Exercise Sheet 8 for Optimization 1
Winter Semester 2011/12

1. (A warning) Let $f(x) = -x$, and $\tilde{f}(x) = f(x) + \tilde{\varepsilon}_f$, where $\tilde{\varepsilon}(x)$ is the rounding error, if one rounds after the third decimal position (e.g. $0.1234578\ldots \approx 0.123$). Show that the relative error

$$\frac{|D_h^+ f(0) - f'(0)|}{|f'(0)|} = 100\%,$$

   if h is chosen too small. Find also an example where the error of the approximated function $\tilde{f}$ is bounded, but the error between $D_h^+ f$ and f' tends to infinity, if h tends to 0.

2. (Local Newton method) Implement the local Newton method from the lecture and test it with the Rosenbrock and Himmelblau functions, with the same starting points as in the steepest descent problem of sheet 6.

3. (Newton without updating) Prove Theorem $7.4.$ from the lecture, and test the Newton method without updating given by

$$x_{k+1} = x_k - (\nabla^2 f(x_0))^{-1} \nabla f(x_k)$$

   out on the same tests as in the steepest descent problem of sheet 6.