Tasks for lecture 7

Exercise 2 from exam august 2023.

Consider the equations:

$$x_0 + 2\sin(x_1 - x_0) - \exp(-\sin(x_1 + x_0)) \equiv 0 \tag{1}$$

$$x_0 \cos(x_1) + \sin(x_0) - 1 \equiv 0 \tag{2}$$

- Set $x_0 = 1$ and $x_1 = 1$ and state the values on the left hand side of the two equations (Hint: you should get approximately 0.597 and 0.382, respectively).

- State which methods form the course you can apply for this problem.

- Perform 6 iterations with a method from the course (I've chosen Newton) using $x_0 = 1$ and $x_1 = 2$ as the initial guess and state the values of x_0 and x_1 after each of the 6 iterations.

- Provide an estimate of the error on the solution after 6 iterations with a detailed explanation on how you arrived at the result.

Tips on the lecture and exercise

- Visualise the system of equations first (eg. plot them)

- Understand 9.6 and 9.7 in NR3 (Pages 477-482 explains the globally convergent Newton method).

- Find the solvers in $'roots\_multidim.h'$ and understand them to implement them in own code. E.g. in the case of Newton's method you don't have to write the method from scratch.