CS5321 Numerical Optimization Homework 4

Multi-dimensional Optimization

Due April 23, 2012

Consider the Beale's function

$$f(x_1, x_2) = (1.5 - x_1 + x_1 x_2)^2 + (2.5 - x_1 + x_1 x_2^2)^2 + (2.65 - x_1 + x_1 x_2^3)^2$$

for $-4.5 \leq x_1, x_2 \leq 4.5$. The global minimizer is at $(3, 0.5)$. [1]

1. (20%) Derive its gradient and Hessian, and use them in the following codes.

2. (80%) Implement the following methods with proper line search algorithms, and compare and discuss their convergence behaviors. Using initial guess $(1, 1)$ and tolerance 10^{-6}.

   (a) Steepest descent method,

   (b) Newton's method,

   (c) Quasi-Newton method (SR1 or BFGS),

   (d) Conjugate gradient method (CG).

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[1]http://www.math.ntu.edu.tw/~wwang/cola_lab/test_problems/multiple_opt/
multiopt_prob/Beale\%20Function/Beale\%20Function.htm