Numerisches Praktikum – Numerical Practical Training

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Linear Equations

Return by 9:15 a.m. Feb 28th

as `.pdf` by Mail to: ostertag@mpia.de

Free Training

- Start writing routines using the

  1. Naive Gaussian Elimination Method and
  2. Naive Gaussian Elimination with Partial Pivoting.
  3. Think how to implement the LU decomposition of a matrix A

  to solve the following set of linear equations:

$$\mathbf{A} \cdot \mathbf{x} = \mathbf{b},$$

  where

$$\mathbf{A} = \begin{pmatrix} 13 & 4 & 7 & 9 \\ 10 & 6 & 5 & 12 \\ 1 & 8 & 2 & 16 \\ 3 & 14 & 15 & 11 \end{pmatrix}, \quad \mathbf{x} = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix}, \quad \mathbf{b} = \begin{pmatrix} 111 \\ 118 \\ 114 \\ 163 \end{pmatrix}.$$

Assignment for the Afternoon / Homework, 20 Points

- **Exercise 1, 10 points**: Print the upper triangular matrix and the new **b**-vector after the *forward* Gaussian elimination and show the solution of **x**. Also, use the method to calculate the determinant of matrix **A**.

- **Exercise 2, 10 points**: Write a routine which does the LU decomposition on a square matrix. Use the above matrix **A** to test your program.
  - Print out the L and U parts of the matrix **A**.
  - Solve the above equation.
  - **Optional:** Compute the inverse of the matrix **A**.