# Artificial Intelligence – Spring 2024
# Semester Project - Phase I

## Exams Schedule Generator Using Genetic Algorithm

### Deadline:  28th April,2024

## General Instructions:

- The project can be done in pairs or individually.

- The deadline will not be extended under any circumstances.

- All the components of the algorithm being used (GA) should be mentioned in the PDF report along with the rationale of choosing that particular technique.

- Evaluation will be done on the basis of a demo. Anyone failing to appear for the demo or unable to give up to the mark demonstration will be awarded zero.

- Evaluation will be individual.

- Four Excel files have been provided along with this project statement containing the dataset to be used in this project. (minor changes can be made)

## Problem Statement:

Your task is to find generic solution that will facilitate generating schedule for university using "**Genetic Algorithm**".

- You have to read the data from the given files.

- You have to write code from scratch.

- Make sure your notebook is well documented

- You cannot use any built-in library for the implementation of Genetic Algorithm except Pandas and NumPy.

- You can use any kind of crossover discussed in class with proper reasoning.

- You can choose any rate of mutation (which can be justifiable)

- You have to roulette wheel selection for selecting potentially useful solutions for recombination (Chromosomes).

The success of solution is estimated on fulfillment of given constraints and criteria. Results of

testing the algorithm show that all hard constraints are satisfied, while additional criteria are optimized to a certain extent. **You have to submit. ipynb with a one-page report of your implementation(pdf).**

## Constraints

There are set of constraints that need to be fulfilled.

## **Hard Constraints**

- An exam will be scheduled for each course.

- A student is enrolled in at least 3 courses. A student cannot give more than 1 exam at a time.

- Exam will not be held on weekends.

- Each exam must be held between 9 am and 5 pm.

- Each exam must be invigilated by a teacher. A teacher cannot invigilate two exams at the same time.

- A teacher cannot invigilate two exams in a row.

<span style="color:red">**The above-mentioned constraints must be satisfied**</span>

## **Soft Constraints**

- All students and teachers shall be given a break on Friday from 1-2.

- A student shall not give more than 1 exam consecutively.

- If a student is enrolled in a MG course and a CS course, it is preferred that their MG course exam be held before their CS course exam.

- Two hours of break in the week such that at least half the faculty is free in one slot and the rest of the faculty is free in the other slot so the faculty meetings shall be held in parts as they are now.

## Input & Output

**Input data** for each exam are *teachers' names, students 'name, exam duration*, *courses (course codes)*, and list of *allowed classrooms* (e.g. C301 to C310)

**Output data** are classroom and starting time for each exam along with course code and

invigilating teacher. Time is determined by day (Monday to Friday) and start hour of the exam.

- Output will be a chromosome which satisfies all hard constraints and soft constraints at least three. (as much as you can)
- You have to display a list of all hard and soft constraints which are fulfilled in the output.
- Don't forget to **show fitness** values at each iteration.
- The output should be in a proper format preferably a Table or a Chart.

## Evaluation Criteria

| Requirement | Marks |
|---|---|
| Correct Implementation of GA | 40 |
| Fulfillment of hard constraint | 10*6 = 60 |
| Fulfillment of soft constraint | 5*4 = 20 |
| One-page report .pdf | 20 |
| Properly Formatted Output | 20 |
| .ipynb file containing code in python | 40 |

## Submission Instructions

- Project must be submitted on the google classroom.
- Submission other than google classroom won't not be accepted.
- You are required to submit your notebook and document separately as **Proj01- <21I- XXXX_21I- XXXX >.ipynb** and **Proj01- <21I-XXXX_21I- XXXX >.pdf**.
- Your report must include a sample dataset along with its output upon running your program – the harshest dataset that you have tested.

Your notebook must contain all the datasets that you have tested your code on.