Artificial Intelligence

8 Queens problem using Genetic Algorithms

Assignment -02

Copied Assignments from ChatGPT will be marked Zero

The 8 queens problem is a classic problem in computer science and mathematics that involves placing 8 queens on a chessboard so that no two queens threaten each other. We can use Genetic Algorithms to solve this problem by evolving a population of solutions over time. Here's how we can implement it:

Represent the solutions: We can represent a solution as an 8-element array where each element represents the row position of a queen on the corresponding column. For example, [3, 1, 6, 8, 2, 7, 5, 4] represents a solution where the queens are placed at (1,3), (2,1), (3,6), (4,8), (5,2), (6,7), (7,5), and (8,4).

Generate the initial population: We can generate an initial population of solutions randomly. Each solution should be valid (i.e., no two queens should be in the same row, column, or diagonal).

Define the fitness function: We can define the fitness function as the number of conflicts between the queens in the solution. A conflict occurs when two queens are in the same row, column, or diagonal. The fitness function should return a higher value for solutions with fewer conflicts.

Implement the selection operator: We can implement the selection operator using tournament selection. In tournament selection, we randomly select a few solutions from the population and choose the one with the highest fitness.

Implement the crossover operator: We can implement the crossover operator using one-point crossover. In one-point crossover, we randomly select a point in the array and swap the tails of two parent solutions to create two new child solutions.

Implement the mutation operator: We can implement the mutation operator by randomly selecting an element in a solution and changing its value to a random value.

Run the algorithm: We can run the Genetic Algorithm by repeatedly applying the selection, crossover, and mutation operators to the population. We should stop when we find a solution with zero conflicts (i.e., all queens are placed on the board without threatening each other).

In the 8 queens problem, the state space refers to all possible configurations of 8 queens on an 8x8 chessboard. Each state represents a particular configuration of the queens, where each queen is placed on a unique square on the board.

The initial state is an empty board with no queens placed. The goal state is a configuration where all 8 queens are placed on the board such that no two queens are threatening each other.

At each step of the problem-solving process, we consider a particular state and generate a set of possible successor states. A successor state is a state that can be reached by making a valid move from the current state.

In the case of the 8 queens problem, a move involves placing a queen in an empty square on the board. Each successor state represents a configuration where one additional queen has been placed on the board. The set of all successor states for a given state represents all possible configurations that can be reached by placing one queen in any of the remaining empty squares on the board.

Deliverables: Solve 8 queens problemusing Genetic Algorithm using the above given twelve steps

State spaces are mandatory to be shown

Bonus: Create a GUI for 8 Queens Problem [5 Marks]