HW2

M 5750-2. Fall 2010. Optimization methods

1. Implement Trust region method (Algorithm 4.1, page 69) for a one-dimensional problem. Use any method (analytic of numeric) for finding minimum of f_i inside the trust region

$$f_1(x) = -.2\,x^4 + x^2 - x, \quad x \in [-1;1], \quad x_0 = -1. \tag{1}$$
$$f_2(x) = 1 - \exp(-x^2), \quad x \in [-3;3], \quad x_0 = -2.5. \tag{2}$$
$$f_3(x) = \sqrt{x^2 + .3}, \quad x \in [-3;3], \quad x_0 = -2. \tag{3}$$
$$f_4(x) = \max\left\{\sqrt{2-x}, \sqrt{2+x}\right\}, \quad x \in [-2;2], \quad x_0 = -1.5. \tag{4}$$

   .

2. Problem 4.7

3. Use steepest descent method (any variant of it) to find minimum of the function

$$F(x_1, x_2, x_3) = x_1^2 + x_2^2 + 1.5x_1x_2 + 5\,x_3^4 + .3\sin^2(x_1 + x_2^2 - x_3^3)$$

   Starting point is $x^{(0)} = (1, 1, 1)$

4. By the same steepest descent algorithm, solve the equation $A\,x = b$ where

$$A = \begin{pmatrix} 2 & 1 & 0 & 0 \\ 1 & 3 & 2 & 0 \\ 0 & 3 & 2 & -1 \\ 0 & 0 & -1 & 5 \end{pmatrix}, \quad b = \begin{pmatrix} 1 \\ 1 \\ 0 \\ 0 \end{pmatrix},$$

   Compare numerical solution with the exact solution. Plot the errors after each step.

5. Problem 5.11