Introduction to Numerical Analysis

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Cost of Computation

- $A = LU$ and backsolve costs n^3 "flops"
- For supercomputers, is this a hurdle?

Two Algorithms: Naive & Specialized

Factor

$$A = \begin{bmatrix} 2 & -1 & 0 & 0 \\ -1 & 2 & -2 & 0 \\ 0 & -1 & 2 & -1 \\ 0 & 0 & -1 & 2 \end{bmatrix}$$

using two algorithms: one specially designed for tri-diangular systems and the other a general matrix solver.

Solve

$$A = \begin{bmatrix} 2 & -1 & 0 & 0 \\ -1 & 2 & -2 & 0 \\ 0 & -1 & 2 & -1 \\ 0 & 0 & -1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$$

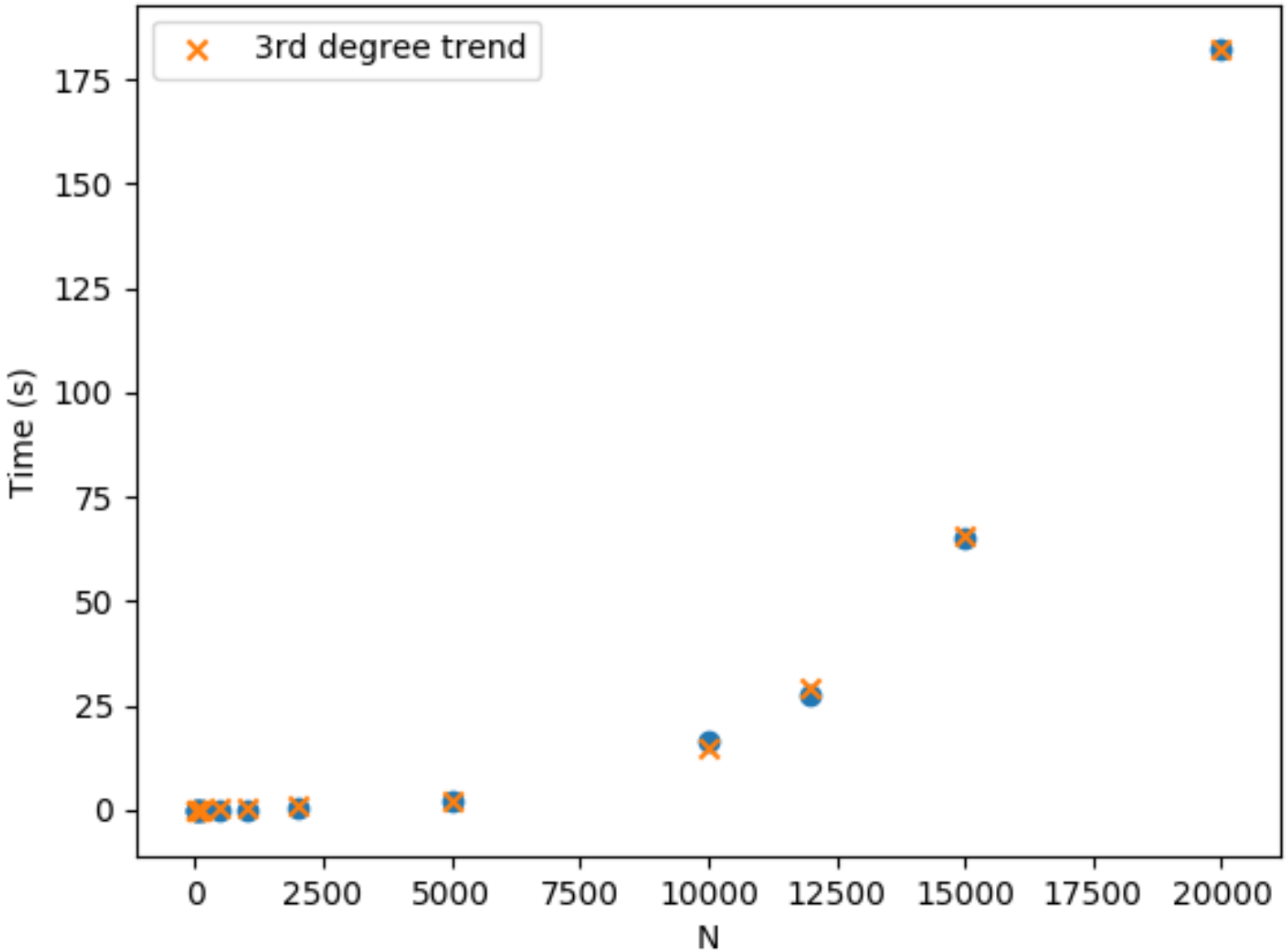
vary N the size of the matrix. Answer $= \begin{bmatrix} 2 & 3 & 3 & 2 \end{bmatrix}$.

LAPACK Routines

LAPACK software is specialized routines built in fortran and portable to C/C++

Why does this problem matter? Answer is resolution.

Algorithm for General Matrix



Specialized Algorithm