Technische Universität Chemnitz
Prof. Dr. R. Herzog, T. Etling, S. Richter, Dr. D. Shklyarov, A. Stötzner

Chemnitz, 23rd October 2017

Optimization for Non-Mathematicians
Sheet 3

Exercise 5: Interpretation of an iteration progress

Interpret the output of `fminunc` when applied to the problems on Sheet 2, Exercise 3 and Sheet 2, Exercise 4. What is the meaning of

- `Func-count`
- `f(x)`
- `Step-size`
- `First-order optimality`?

Which conclusions can be drawn from the following messages?

- `Optimization completed because the size of the gradient is less than the default value of the function tolerance.`
- `Problem appears unbounded.`
- `Local minimum possible. fminunc stopped because it cannot decrease the objective function along the current search direction.`

Exercise 6: Plot of the iteration progress

The goal of this exercise is to display the sequence of iterates $x^{(k)}$ inside a plot of the objective.
Hints:

- Use the option `PlotFcn` inside of `optimoptions` to plot the progress of the sequence of iterates. Complete the template `my2Doptimplotx` in order to implement the plot function.
- The objective should only be plotted once, in iteration zero (see Sheet 1, Exercise 2). It is recommended to use `surf` or `contour` as plot type.
- `plot3(x,y,z,'ro','MarkerFaceColor','r','MarkerSize',6);` adds a point with coordinates (x, y, z) to the plot.
- Use the command `hold on` to draw more than one object into one plot.

Illustrate the iteration progress of Sheet 2, Exercise 3 and Sheet 2, Exercise 4 for different starting points.

Exercise 7: Rosenbrock function

The *Rosenbrock* function (compare Sheet 1, Exercise 2)

$$f(x_1, x_2) = (1 - x_1)^2 + 100\,(x_2 - x_1^2)^2$$

is often used as a test example for optimization algorithms.

(a) Create some plots using `surf` and `contour` to illustrate this function.

(b) Solve the minimization problem $f(x) \to \min$.

(c) Plot the iteration progress using the function `my2Doptimplotx` from Exercise 6.