NIIT University
Worksheet 6

Semester (Aug-Dec 2019)

Subject Code: **CS 4101**   *Subject Name:* **Linear and Non Linear Optimisation.**

Date: 03.10.2019, Thursday   **Time:** 2:30 PM   **Maximum Marks:** *10*

Course Instructor: Tapan Naskar

Instructions:

1. Make a appropriate tables for the calculations.

2. Use only scientific non-programming calculator.

3. Clearly justify all the steps.

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1. Gradient descent method usually exhibit oscillatory behaviour. Using the functions given in all previous assignments, show this. Identify those functions which have oscillatory behaviour around the minima.

2. Show using the functions given in all previous assignments, that the method terminate far from solution owing to round-off effect. Arrange the functions in an order such that which terminate farthest is first in the list and which terminates closer to the minima is last in the list.

3. Test to terminate:
   $|f^{(k+1)} - f^{(k)}| \leq \epsilon_1$ and $|\mathbf{x}^{(k+1)} - \mathbf{x}^{(k)}| \leq \epsilon_2$
   Find which condition satisfy first for the functions given in all previous assignments.

4. All the functions given in the assignments have minima which can be found analytically, which is $(x^\star, \ f^\star)$. Repeat question (3).

5. What is the difference between your observation in answering question(3) and question(4)?

6. For the given functions in the assignments, find ϵ_1 such that $|f^{(k)} - f^\star| \geq \epsilon_1$, for all values of k. Find the same for $|\mathbf{x}^{(k)} - \mathbf{x}^\star| \geq \epsilon_2$.

7. Suppose for a function which have minima at $(x^\star, \ f^\star)$. The method oscillates such that $\lim_{k \to \infty} \mathbf{x}^{(k)} = \mathbf{x}^{\star\star}$ and $\lim_{k \to \infty} f^{(k)} = f^{\star\star}$. Find these cases in your previous assignments. What will happen if we restart the iteration again from $\mathbf{x}^k \pm \delta$, where δ is very small number?

8. See if above situation arise in case of conjugate gradient methods using functions given in previous assignments.

9. Find the minima using conjugate gradient method for the function:

$$f(x,y) = \left[3\sin(\sqrt{x^2 + y^2}) - \frac{3}{2}\exp\left(-(x^2 + y^2 - 3x - 6y + 14)\right) \right] \sin^{-1}\left(\frac{y}{\sqrt{x^2 + y^2}} \right).$$

10. Find the minima of $f(x) = \sqrt{|x - 5|}$. See if Wolfe and Armijo conditions are satisfied for your choice of parameters.