

Optimization Methods – Spring Semester 2020

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Exercise Sheet 3

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1) Always refer to the Assignment's rules.

Exercise 0

Please, save the files in a folder named as:

SurnameNameAssignmentX

where Surname, Name and X are respectively you surname, your name and the number of the assignment.

Exercise 1

Discuss the following:

- (a) the line search method;
- (b) different methods you know for the computation of the search direction;
- (c) different methods you know for the computation of the step length;
- (d) the convergence behaviour for the gradient method and the Newton's method;

Exercise 2

(a) Write down two MATLAB functions for:

- the Newton's method
- the gradient method

where both methods can be solved with or without the backtracking algorithm (as a reduction factor use $\alpha = 0.9$) The maximum number of iteration $N = 50.000$ and the stopping criterion is given by the norm of the gradient, with a tolerance $toll = 10^{-6}$.

(b) Write a main function which calls for both methods and creates all the plots requested in the following points without saving any file (if needed, before uploading the assignment, comment such parts).

(c) Consider the highly non-linear Rosenbrok function:

$$f(x, y) := (1 - x)^2 + 100(y - x^2)^2$$

minimize this function, by using the previous methods, with and without the backtracking algorithm. The starting value is $(0, 0)$.

- (d) Plot the obtained iterates on the energy landscape in 2D.
- (e) Plot the log10 of the norm of the gradient and the value of the energy function as functions of the iterations.
- (f) Briefly comment the results.