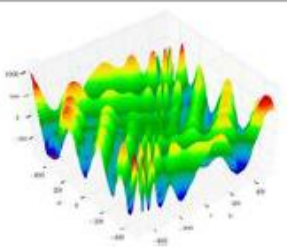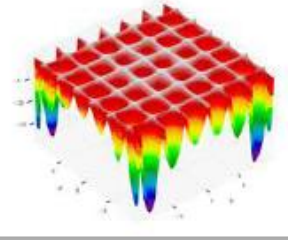# Programming Assignment #2 : Differential Evolution

1.   Refer to the Wikipedia page: https://en.wikipedia.org/wiki/Test_functions_for_optimization

(The relevant sections of that page are copied in this assignment.)

You need to develop your own program, in Python, that performs DE optimization. The step-by-step process for this is given in the lecture slides, along with the logic and formulae for generating the Mutant vector, Trial Vector, and for performing Selection.

Use this program to find the optima for two of the functions in that Wikipedia page – the *Eggholder function*, and the *Holder Table function*. The relevant section of the page is reproduced below:

Function Name	3-D Plot	Objective function – Note only 2 paras - (x, y) involved
Eggholder function		$f(x,y) = -(y+47)\sin\sqrt{\left|\frac{x}{2}+(y+47)\right|} - x\sin\sqrt{\left|x-(y+47)\right|}$
Hölder table function		$f(x,y) = -\left|\sin x \cos y \exp\left(\left|1-\frac{\sqrt{x^2+y^2}}{\pi}\right|\right)\right|$

The range of parameters for the Eggholder function is: $-512 \leq$ x, y $\leq$ 512, while for the Holder Table function is $-10 \leq$ x, y $\leq$ 10. There are no explicit constraints in these problems.

The same DE program should work on both, as well as any other single-objective optimization problem you would like to solve.

Your optimized values should match the values given in the link page. You will need to make plots of the convergence history of the average (across all candidates) and the best (candidate) value of the objective function across all generations (gens. on x-axis). [Note that the identity of "best candidate" will change across generations; the plot should track the best value independent of candidate]. Both these parameters should appear on the same plot; however, the two test functions are to be plotted on two different plots. You need to experiment with two parameters – the population size and the max. number of generations for solution. Do you find similar trends for both functions?

Ball-park figures for parameters:

1.   Population size: 20, 50, 100, 200.

2.   Num of Gens: 50, 100, 200.

3.   Crossover Probability : 0.80

4.   Constants K and F for creating mutant vector: K = 0.5; for F, choose between -2 and +2 randomly across generations, but keep it same for all candidates within a generation.

Your submission should be a folder containing your code, and a word doc containing comparison of your optimized solution against the correct solution, as well as the plots for the given cases. Plots should be for all population cases, for 200 generations. That makes 4 plots for each of the two test functions.