

Algorithms, Winter 2020 at CIS

Homework 1

1. In the steepest descent framework, recall we want to choose a direction d so as to minimize $\nabla f(x) \cdot d$, subject to the norm of d being equal to 1. Here we choose the norm $\|d\|_\infty = \max(|d_1|, |d_2|, \dots, |d_n|)$. Which direction d should you choose, subject to $\|d\|_\infty = 1$, to minimize $\nabla f(x) \cdot d$ for a given value of $\nabla f(x)$?
2. Run Newton's method for two iterations on the function $f(x) = x^3 - 7x^2 + 8x - 3$, to try to find an x with $f(x) = 0$, with starting point $x_0 = 5$ and show your work.
3. Run the momentum algorithm with momentum parameter $\eta = .9$ and learning rate $\alpha = .8$ on the function $f(x, y) = x^2 + y^4 + 3x^2y^2$ with initialization $(x, y) = (2, 2)$, for two iterations. Show your work.