IE 440 Fall 2021 - Nonlinear Models in Operations Research

Homework # 4

due December 20^{th}, Monday, 23:59.

Consider the following two functions:

$$f(x_1, x_2) = (5x_1 - x_2)^4 + (x_1 - 2)^2 + x_1 - 2x_2 + 12$$

$$f(x_1, x_2) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2 \text{ (Rosenbrock's curved valley function.)}$$

You are asked to find the minimum of these functions using:

- Steepest Descent Method
- Newton's Method *(with exact line search)*
- DFP *(Davidon - Fletcher - Powell)* Method
- BFGS *(Broyden - Fletcher - Goldfarb - Shanno)* Method

- Use an exact line search method to determine the steplength. You may take the parameter set (ϵ_2, a, b) as (0.005, -100, 100).
- For the remaining parameters $(\epsilon_1, x^{(0)})$ select two different sets of values, and repeat your computation for these two sets.
- $H^{(0)}$ matrix should be taken as the identity matrix.
- Rosenbrock's curved valley function is a non-convex function and it has a unique minimum at $(1, 1)$. Observe that the Steepest Descent Method becomes very slow as it gets closer to the minimum. Indicate this fact in your iteration logs.

Your output should be in the following format:

k	$x^{(k)}$	$f(x^{(k)})$	$d^{(k)}$	$\alpha^{(k)}$	$x^{(k+1)}$
0	...	...	...	...	...
1	...	...	...	...	...
...					

$$x^* = ...$$
$$f(x^*) = ...$$

Include the screen shots of your outputs and your source codes in your report. Also submit the soft copy of your report and the source code which are named as **HW4-GroupID** to moodle.