CHBE 552 Problem Set 1

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Question 1

By implementing SA method with following parameters: bounds = $(-1, 1)$, initial temperature = 10000, cooling rate = 0.95, stopping temperature = 0.001, and max iterations = 1000, three tests are conducted and the results are shown as following:

Test 1:

Best x_1 and x_2 are $[0.00016685, -0.00014399]$ and the best function value is $1.074285020 \cdot 10^{-6}$.

Test 2:

Best x_1 and x_2 are $[0.00019128, 0.00056343]$ and the best function value is $1.08674897771 \cdot 10^{-5}$.

Test 3:

Best x_1 and x_2 are $[0.00023714, 0.00051509]$ and the best function value is $9.45038628186 \cdot 10^{-6}$.

Thus, one can conclude the best x_1 and x_2 are $[0, 0]$ and the best function value is 0. The tiny error might comes from the numerical uncertainty of float computation in Python.

Question 4&5

By implementing Nelder-Mead algorithm in Python, for function in part 1: the minimum point is $[0.99999871 \approx 1, 0.99999707 \approx 1]$, and the minimum function value is $1.3556651538450528e-11 \approx 0$.

For function in part 2: the minimum point is $[6.50737582e-04 \approx 0, -6.52767435e-05 \approx 0, -6.74455549e-04 \approx 0, -6.76241743e-04 \approx 0]$, and the minimum function value is $5.379451007433241e-11 \approx 0$.

Again, The tiny error might comes from the numerical uncertainty of float computation in Python.