

Numerical Optimization 2024 - Project 1, Phase 1 (individual)

Aral Cincim, k11720457

Artificial Intelligence, JKU Linz

May 5, 2024

(i)

Auxiliary score: 25/30

Reason: For some cases, the results were not as I expected. Overall, the results do meet the solution criteria in the .pdf file.

The chosen functions were:

$$x^3 - 3x^2 + 2x - 1$$

$$x^4 - 6x^2 + 9$$

$$x^5 - 10x^3 + 25x$$

$$x^4 - 12x^2 + 36$$

$$x^3 - 6x^2 + 9$$

Gradients

$$3x^2 - 6x + 2$$

$$4x^3 - 12x$$

$$5x^4 - 30x^2 + 25$$

$$4x^3 - 24x$$

$$3x^2 - 12x$$

Hessians

$$6x - 6$$

$$12x^2 - 12$$

$$20x^3 - 60x$$

$$12x^2 - 24$$

$$6x - 12$$

Steepest Descent Results:

For the first function, the function minimum is -1.38 , the final x value is 1.57 one of the stationary points of the function at iteration 116.

For the second function, the function minimum is found at $x = 1.73$, which is one of the stationary points of the function at iteration 169.

For the third function, the function minimum is found at $x = -1$, which is one of the stationary points of the function at iteration 110.

For the fourth function, the function minimum is found at $x = 2.44$, which is one of the stationary points of the function at iteration 221.

For the fifth function, the function minimum is found at $x = 4$, which is one of the stationary points of the function at iteration 390.

Newton's Method Results:

For the first function, the function minimum is -0.62 , the final x value is 0.49 . Converges faster than SD but the final result is not as good.

For the second function, the function minimum is found at $x = 0.09$ at 10000 iterations. The function does not converge.

For the third function, the function minimum is found at $x = 0.104$ at 10000 iterations. The function does not converge.

For the fourth function, the function minimum is found at $x = 0.29$ at 10000 iterations. The function does not converge.

For the fifth function, the function minimum is found at $x = 0.09$ at 10000 iterations. The function does not converge.

For (ii), (iii) and (iv) see the jupyter notebooks in the .zip file.