CS/CSYS 352 HW 3: real-valued decision variable optimization: CMA-ES and DE
Assigned: 9/27
Due: 10/4 (softcopy in BB by 4pm, hardcopy to me by 4:30)

You are design and conduct some well designed experiments to make comparisons (that are as fair as possible) between the following variants of CMA-ES and DE to optimization of real-valued vectors on three N-dimensional functions: the sphere function provided (in the range -100 100), the Schewefel's 1.2 function provided (in the range -100 100), and the Matlab built-in rastriginsfcn (in the range -5.12 5.12),; use at least N = 2 and N = 10. Plots of the 2D versions of these benchmark objective functions are shown at the end of this assignment (these were created using the myezplot3d function I provided in the Matlab tutorial). Notice that the optimal fitnesses of all 3 functions are where all the decision variables are zero; this makes it easy for you to compute the Euclidean distance from the best found solutions to the optimum.

Compare the following methods:

a. CMA-ES including both rank 1 and rank mu updates
b. CMA-ES including only rank 1 updates; i.e., cmu = 0
c. CMA-ES including only rank mu updates; i.e., c1 = 0
d. CMA-ES with no cov updates; i.e., both c1 = 0 and cmu = 0
e. DE using constant F = 0.85
f. DE using random F between 0.5 and 1.2

I have provided custom functions purecmaes2.m and de_rand_1_bin.m for you to use in this assignment but feel free to modify them further if needed.

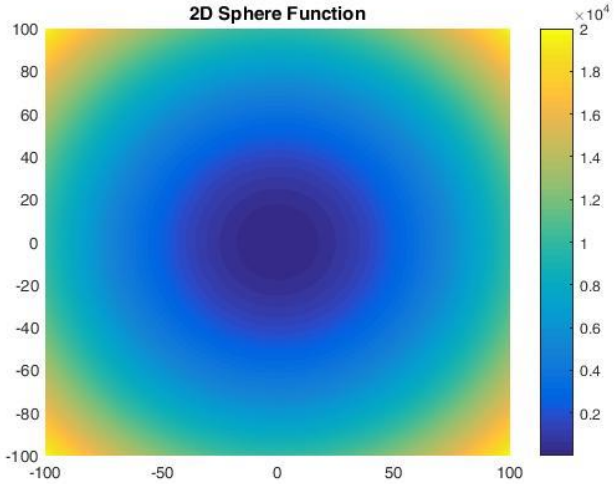
Create driver scripts that I could run to recreate the following plots.

For each given problem and each problem size, plot a single representative run of fitness vs. runtimes over the course of the evolution, for all 6 methods on the same graph (using different colors and linetypes), and similarly for fitness vs. number of function evaluations over course of the evolution on another graph, using semilogy plots to see how the types of updating affect convergence rates. Use boxplots to compare the Euclidean distances of the final best solutions to the global optimum returned by these 6 methods over some number of reps. Try to come up with some other informative plots or tables with fair comparisons to help summarize and clarify other aspects of the results.

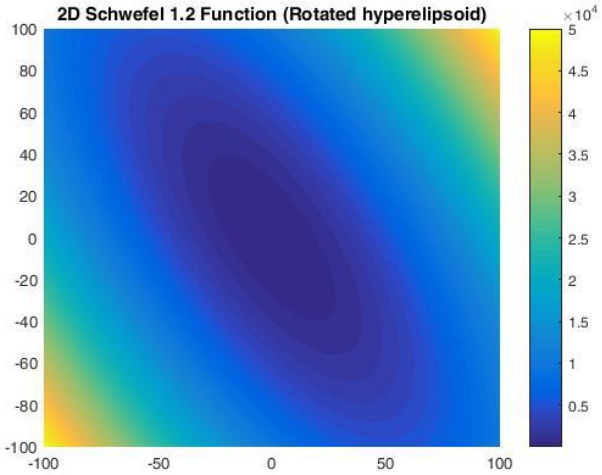
Writeup: Describe your results clearly, referring to your figures by number to back up what you say. Discuss your results thoughtfully and describe any take-home messages you can glean from these experiments. Also identify what results, if any, were confusing to you that you cannot explain. Describe at least one subsequent experiment that you think might be interesting to further illuminate the relative merits of these variants of CMA-ES and DE.

HAND IN: both Softcopy and Hardcopy of your writeup, your drivers, and any other code you modified, if any. Please indicate any new or altered code in purecmaes2.m or de_rand_1_bin.m (if any) by commenting these lines with a comment starting with %CHANGED.

myezplot3d(@pcolor,@sphere,-100,100)



myezplot3d(@pcolor,@schwefel1p2,-100,100)



myezplot3d(@pcolor,@rastrigingsfcn,-5.12,5.12)