Assignment 1

Two-step assignment:

1. Write a steepest descent algorithm program for minimizing a quadratic function $f(x) = \frac{1}{2}x^T Qx - b^T x$, Q is symmetric and pd. Implement this algo for large size n - say $n = 10, 50, \text{or}100$, by randomly generating Q of size $n \times n$ and random $n \times 1$ vector b with Q must be symmetric and pd. See, how the iterations are performing (you can plot graphs for iteration number vs value of $f(x)$ or value of stopping metric. See if iterations become larger than how fast/slow the function values decrease. Check this for a number of random matrices of large size n. If possible check your answer vs the conditional number of Q.

2. Implement the steepest decent algo for a general convex function f minimization (without line search) by using the estimated value $\hat{\alpha}$ which can be taken as the previous iteration alpha value. See how the algo performs on some benchmark minimization of f problems and conclude your analysis. I will soon supply the link or pdf of some benchmark convex functions so that one can see the performance of SD method with alpha updation (without line search).

Kindly write a generic program and do a good number of run to convince and justify its analysis.

Submit the assignment by at most October 7, 2022. This assignment carries 20 marks.

Those Ph.D. scholars who are not comfortable in programming assignments can ask separately for some theory-based workouts. Such students have to inform me. The last date of submission of the programming assignment as well as the theory assignment stands at 07/10/2022.

Best wishes