Matrícula (First-name Last-name)

CK0031/CK0248: Assigment, part I

Exercise 1. You are given the function $f(\mathbf{x}) = (4-2.1x_1^2+1/3x_1^4)x_1^2+x_1x_2-4(1-x_2^2)x_2^2$ and you are asked to minimise it. The function is often optimised in the rectangle $x_1 \in [-3,3], x_2 \in [-2,2]$.

Firstly, you are requested to

A) Separately sketch function $y = f(\mathbf{x})$ and its contour lines. Then, comment the plots;

B) Visually identify the portion of the domain with the key features of the function. Comment on the general characteristics of the function that emerge from this visual exploration;

C) Determine and report expressions for the gradient $\nabla f(\mathbf{x})$ and the Hesse matrix $\nabla^2 f(\mathbf{x})$.

Secondly, you must select a line-search method of your choice

1) Newton's directions;

2) Quasi-Newton's directions;

3) Gradient directions;

4) Conjugate-gradient directions.

Thirdly, after setting an initial minimiser $\mathbf{x}^{(0)}$ (motivate your choice), a tolerance value for a stopping criterion of your choice (explain how and why you defined that criterion), and a maximum number of iterations, you must optimise function $f(\mathbf{x})$ using the selected method. You are free to either use existing optimisation routines or code your own implementation of the chosen method.

You are requested to return your answers in the form of technical report. Along with the solution to the aforementioned questions, you are expected to report on the progress of the iterations and to diagram the convergence history sequence $(\{\mathbf{x}^{(k)}\})$ over the function contours. As for the code, you must provide the `main` function that calls the routines that implement the optimisation method (you can copy-and-paste your code to the report). If you use your own implementation, then the relevant code must be provided, too (copy-and-paste, again). If you use existing an existing implementation, you must provide pointers to the used libraries (urls are fine).

The code will be tested, make sure it works!

Instructions

[*Deadline*]: Submissions via SIGAA close Friday December 08, 2017 at 23:59:59 (Fortaleza Time).

[*Delays*]: Delayed submissions via email to `fcorona@ufc.br`. Delays will be penalised.

[*Solutions*]: You can write your solutions in either Portuguese or English language. Solutions must be submitted in PDF (`.pdf`) format; Other formats (`.doc`, `.docx`, `.rtf` etc.) will not be considered. The LaTeX template available at the course website is recommended, though not obligatory.

[*Others*]: Collaborations and solutions inspired by other people's work will be tolerated only within the limits explained in the website. Plagiarism will not be tolerated and will be reported to the UFC.