ECE592-084: Optimizations and Algorithms
Fall 2019

Prof. Shih-Chun Lin

Homework 3

Due: 11:59pm, Thursday, November 7, 2019

Clearly identify the steps you have taken to solve each problem. Your grade depends on the completeness and clarity of your work as well as the resulting answer.

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1. Minimize

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

using the conjugate gradient algorithm. The initial guess is $\boldsymbol{x}^{(0)} = \begin{bmatrix} 0 & 0 \end{bmatrix}^T$.

Use your line search algorithm that you developed in the previous assignment to minimize

$$f(x_1, x_2) = (x_2 - x_1)^4 + 12x_1 x_2 - x_1 + x_2 - 3,$$

using

2. the rank one correction algorithm;

3. the DFP algorithm;

4. the BFGS algorithm.

Connect the successive points with lines with arrows to show clearly the progression of the optimization process. Use two starting points,

$$\boldsymbol{x}^{(0)} = \begin{bmatrix} 0.55 \\ \\ 0.7 \end{bmatrix} \quad \text{and} \quad \boldsymbol{x}^{(0)} = \begin{bmatrix} -0.9 \\ \\ -0.5 \end{bmatrix}.$$

In each run, locate the obtained sequence of points on the level sets of f.

5. Exercise 12.1 from the textbook on page 244.

6. Exercise 12.6 from the textbook on page 245.