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2110742 Evolutionary Computation
HW 2

SOLVING 8-QUEEN PROBLEM

Using Genetic Algorithm to solve the 8-queen problem, the solution is represented with an array of 1×8 where {0,1,2,3,4,5,6,7} represent the position in the row 0, 1, 2, 3, 4, 5, 6, 7 respectively. The number is an integer (0..7) representing the column number.

The first generation of population is randomly created that there is no repeated number. Therefore, there is no attack between the same row and the same column.

The fitness of each candidate is evaluated by counting how many times the queen attack each other diagonally. If there is no attack at all then the number is zero, means the solution is found.

The process to count how many times the queen attack each other is as follow:

For any two positions - (i, m) and (j, n), the row distance is $|i - j|$ and the column distance is $|m - n|$ Whenever the row distance and the column distance is the same then there is an attack. For example,

$$\{ 7, 2, 3, 0, 1, 4, 5, 6 \}$$

The row distance between row 1 and 2 is equal to 1. The column distance between the position of the queen in row 1 (column =2) and row 2 (column =3) is equal to 1 (3-2). This means there is an attack and the attack number is 1.

To count the total attack number, the first queen position is compared to other 7 positions, the second queen is compared to other 6 positions, the third queen is compared to other 5 positions, and so on. The total attack number is the sum of all attack of every pair.

When the total attack of all population is calculated, the population is sorted according to the total attack number. The population with the total attack number equal to zero is hence the solution. All the population is used to create the next generation.

Crossover

Two randomly selected parents, A and B, will be used. An 8-bit binary bit string is randomly created. Each bit will be use as a selector, if the bit is zero then the number from A is chosen otherwise the number from B is selected.

Mutation

A simple mutation will be applied by randomly selected two positions in a candidate and the two numbers are swapped.