

Homework 5

Write a documented clear code for solving for the minimum of the problem:

$$\min f(x, y) = 2x^2 + y^2$$

using the steepest descent method from the initial guess $x_0 = (1, 2)$

using the steepest decent method given by:

$$x_{k+1} = x_k - \alpha_k g_k$$

$$\alpha_k = \frac{g_k^T g_k}{g_k^T Q g_k}$$

Where Q stands for a positive definite and symmetric matrix of the quadratic form of $f(x)$:

$$f(x) = \frac{1}{2} x^T Q x - x^T b$$

$$x = (x_1, x_2, \dots, x_n)^T \in \mathbf{R}^n$$

Conduct iterations until you reach accuracy $\varepsilon = 10^{-9}$

Hint: Derive analytic expression of stepsize α_k and also check that your final solution is near $x^* = (0, 0)$. In your calculations use matrix:

$$Q = \begin{bmatrix} 4 & 0 \\ 0 & 2 \end{bmatrix} \quad \text{and for our case } b=0$$