Tutorial Sheet

Indian Institute of Technology Jodhpur
Optimization for Data Science(MAL7070)

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1. Consider the minimization of the objective function $f(x) = x_1^3 + x_1x_2 - x_2^2x_1^2$ by Newton's method, starting from the point $\mathbf{x_1} = (1,1)^T$. Will the method be successful? Give reasons for your answer.

2. What is the Newton direction for minimizing the function $f(x) = (6 - x_1 - x_2)^2 + (2 - 3x_1 - 3x_2 - x_1x_2)^2$, starting at $\mathbf{x_1} = (-4,6)^T$? Perform iterations of the Newton method.

3. Starting with the point $\mathbf{x_1} = (1,-2,3)^T$, perform one iteration of the conjugate gradient method to minimize the function $f(x) = 2x_1^2 + 2x_1x_2 + x_3 + 3x_2^2$.

4. Perform one iteration of the Davidon-Fletcher-Powell method to minimize the function $f(x) = exp(x_1^2 + x_2^2 - x_3 - x_1 + 4)$, starting at $\mathbf{x_1} = (1,-2,3)^T$.

5. Starting with $\mathbf{x_1} = (-2,4)^T$, minimize $f(x) = \frac{3}{2}x_1^2 + \frac{1}{2}x_2^2 - x_1x_2 - 2x_1$ by Davidon-Fletcher-Powell.

6. Solve Question 5 by conjugate gradient method.

7. Check whether the function in Question 3 can be solved by Newton's method? If yes, then solve it.

8. Find the mutually conjugate directions with respect to the matrix

$$G = \begin{pmatrix} 1 & 2 \\ 2 & 8 \end{pmatrix}$$

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9. Find the mutually conjugate directions with respect to the matrix

$$\text{A}= \begin{pmatrix} 2 & -2 & 0 \\ -2 & 3 & -1 \\ 0 & -1 & 6 \end{pmatrix}$$

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10. Check whether the function $f(x) = 2x_1^2 + 2x_1x_2 + x_3 + 3x_2^2$ can be minimized by steepest decent method. If yes, then solve it with the starting point $\mathbf{x_1} = (1,-2,3)^T$..

11. Solve the Question 1 by steepest decent method.