applying armijo rule into rosenbrock function

I applied armijo rule into rosenbrock function to find the minimal point. I will explain briefly about rosenbrock function first and show how I applied armijo rule into rosenbrock function.

rosenbrcok function

I refered the website https://en.wikipedia.org/wiki/Rosenbrock_function (https://en.wikipedia.org/wiki/Rosenbrock_function).

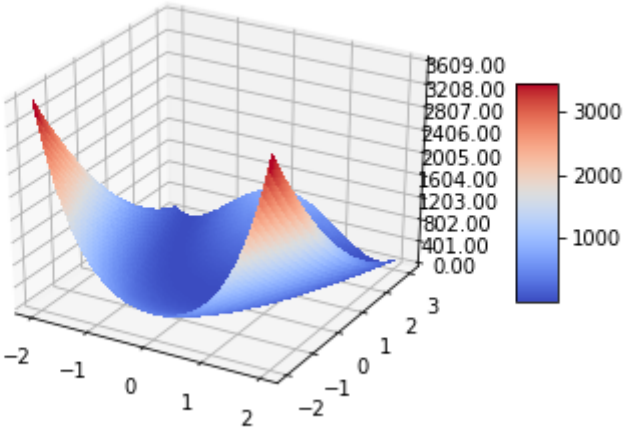
This function is also known as **rosenbrock's valley** or **Rosenbrock's banana function**. It is introduced by Howard H.Rosenbrock in 1960, and used to test problem for optimization algorithms. As you can see below it is a non-convex function.

The function is defined as

$$f(x, y) = (a - x)^2 + b(y - x^2)^2$$

The plot below is when $a = 1, b = 100$ and the minimum value of zero is at $(1, 1)$. Only in the trivial case where a=0 is the function symmetric and the minimum at the origin.

The global minimum is inside a long, narrow, parabolic shaped flat valley. To find valley is trivial, but to find gloval minimum is difficult.



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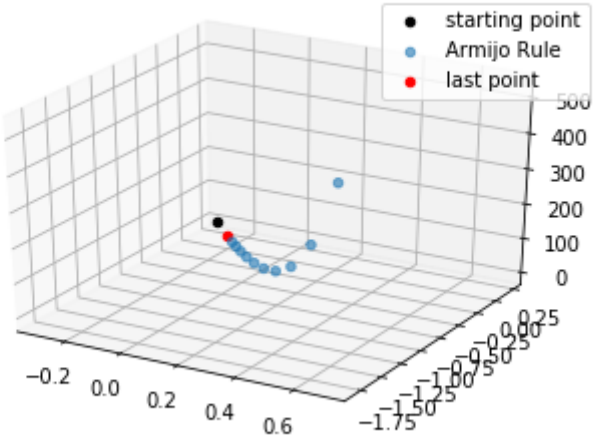
I set the starting point at $(-0.3, -0.2, 2.9)$ and descent direction as $[1, -2]$. The maximum iteration was set 100. If it could not find the minimal point before 100 iteration, it failed to find minimal point. It could find the valley and get the point which has close value of 1, but it could not find the global minimum value of zero at $(1, 1)$. The tracking process is below.

The starting point is black at $(-0.3, -0.2, 2.9)$ and last point is red at $(-0.207, -0.0147, 1.53)$. It takes 12 iterations and z value was decreased fastly. The last five values of z value is $[7.24, 4.13, 2.55, 1.81, 1.53]$.

The value of beta is set randomly from 0 to 1 and sigma value was sampled from uniform distribution over the half-open interval $[0, 0.5)$. Because it is using random values, number of iteration this algorithm takes were different everytime.



The address of sharable colab file is [https://drive.google.com/file/d/125J73IIcXQofK7bz3-Uvk0EFUNb5J96z/view?usp=sharing (https://drive.google.com/file/d/125J73IIcXQofK7bz3-Uvk0EFUNb5J96z/view?usp=sharing)](https://drive.google.com/file/d/125J73IIcXQofK7bz3-Uvk0EFUNb5J96z/view?usp=sharing)