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INDIVIDUAL ASSIGNMENT
8 QUEENS PROBLEM USING GENETIC ALGORITHM

KK04503 EVOLUTIONARY COMPUTING
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8 QUEENS PROBLEM WITH GENETIC ALGORITHM

Assignment 1

Problem identification :

In chess, queen is one of the most powerful pieces that can move vertically, horizontally and diagonally without any obstacles unless there is another piece blocking the way. The 8 queens problem is a problem where the solution is to ensure that the 8 queens on the chess board are not attacking each other.

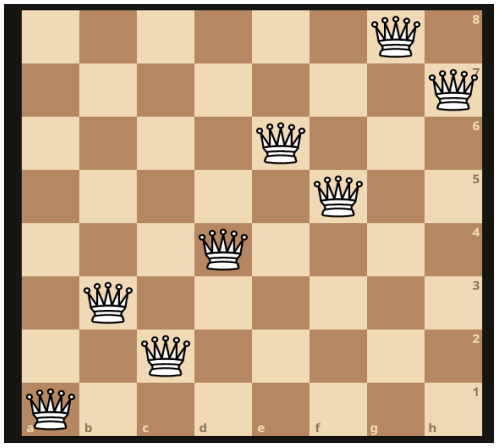
Chromosome Design :

The genes are encoded as the example below

<column1, column2, column3, column4, column5, column6, column7, column8>

For example

<1,3,2,4,6,5,8,7>



Dataset that are being used is :

8_Queens_initial_population.csv

Assignment 2

Fitness Function :

Fitness of the chromosome is calculated based on the queen. Fitness of the chromosome will be deducted if any of them are attacking each other either diagonally or horizontally or vertically. The maximum fitness of this problem is 28. Formula that are used to calculate fitness maximum are shown below :

$$f(x) = \frac{x(x-1)}{2}$$

where x indicates the number of queens on the board.

Parent Selection :

Parent selection of the population is based on the probability from the chromosome. The probability of each parent pick is calculated by current fitness divided by the maximum fitness.

Assignment 3

Crossover :

The crossover process is using one point crossover at random bit.

Mutation :

Mutation of the chromosome also at random bit but the probability for the mutation to happen is 0.9 which is 90 percent.

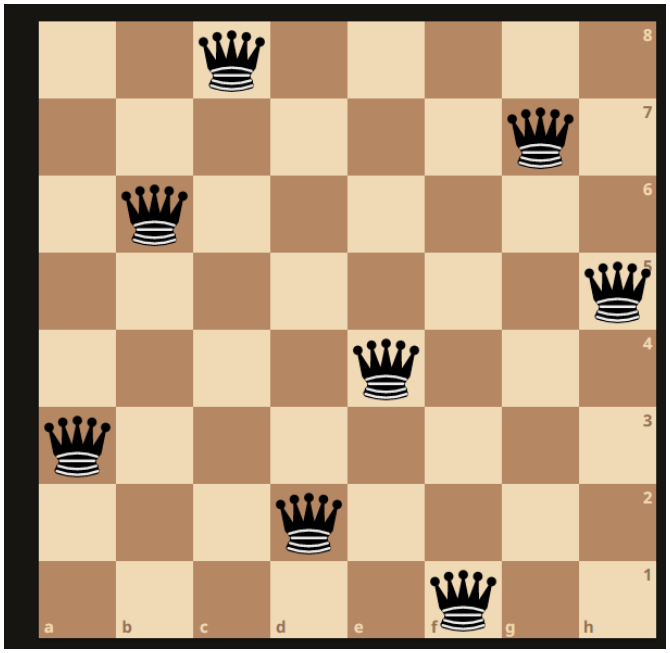
Assignment 4

The survivors from the population are shown in the "8 Queens Problem.ipynb" file.

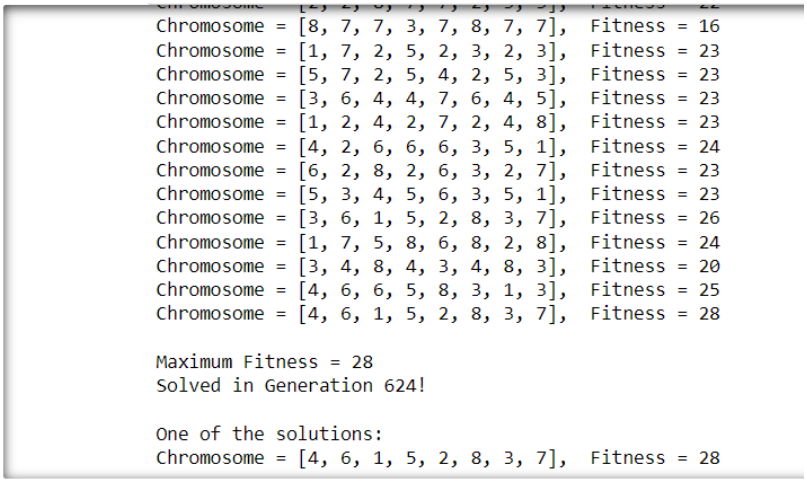
Assignment 5

```
Chromosome = [5, 6, 3, 2, 4, 2, 4, 3],  Fitness = 24
Chromosome = [8, 6, 8, 2, 3, 3, 1, 3],  Fitness = 23
Chromosome = [4, 1, 8, 8, 7, 2, 4, 2],  Fitness = 24
Chromosome = [7, 4, 4, 8, 7, 3, 7, 5],  Fitness = 23
Chromosome = [8, 6, 1, 6, 4, 6, 2, 5],  Fitness = 24

Maximum Fitness = 26
=== Generation 2944 ===
Chromosome = [8, 6, 1, 2, 3, 3, 1, 3],  Fitness = 23
Chromosome = [4, 1, 8, 2, 7, 2, 1, 3],  Fitness = 25
Chromosome = [2, 4, 8, 3, 4, 6, 2, 1],  Fitness = 25
Chromosome = [6, 6, 4, 2, 2, 2, 4, 3],  Fitness = 22
Chromosome = [3, 6, 8, 2, 4, 1, 7, 5],  Fitness = 28

Maximum Fitness = 28
Solved in Generation 2944!

One of the solutions:
Chromosome = [3, 6, 8, 2, 4, 1, 7, 5],  Fitness = 28
```

The above diagram shows the problem can be solved on the 2944 generation with maximum fitness. The population size is 20 in this case.



Another testing was done with 100 population size and the problem can be solved on the 624 generation.



Judging from the results of the experiment, the problem can be solved with any size population. The higher the size, the lower the generation needed to solve the problem.