SSG 438: BIO-INSPIRED COMPUTING (GROUP ASSIGNMENT)

ASSIGNMENT 1.2 (TO SUBMITTED ON OR BEFORE JANUARY 26, 2024: 23:59)

Using the following Genetic Algorithm parameters,

Population size = 200

Number of generations = 100

Crossover Probability = 0.85

Mutation probability = 0.25

Selection mechanism = Roulette Wheel

Chromosome entries = 0 – 1 binary numbers

String length = 6

Number of strings = 4

Use two-point crossover

Write a code in any chosen language to solve the problem:

$$Maximize\, f(X) = 3x_1^2 x_3 x_4^3 + 2x_2 x_3^3 x_4^2 + 4x_1 x_2$$

Given that $2 \le x_1 \le 5, 5 \le x_2 \le 10', 0 \le x_3 \le 6 \wedge 10 \le x_4 \le 15$

(1) Obtain the best solution in each generation
(2) Obtain the best solution chromosome up to each generation
(3) After obtaining the approximate solution, plot the graph of Generation Number versus Best Fitness up to the generation.
(4) Determine at which generation the solution converges (if any) to the estimate optimum value.
(5) Estimate the computation time of convergence.

The generic pseudo-code of Genetic Algorithm is given by:

```
    Generate Initial Population, N = 0
    Evaluate                    'Keep best Chromosome
Do While Termination Criterion is False
    N = N + 1                   'Increment generation No
    Select
    Crossover
    Mutate
    Evaluate                    'Determine best chromosome to date
Loop
```

2. Repeat Question 1 by generating decimal values in chromosome byte positions.

3. Repeat Question 1 using the following elitism rules:
   At the selection stage:
   - Rank the Chromosome in descending order of fitness
   - Select the best 20 Chromosome without crossing over to next generation.
   - Next select the best 20 chromosomes without crossing over to next generation
   - Select the remaining chromosomes using roulette wheel method.

What is the difference in solutions of Questions 1 and 3?

4. For the problem Question 2 above use the Elitism Selection as specified below:
   At the selection stage:
   - Rank the Chromosome in descending order of fitness
   - Select the best 20 Chromosome without crossing over to next generation.
   - Next select the best 20 chromosomes without crossing over to next generation
   - Select the remaining chromosomes using roulette wheel method.

What is the difference in solutions of Questions 2 and 4 ?

Deliverables

1. Answer File
2. Feedback Questions

Please note that each answer file must be named with the student's

Course Code_Assignment No_Matriculation Number

e.g.

SSG438_Assign 2.2_170407419 for Assignment written part

SSG438_Code (Part B) Answer_Assign 2.2_170407419 for answer to coding part

SSG438_Code (Part B) Written Code_Assign 2.2_170407419 for written code