Project 1 - Summary of Results

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Introduction

In this project I utilized three different numerical routines in R to calculate solutions to a nonlinear system of equations also known as Rosenbrock's Banana Function. This function was solved using three ways:

1. nleqslv
2. nlv
3. optim

Methodology

I first calculated everything needed starting with n = 2, so i = 1 and I calculated

f(x) =

$$\begin{cases} f_1(x) = 10(x_2 - x_1^2) \\ f_2(x) = 1 - x_1 \end{cases}$$

Then, using that function, I found the Jacobian to be $JF = \begin{vmatrix} -20x_1 & 10 \\ 0 & 0 \end{vmatrix}$

So, our Fobj = $(100(x_2 - x_1^2))^2 + (1 - x_1)^2$

Then, we found the gradient of Fobj = $\begin{vmatrix} -400x_1(x_2 - x_1^2) + (-2(-x_1 + 1) \\ 200(x_2 - x_1^2) \end{vmatrix}$

And using that same method we were able to find Rosenbrocks Banana Function with n = 4.

Results

For n = 2, the Broyden Method produced an output out 23 iterations . The Optim. Optimization gradient was 195. The Quasi-Newton method gave a gradient of 28, 1.

Similarly, for the Newton Method, the Optim. Optimization gradient was 195. The Quasi-Newton method gave a gradient of 28, 1. However, it produced only 16 iterations so it was more efficient.

For n = 4, the Broyden Method produced an output out 43 iterations . The Optim. Optimization gradient was 501. The Quasi-Newton method gave a gradient of 28, 1.

Similarly, for the Newton Method, the Optim. Optimization gradient was 501. The Quasi-Newton method gave a gradient of 28, 1as well.. However, it produced 42 iterations as well so it was just as efficient.