ARTIFICIAL INTELLIGENCE

Semester Project

Clash-free Timetable Generation

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Introduction:

The following project report is based on the implementation of code for the generation of a clash-free timetable using the **classical genetic algorithm.** The process involved generation of chromosomes as a preprocessing step, where each chromosome represented an entity to be placed in the timetable**.** A number of sequential steps were involved in generation of the timetable and are explained below.

Steps:

1. **Population Initialization:** First the maximum values of data components like number of courses, total number of sections, students etc. are initialized and then converted into binary before finally concatenating them into the string representing the chromosome.
2. **Fitness Calculation:** Fitness for each of the chromosome in the population is calculated by calculating the total number of clashes (according to the

requirements and conditions mentioned in the problem Pdf) the chromosome has with the rest of the population.

3. **Tournament Selection:** After calculating fitness, the code proceeds for tournament selection that involves shortlisting a random pool of chromosomes from the population and finding two chromosomes with the worst fitness in the shortlisted group. These two chromosomes are forwarded for the crossover step.
4. **Crossover:** In this step of the classical genetic algorithm, I used a two-point cross-over function to generate new children with improved fitness. Crossover occurs at random indices of the string's 1st lecture's timeslot and the 2nd lecture. Point 1 is a random index of the 1st lecture's timeslot, while point 2 is a random index of the 2nd lecture.
5. **Mutation:** Fitness tests of the new children are done and validated. If the new offsprings are less healthy than the parents, the offsprings are forwarded for the mutation step. The mutation step involves randomly flipping the bits of the string components of both the 1st and 2nd lectures of that specific section's particular course.
6. **Replacement:** After the cross-over and mutation step, fitness of offsprings is evaluated and compared with their parents. If the offsprings have improved fitness as compared to their parents, the parents are dropped from the population and are replaced with their respective offsprings. Whereas, if the offsprings are comparatively unhealthy, they are dropped, and parents are retained.
7. **Timetable Generation:** The genetic reproduction cycle continues until all chromosomes acquire a fitness of "0" equivalent to "100% fit". Once we get the best generation of chromosomes, they are mapped on the grid representing the weekly timetable.

Results:

Initially the population contain chromosomes having relatively poor fitness values, which are then improved by replacement of the older generation with the new offsprings through the genetic reproduction cycle in each iteration. The genetic reproduction cycle terminates, once we obtain the best/optimal generation i.e. all chromosomes in the population have a fitness value of "0".