MTMM.00.005 Numerical Methods
Practical lesson 5: Fixed-point iteration for solving systems of equations.

March 12, 2019

To get a positive result, student has to solve all of the exercises given in practical lessons, explain the programming code and answer the questions.

The deadline for the fifth set of exercises is March 19th.

NB! In order to use the nonstandard packages as *numpy* and *matplotlib* one could use Command Prompt and type

```
H:\nm> "C:\Program Files\Anaconda3\python" <filename>.py
```

Here `H:\nm` is the folder for `<filename>.py`.

Exercise. Use ordinary iteration method and Seidel's method to solve the system

$$\begin{aligned} 12x_1 - 3x_2^2 - 4x_3 &= 7.17, \\ x_1^2 + 10x_2 - x_3 &= 11.54, \\ x_2^3 + 7x_3 &= 7.631. \end{aligned}$$

First write the system in form $x = G(x)$, find some initial approximation, an arbitrary termination condition and solve the system.
To find the correct termination condition choose, for example, $B = [0, 1.3]^3$ and find $q > 0$ which satisfies the convergence theorem (use the conditions from lecture notes page 34). Which matrix norm did you use? Use the same as a vector norm. Terminate the iteration process if

$$\frac{q}{1-q}\|x^m - x^{m-1}\| \leq \varepsilon,$$

where $\varepsilon = 10^{-5}$. Then $\|x^m - x^*\| \leq \varepsilon$.
Print out the value of q, all approximations and the number of iterations needed.