

Stat 310, Part II, Optimization. Homework 1.

1. Implement Newton's method ((3.38) in Nocedal and Wright, or from lecture notes).
2. Apply the method to the following function (Fenton's function).

$$f(x) = \left\{ 12 + x_1^2 + \frac{1 + x_2^2}{x_1^2} + \frac{x_1^2 x_2^2 + 100}{(x_1 x_2)^4} \right\} \left(\frac{1}{10} \right)$$

3. Initialize the method at (3,4). Describe what you observe, and explain.
4. Initialize the method at (3,2). Describe what you observe.
5. Modify the method in the following two ways; use $p^k = -B_k^{-1} \nabla f(x^k)$, where the matrix B_k is, instead of the Newton choice (1) $B_k = \nabla^2 f(x^k)$; one of:

$$(2) \quad B_k = I + \nabla^2 f(x^k);$$

$$(3) \quad B_k = \frac{1}{k} I + \nabla^2 f(x^k) \quad .$$

Start the method from (3,2), again.

6. Propose a way to estimate the rate of convergence of the 3 methods (Newton + (2),(3)) and carry it out for the experiment at point 5. I suggest finding a way to graphically represent your answers.