MAT 331, Spring 2012

Project 3: Newton's Method for Nonlinear Systems

Due Thursday, May 10

Newton's method to solve $f(x) = 0$, where f is a differentiable function of one variable, works as follows.

First, an initial estimate x_0 is made. This estimate is refined by letting x_1 be the value where the line tangent to $f(x)$ at $(x_0, f(x_0))$ crosses the x-axis. We then repeat the process using x_1 as the estimate. This works out to be equivalent to

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

As long as x_0 is sufficiently close to a solution of $f(x) = 0$, this process converges rapidly to the a solution.

In this project, you are to investigate the generalization of this process to solve a system of n nonlinear equations in n variables. Your write-up should describe the mathematics of the algorithm, and you should adapt the maple worksheet at `http://www.math.sunysb.edu/~scott/mat331.spr12/problems/project3.mw` to implement the method. Demonstrate your implementation by finding the solution to a nonlinear system of three variables in three unknowns.