

# Solving Systems of Equations, Errors and Explorations

David Tran and Spencer Kelly

March 9, 2024

## Abstract

## 1 Introduction

## 2 The $PA = LU$ factorization method for linear systems

### 2.1 Why is $PA = LU$ needed for solving linear systems approximately?

### 2.2 How to identify systems $Ax = b$ for which $PA = LU$ is not suited

### 2.3 Larger applications of $PA = LU$ factorization

## 3 Iterative solution of systems of linear equations

### 3.1 Solving an equation for $n = 100,000$

### 3.2 Comparison of $PA = LU$ and Jacobi Iteration

### 3.3 Why is solving such large systems important in applications?

## 4 Implement Newton's method for multiple variables

### 4.1 Implement Newton's method for systems using vectorization

### 4.2 Testing

### 4.3 Challenging Example

## 5 Summary

## 6 Appendices

### 6.1 Code

### 6.2 Plots

## 7 Code

## 8 Summary

### 8.1 Results

### 8.2 Team Description

### 8.3 Future Explorations

### 8.4 References

## Appendix