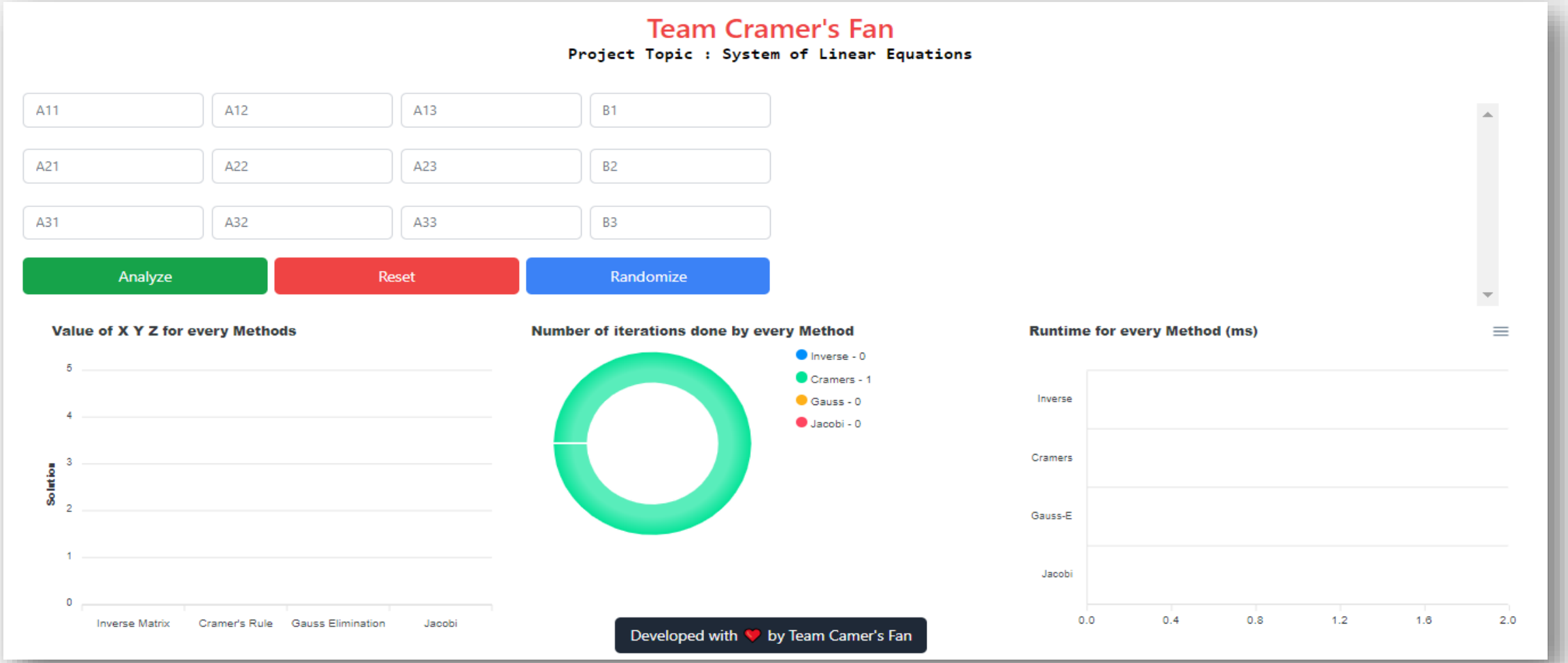
Language:

- ❑ Html
- ❑ CSS
- ❑ Tailwind CSS
- ❑ Java Script

Tools:

- ❑ Modern Browser *(Edge, Chrome etc)*
- ❑ VS Code
- ❑ GitHub
- ❑ Vercel *(for hosting)*

User Interface (Output)



Future Work/ Plan

While this application provides a robust platform for analyzing and comparing solutions to linear systems, the journey doesn't end here. We envision a future where this tool expands its capabilities and delves deeper into the fascinating world of linear algebra. **Here's a glimpse into what's to come:**

- **Conquering Larger Dimensions** *(n X n)*
- **Beyond the Desktop** *(Mobile App)*
- **Embracing the Realm of Complex Numbers**

Conclusion

This project promises to equip us with a mastery of solving linear systems using a focused set of numerical methods. We will gain valuable insights into their performance, limitations, and real-world applications. By pursuing this project, we aim to contribute to the advancement of numerical methods and enhance our problem-solving skills in this crucial field.

References & Acknowledgment

[1] Book: "Numerical Analysis" by G. Shanker Rao (5th Edition).

[2] Course Notes and Lecture Slides provided by our honorable course teacher.

Special acknowledgement to our course teacher, **Prof. Mohammed Shamsul Alam**, *Professor, Computer Science and Engineering*, IIUC for his support during the course.

Thank you, all.