

Session 1

23.10.2025

Exercise 1.0 - Setup

- Familiarize yourself with MATLAB on the compass computers.
- Make sure you are enrolled in the *Moodle* website of the course.
- Read the submission instructions for the exercises which can be found in *Moodle*.
- Find a partner with whom you would like to solve LAB1 problems. You can also work by yourself. Groups should stay fixed throughout the course.

Exercise 1.1 - Elementary operations

- Define a (4×4) -matrix A with integer elements in MATLAB which is **not** a diagonal matrix. Verify that A is not a singular matrix, i.e. that it is invertible [Hint: try the online-help for `det`], otherwise choose a new matrix. Compute $A \cdot A$, A^2 , A/A and the corresponding *element-wise* operations ($A \cdot \star A$, $A \cdot ^2$, $A \cdot /A$).
- Given a positive real number c and a real $n \times n$ matrix A , what is the meaning of c^A and $c \cdot ^A$ in MATLAB?
- Compute $0/0$ and $1/0$. Use the online-help to explain the results you obtain. Depending on the matrix A , this may have already occurred.

Exercise 1.2 - Numerical precision

Predict the outcome of the following lines, before trying them out.

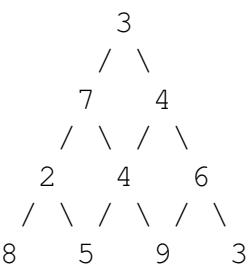
- $-1+1+1e-21$
- $-1+(1+1e-21)$
- $(-1+1)+1e-22$
- $-1+1e-22+1$
- $12345678910111213 - 12345678910111212$
- $0000000000000003 - 0000000000000002$
- $0.0000000000000003 - 0.0000000000000002$

Exercise 1.3 - Maximum path sum

A triangle of numbers is defined by a matrix x . E.g.

$$x = \begin{bmatrix} 3 & 0 & 0 & 0 \\ 7 & 4 & 0 & 0 \\ 2 & 4 & 6 & 0 \\ 8 & 5 & 9 & 3 \end{bmatrix}$$

corresponds to the triangle



Different paths from top to bottom are possible, e.g. $3 \rightarrow 7 \rightarrow 2 \rightarrow 8$ or $3 \rightarrow 7 \rightarrow 4 \rightarrow 5$. The sums of the numbers along these paths are 20 and 19. Write a function `tril` that, for a given triangle, returns the highest possible path sum. In the example above, the result is 23 ($3 + 7 + 4 + 9 = 23$). You can test your function using `x = tril(magic(100)^2)` (the result is 251716502500).