Assignment 2

CS 776: Genetic Algorithms
Fall 2023
Max Score: 100

Genetic algorithms and function optimization

Design and implement a simple genetic algorithm in any language of your choice. Do not download and use existing code although you may certainly use existing code for inspiration. Rather, understand and implement simple genetic algorithm code from the textbook. It is in pascal, but you can easily translate it to your favorite language as I have done, to C/C++ and python. A simple genetic algorithm uses fitness proportional selection, one-point crossover, and bit flip mutation.

DeJong Functions

First, use this simple genetic algorithm that you write to solve the DeJong functions from page 108 of your textbook and available at this link. He chose these functions because the represent common characteristics of easy and difficult function optimization problems. You will have to

1. Implement our binary encoding for scalar variables as discussed in class.
2. Implement evaluation functions for each DeJong function
3. Experiment with different population sizes, number of generations to run, and probabilities of crossover and mutation. Start with $50, 100, 0.7, 0.001$ for these genetic algorithm parameters.

Analysis of GA performance

Second, once you have discovered the best genetic algorithm parameters for each of the five DeJong functions, plot **on one graph**, the population minimum, maximum, and average fitness (y-axis) versus number of generations (x-axis). In addition, plot **on one graph**, the population minimum, average, and maximum *objective function value* (y-axis) versus number of generations (x-axis). Note the following.

1. Since the Genetic Algorithm (GA) is randomized, you will need to run the GA 30 different times with 30 different random seeds in order to get useful data for your plots.

2. Each point on this graph will be the average of 30 different values for that generation over all 30 random seeds

CHC GA performance, 20 points

Third, implement CHC selection (as discussed in class and in Eshelman's CHC paper). Change GA parameters to be suitable for CHC and run the CHC-GA on the same problems. Use $50, 75, 0.95, 0.05$ for population size, number of generations, probability of crossover, and probability of mutation with CHC.

Turning in your assignment

Write a report that contains the following sections

1. A link to you your simple genetic algorithm and CHC GA source code

2. A link to your source code for the evaluation function for each of the five DeJong functions

3. 70 points. The plots of your genetic algorithm running as described above on each DeJong function. I will expect two plots for each DeJong Function.

4. 20 points. A table that lists the genetic algorithm parameters and the average number of function evaluations needed by the simple genetic algorithm (SGA) and CHC-GA for finding the optimum (or getting within 1% of optimum) for each DeJong function (row).

5. 10 points. A table with reliability, quality, and speed metrics for each GA based on your gathered performance data

6. Use canvas to turnin in this assignment report.

7. Your FULL name and email address on the cover page of your report

Email me with questions.