School of Computer Science
Faculty of Science
National University of Engineering

Test 5

Topics: Iterative Solution Algorithm for Unconstrained NLOP
Subject: Computational Mathematics **Period: 2020.1**

Consider the following unconstrained NLOP:

$$\begin{aligned} &\min && f(x_1, x_2), \\ &(x_1, x_2) \in \mathbb{R}^2 \end{aligned}$$

where $f(x_1, x_2)$ is defined by

$$14 \cdot \sqrt{(x_1 - 7)^2 + (x_2 - 2)^2} + 20 \cdot \sqrt{(x_1 - 5)^2 + (x_2 + 3)^2} + 30 \cdot \sqrt{(x_1 + 6)^2 + (x_2 - 4)^2}.$$

1. (3 pts.) Plot the graph of f over an appropriate domain.
2. First attempt.
   (a) (2 pts.) Starting from the point $x^0 := (0, 0)$ conduct iterations of the Generic Algorithm for Unconstrained Nonlinear Optimization Problems using the steepest descent search direction and an exact line search to solve this problem.
   (b) (4 pts.) Implement a program in Python for the previous task.
   (c) (2 pts.) Is the point at which the algorithm terminates guaranteed to be a local or global optimum? Why?
3. Second attempt.

(a) (2 pts.) Starting from the point $x^0 := (0, 0)$ conduct iterations of the Generic Algorithm for Unconstrained Nonlinear Optimization Problems using the Newton's method search direction and the Armijo rule with $\sigma = 10^{-1}$, $\beta = 1/2$ and $s = 1$.

(b) (5 pts.) Implement a program in Python for the previous task.

(c) (2 pts.) Is the point at which the algorithm terminates guaranteed to be a local or global optimum? Why?

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