FINAL PROJECT

Artificial Intelligence

MAY 12, 2024

MUHAMMAD OMAIS AFZAL 21I-1369
CS-D

Genetic Algorithm for University Course Timetabling

Introduction:

The code is based on forming a timetable for a university by using its facility details. It will review hard and soft constraints to make a nearly perfect timetable.

Overview of the Code:

The provided code implements a genetic algorithm to generate optimal timetables for university courses. Here's a breakdown of the major components:

Initialization:

The algorithm initializes a chromosome population, each representing a potential timetable solution. The information encoded in each chromosome includes details such as course, theory/lab designation, section, section strength, professor, lecture day, lecture timeslot, and lecture room.

Population Encoding:

The chromosomes are binary-encoded, with each gene representing a specific attribute of the timetable. For example, the 'Course' gene denotes the course name, the 'Theory/Lab' gene denotes whether the course is a theory or lab session, and so on. Lists of sets are utilized for mapping strings to binaries, facilitating efficient encoding and decoding.

Fitness Calculation:

Each timetable solution is evaluated based on predefined criteria and hard and soft constraints. The fitness function will calculate the number of clashes in each variety of the timetable and then return that value.

Selection:

The algorithm chooses two individuals as parents who are the fittest among the entire population. These parents are then used for mutation and children's reproduction.

Crossover:

Crossover is performed to create offspring with genetic material from each of the parents. In the code, a single-point crossover strategy is utilized, where a random crossover point is selected from the population. From that point, the genes are swapped between children.

Mutation:

Mutation introduces random changes in the offspring chromosomes to maintain diversity within the population and explore new solution spaces. In this implementation, mutation occurs with a predefined probability, and randomly selected genes are altered to generate new timetable configurations.

Genetic Algorithm Loop:

The genetic algorithm iterates over multiple generations, with each iteration involving selection, crossover, and mutation operations. The process continues until all the iterations are completed.