

Optimization methods – Homework 3

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1 Exercise 1

1.1 Exercise 1.1

Please consult the MATLAB implementation in the files `Newton.m`, `GD.m`, and `backtracking.m`. Please note that, for this and subsequent exercises, the gradient descent method without backtracking activated uses a fixed $\alpha = 1$ despite the indications on the assignment sheet. This was done in order to comply with the forum post on iCorsi found here: <https://www.icorsi.ch/mod/forum/discuss.php?d=81144>.

1.2 Exercise 1.2

Please consult the MATLAB implementation in the file `main.m` in section 1.2.

1.3 Exercise 1.3

Please find the requested plots in figure 1. The code used to generate these plots can be found in section 1.3 of `main.m`.

1.4 Exercise 1.4

Please find the requested plots in figure 2. The code used to generate these plots can be found in section 1.4 of `main.m`.

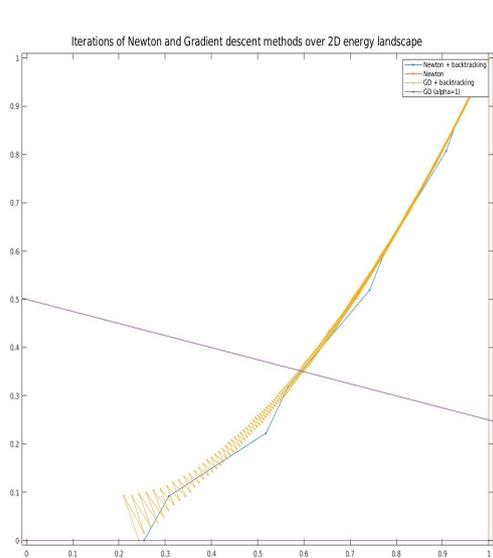
2 Exercise 1.5

TBD

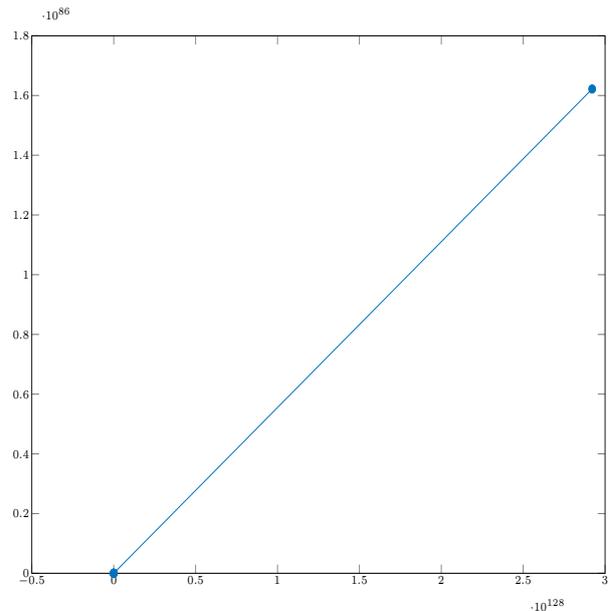
3 Exercise 2

3.1 Exercise 2.1

Please consult the MATLAB implementation in the file `BGFS.m`.



(a) Zoomed plot on $x = (-1, 1)$ and $y = (-1, 1)$



(b) Complete plot

Figure 1: Steps in the energy landscape for Newton and GD methods

3.2 Exercise 2.2

Please consult the MATLAB implementation in the file `main.m` in section 2.2.

3.3 Exercise 2.3

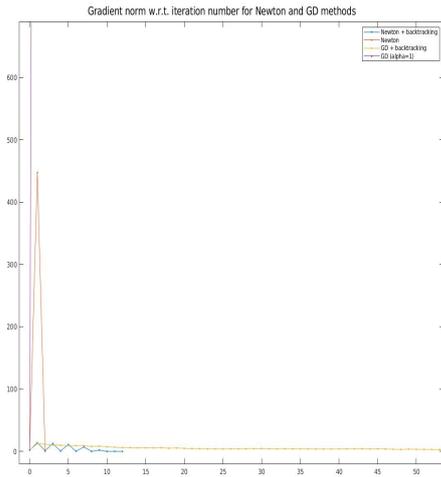
Please find the requested plots in figure 3. The code used to generate these plots can be found in section 2.3 of `main.m`.

3.4 Exercise 2.4

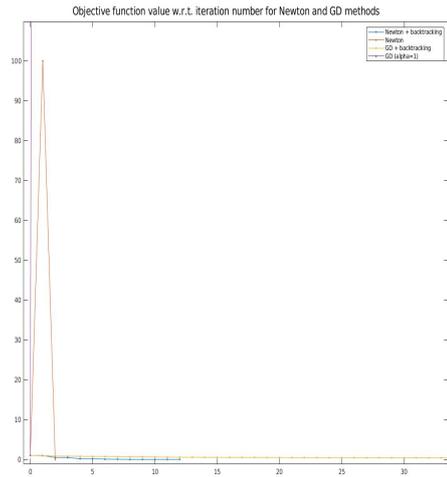
Please find the requested plots in figure 4. The code used to generate these plots can be found in section 2.4 of `main.m`.

3.5 Exercise 2.5

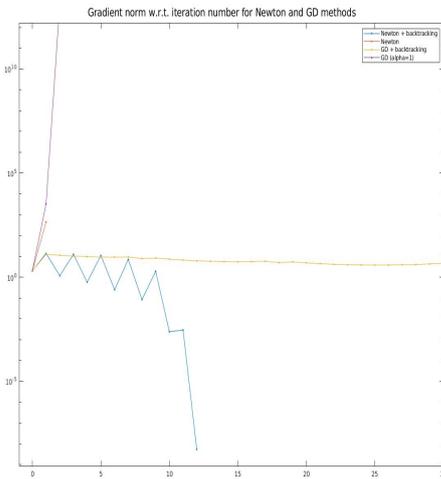
TBD



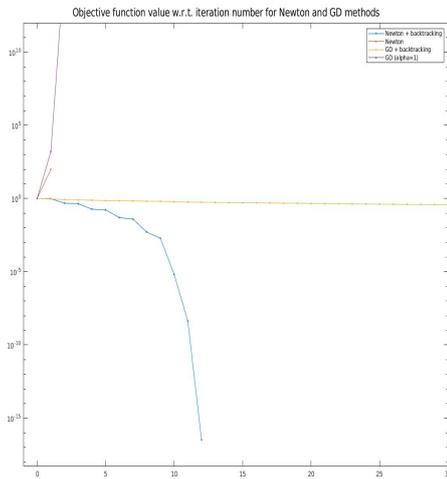
(a) Gradient norms
(zoomed, y axis is linear for this plot)



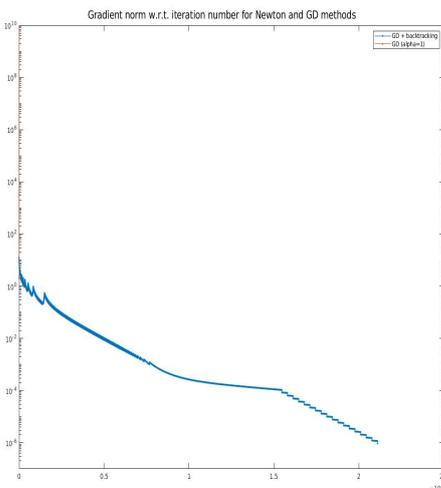
(b) Objective function values
(zoomed, y axis is linear for this plot)



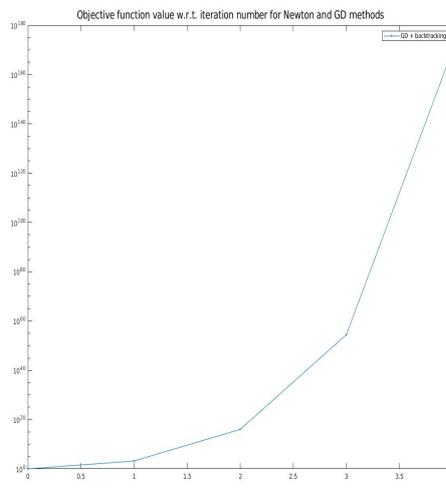
(c) Gradient norms (zoomed)



(d) Objective function values (zoomed)



(e) Gradient norms



(f) Objective function values

Figure 2: Gradient norms and objective function values (y-axes) w.r.t. iteration numbers (x-axis) for Newton and GD methods (y-axis is log scaled, points at $y = 0$ not shown due to log scale)

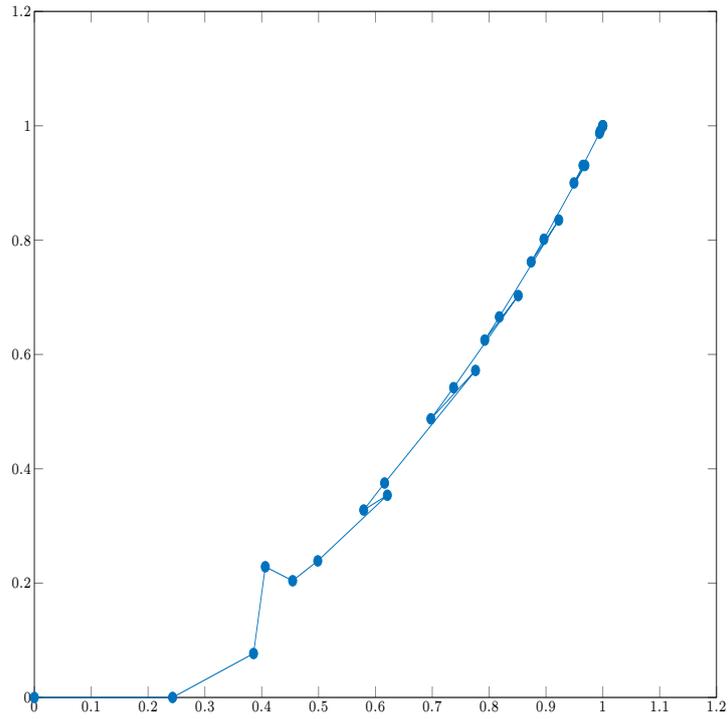


Figure 3: Steps in the energy landscape for BFGS method

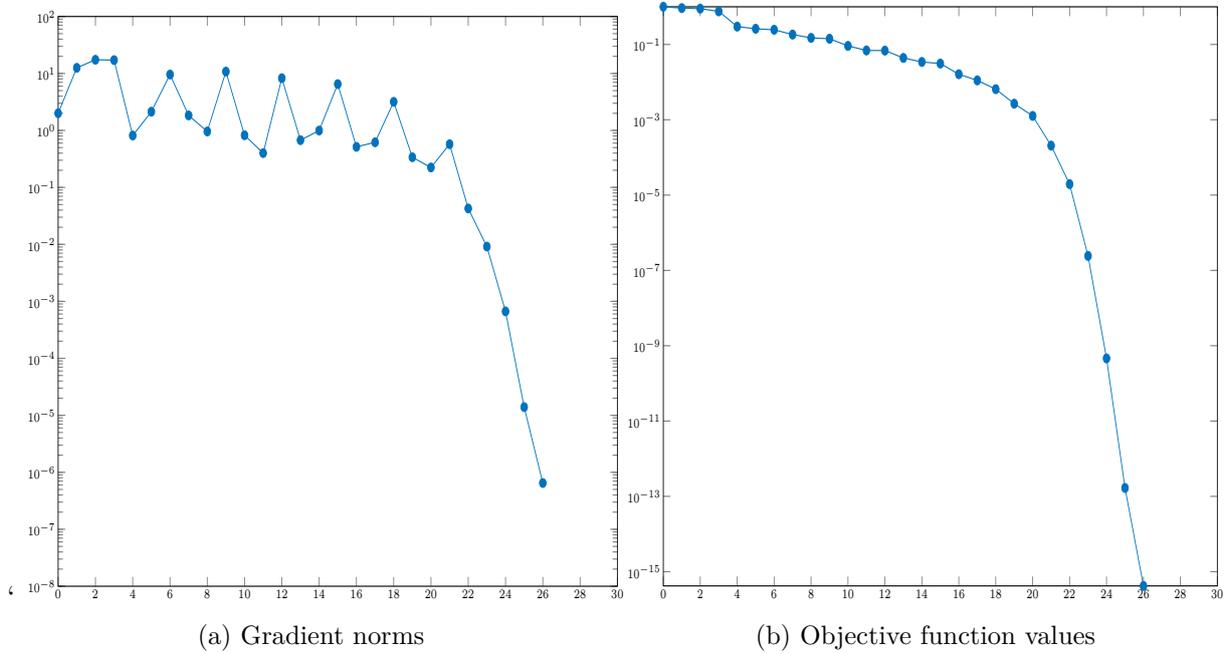


Figure 4: Gradient norms and objective function values (y-axes) w.r.t. iteration numbers (x-axis) for BFGS method (y-axis is log scaled, points at $y = 0$ not shown due to log scale)