## Introduction:

Evolutionary algorithms can be seen as a type of random search that tries to solve problems with the help of nature. Evolutionary processing defines an algorithm as follows: "There is a population of individuals (states) in which more appropriate individuals (the highest value) produce offspring (substitute states) that fill the next generation, a process called recombination. ».

Problem definition of 8 ministers:

To find the possible arrangements of 8 ministers on a standard 8x8 chessboard so that no minister is in an offensive position. If we know the basics of chess, we can say that a minister can move horizontally, vertically, or diagonally. Therefore, for two or more ministers to be on the offensive, they must be horizontally, vertically, or transversely aligned with the other minister. The figure below shows the minister's attack situations.
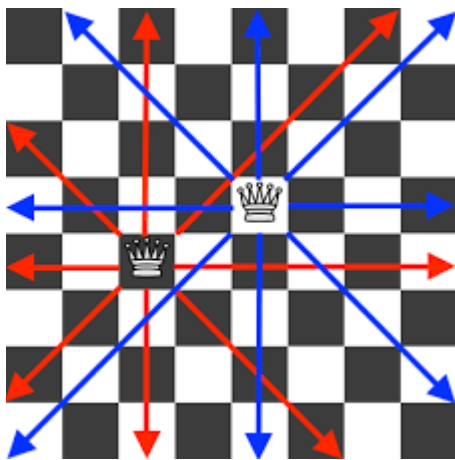
As can be seen, attack positions are positions where the minister can move horizontally, vertically, or diagonally along the chessboard. The figure below shows one possible arrangement that serves as a solution to the 8-minister problem.
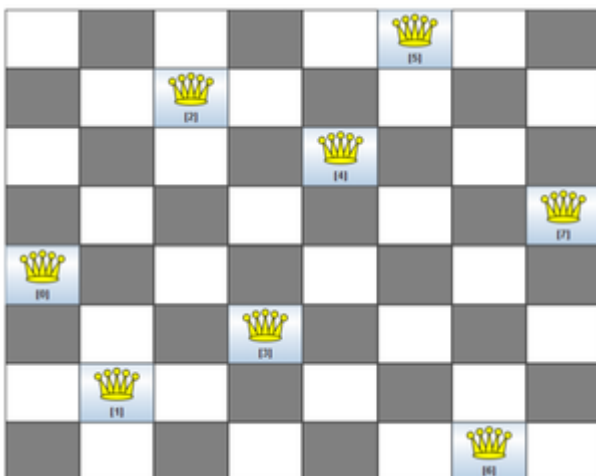
Explain the required concepts:

Show the issue of 8 ministers:

In the case of 8 ministers, our space is an 8 * 8 range, and for this space, which is our search space, we have 264 cases, which is a huge search space and makes our work difficult. So we add problem

information to make the search space smaller, and we use an 8-element array to display the answers to the problem, which gives us an 8-digit permutation, and finally, we have 8! We have a mode, and the search space becomes smaller, and the search in this space is more accessible.

Fitness:

Fitness is a quantity that helps us know how good the answer to the problem is.

Here is the best Fitness as follows:

$$\text{Fitness}(n) = \frac{n(n-1)}{2} = \frac{8(8-1)}{2} = 28$$

Mutation:

A mutation is an operator that causes a small change in a gene at random. The mutation must always follow two principles:

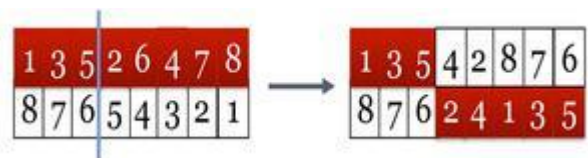1. Production of new material genetics.
2. Take small steps.

Here we randomly select two points and move their genes together:

Crossover:

The Crossover operator combines two genes in the hope of recovery.

Here Crossover randomly selects a breakpoint and then combines two genes:

Selection:

The Selection operator selects the parents, randomly selecting 5 parents from the initial population, then selects 2 of the 5 parents with the best fitness. Then we apply the Mutation and Crossover operators to them.