CS 591 Numerical Optimization - Homework #1 Due Sept 13th

August 29, 2005

- Formulate an optimization problem using a problem from your graduate studies, research, general area of interest, or work. Note that this assignment will be the foundation for future assignments and some care in the selection of the problem is appropriate.

  Provide mathematical formulation, including potential equality, inequality constraint, spaces of vectors and matrices. Describe in words the goal of the optimization problem, what the underlying dynamics are, how large the optimization and state spaces are, the implementation of the forward solution, implementation issues associated with the optimization problem. Discuss the potential size of the problem.

  Note: the state and optimization spaces must be smooth and differentiable and therefore conducive to gradient based optimization methods (although that can sometimes be difficult to determine a priori).

  It is highly recommended that Latex be used for the writing assignment, since there will be some formulation, equation, and algorithm writing throughout the class.

- Using Matlab find the roots of the following problem with Newton's method:

$$f_1 = x_1 + x_2 - 3 \qquad f_2 = x_1^2 + x_2^2 - 9 \qquad x_0 = [1.5]^T \tag{1}$$

  Try different initial starting points. Calculate convergence rate. Plot x_1 x_2 versus iteration.

- Find the minimum for

$$f = 100(x_2 - x_1^2)^2 + (1 - x_2)^2 \tag{2}$$

  Plot x_1 versus x_2, and plot the sequence of solutions.

  Compare Newton's method to steepest descent for f. Try different starting points.

  Submit your writeup, matlab code, plots, and solutions via email.