# Introduction to Mathematical Software Exercise 5

TECHNISCHE UNIVERSITÄT DARMSTADT

**PD Dr. Ulf Lorenz**
**Dipl.-Math. Thomas Opfer**

**Winter Term 2011/2012**
**Week: 05.12.2011 - 09.12.2011**

## Problem 1 Matrices ☆☆★

Calculate determinant and inverse of the following matrices:

$$A = \begin{bmatrix} 1 & 4 & 7 \\ 8 & 2 & 5 \\ 6 & 9 & 3 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

## Problem 2 Procedures ☆☆★

Write a procedure that sums up all natural numbers from 1 to $n$ which have at least four different prime factors.
*Hint:* The commands `factorset` and `nops` might be helpful.
Example: Input: 4321, Output: 724245.

## Problem 3 Decimal Expansion of Rational Numbers ☆★★

Complete exercise 3 from exercise sheet 4.

## Problem 4 Fibonacci Numbers ★★★

Implement procedures that calculate the $i$-th Fibonacci number

a) recursively,

b) iteratively,

c) using matrix exponentation,

d) using the formula of Moivre-Binet.

Compare running times and possible input sizes.

## Problem 5 An Application: Image Processing ★★★

Complete the image processing exercise from exercise sheets 2-4.