Statistics and Machine Learning
Homework1

Due on October 7, 2005

Exercise 1: **(a)** Solve

$$\min_{x \in R^2} \quad \frac{1}{2} x^T \begin{bmatrix} 1 & 0 \\ 0 & 900 \end{bmatrix} x$$

using the *steep descent with exact line search*. You are welcome to copy the MATLAB code from my slides. Start your code with the initial point $x_0 = [1000\ 1]^T$. Stop until $\|x_{n+1} - x_n\|_2 < 10^{-8}$. Report your solution and the number of iteration.

(b) Implement the Newton's method for minimizing a quadratic function $f(x) = \frac{1}{2} x^T Q x + p^T x$ in MATLAB code. Apply your code to solve the minimization problem in **(a)**.

Exercise 2: Find an approximate solution using MATLAB to the following system by minimizing $\|Ax - b\|_p$ for $p = 1, 2, \infty$. Write down both the approximate solution, and the value of the $\|Ax - b\|_p$. Draw the solution points in R^2 and the four equations being solved.

$$\begin{array}{rcrcr} x_1 & + & 2x_2 & = & 2 \\ 2x_1 & - & x_2 & = & -2 \\ x_1 & + & x_2 & = & 3 \\ 4x_1 & - & x_2 & = & -4 \end{array}$$

.