**Simple matrix operations**

*Task 1 and 2 require matrix A available from the data file MO-Task12-DataX.txt.*
*Task 3 requires matrices sa and sb available from the data file MO-Task3-DataX.txt*
*X is the number of the assigned data set.*
*Task 4 requires data from the file MO-Task4-DataX.txt*
*X is the number of the assigned data set.*

1. Calculate L and U matrices for the A matrix without using Matlab functions.
Write the L and U matrices to the report.
Tips: The formulas for U and L matrices can be found on the first slide in the file matrix_lecture.pdf. Please note the correct use of indexes, e.g. ij or ji.
Start from the following matrices: L=eye(N); U=zeros(N,N);
Finally, check if L*U provides the original matrix.

2. Calculate matrices L and U, as well as L, U and P, by means of Matlab lu(A) function.
Show that the determinant of the A matrix can be obtained as a product of determinants of the obtained matrices. Write the results to the report.
Tip: Check if the obtained matrices (L, U and L, U, P) provide the original matrix.

3. Rewrite two arrays from sparse form into classical matrices. Multiply them and write the resulting matrix to the report.
Tip: You should write a code with loops rewriting the values from a sparse form to classical form of matrix.

4. Randomly generate (use Matlab rand() function) a set of 100 data described by 5 features. Ranges of values for individual features are provided in the text file. Normalize this data:
- with zero mean value and unit variance,
- to the range [-1, 1].
In case of normalization to the range [-1, 1], check its correctness by:
- finding minimum and maximum values,
- making charts (first 2 features).
Include unnormalized data and both types of normalized data in your report.

Data normalization (description based on [1])

Normalization is performed to "equalize" the impact of individual features in the feature vector that differ significantly in size or range of values. In such a situation, features with larger values have a greater impact in the various criteria used in classification algorithms than features with relatively small values, although this does not necessarily reflect their "importance". The data should then be normalized - linear or non-linear scaling of all data to the appropriate range. Normalization is often used, which results in features having zero mean value and unit variance, or normalization to a fixed range (both types of normalization will be discussed in class).

[1] Stąpor K.: „Automatyczna klasyfikacja obiektów”, w „Problemy współczesnej nauki, teoria i zastosowania”, Bolc L. (red.), Akademicka Oficyna Wydawnicza EXIT, Warszawa, 2005.