# **Automated Timetable Optimization Using Genetic Algorithms**



**Roll No: I210503**

**Name: Zian Ahmed**

**Section: CS B**

## Objective

Our system aims to automate the creation of optimized timetables by incorporating various constraints and preferences. Through the utilization of advanced optimization techniques, we seek to streamline the scheduling process and enhance resource utilization within educational environments.

## Methodology

1. Problem Representation: Timetables are represented within a Constraint Satisfaction Problem (CSP) framework, where variables depict scheduling entities like courses, professors, and rooms. Constraints encode dependencies and conflicts, facilitating a systematic approach to modeling scheduling constraints and enabling efficient search for feasible solutions.
2. Optimization Algorithm: Our system employs a Genetic Algorithm (GA) for timetable optimization. GAs are well-suited for combinatorial optimization problems such as timetable scheduling, simulating natural selection and evolution. The GA evolves a population of timetables iteratively using genetic operators like crossover and mutation, guided by a fitness function assessing each timetable's quality.
3. Constraint Handling: Constraints like room availability, professor preferences, and course conflicts are integrated into the fitness function to ensure generated timetables adhere to specified constraints. Constraint propagation techniques are employed to efficiently enforce constraints and eliminate infeasible solutions during optimization.
4. Implementation Details: Implemented in Python, our system utilizes libraries such as DEAP for GA optimization and constraint satisfaction libraries for handling scheduling constraints. With a modular design, the system allows for easy integration of additional constraints and optimization algorithms.

## **Results**

Testing our system on real-world datasets revealed significant improvements in timetable quality compared to manual scheduling methods. The generated timetables effectively minimized conflicts and satisfied all specified constraints, showcasing the effectiveness of our approach.

## Conclusion

Our system offers a promising solution to the intricate problem of timetable scheduling in educational institutions. By merging advanced optimization techniques with robust constraint handling, we've developed a system capable of efficiently generating high-quality timetables.