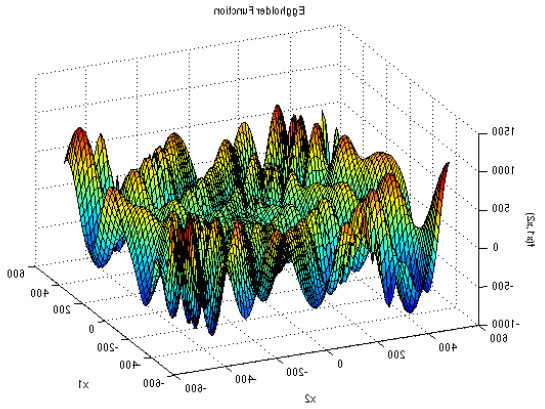
Purpose

This practice work consists to apply GA for optimizing one the famous test functions for optimization, which known with a great number of local minima that is called Eggholder function defined as ;

$$f(\mathbf{x}) = -(x_2 + 47)\sin\left(\sqrt{\left|x_2 + \frac{x_1}{2} + 47\right|}\right) - x_1 \sin\left(\sqrt{|x_1 - (x_2 + 47)|}\right)$$

This function is usually evaluated on the square $x_i \in [-512, 512]$, for all i = 1, 2.



$$f(\mathbf{x}^*) = -959.6407, \text{ at } \mathbf{x}^* = (512, 404.2319)$$

Goals:

- Understanding optimization concepts ;
- Implementing basic GA ;
- Adjusting parameters to improve GA efficiency;
- Discovering GA power ;
- Comparison between binary and decimal encoding ;
- Comparison between different genetic operator types.

Part 1

- Write the mathematical formulation for this problem.
- What is type of this optimization problem?
- Determine the search space.

Part 2

- Implement a basic GA for solving this problem using decimal encoding.
  (take NumIter = 200 ; m = 50 ; pc = 0.7 ; pm = 0.05 ; roulette wheel selection ; one-point crossover ; bit flip mutation).
- Adjusting parameters :
  - ✓ Number of iterations: construct the curve that represent the deviation ratio of means of 10 runs in terms of NumIter). Choose ideal value of NumIter.
  - ✓ Perform the same process for population size m ;
  - ✓ Rake pm=0 then pm=1 and run your program. Write then interpret your results.
  - ✓ Perform the same process for pc.