Application Project Report

IENG6923 Distribution Management

Class and Exam Scheduling for St. Paul's School, London (ON)

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Submission Date – 06/04/2022

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Abstract

By this project, the general class scheduling and exam scheduling problem for the schools around the globe is solved. The data and problem of St. Paul's school, London (ON) is taken for this project. It can be directly used by St. Paul's school that will save much time and efforts. Initially, around 7 research papers related to this problem were studied. The review of which is included in this report. In most of the cases, the problem was solved as an assignment problem using Hungarian algorithm. But later, it came out that Shortest Augmenting Path algorithm by Martello and Toth was more efficient for solving the assignment problem. Whereas in this project, the problem is solved using genetic algorithm in python. The basic aim of this project is to minimize the conflicts between the schedules of classes or exams to 0. Genetic algorithm basically creates number of generations and verifies if the conflicts are removed or not. If conflicts exist in the given generation, it creates another generation removing those conflicts and the process continues so on until the conflicts reduces to 0. The idea of this algorithm is derived from the Charles Darwin's theory of natural evolution. As, in the theory of natural evolution, the fittest individual is selected for reproduction and the offspring produced from that individual will be more fitter and have better chance of survival [8].

Introduction

The management of St. Paul's school, London (ON) invests much time and assets for preparing class and examination schedule. There are 9 Grade of students in the school from FDK to Grade 8 and 9 teachers i.e., one for each grade. I found the following data on the site of the school [9]: -

Staff and Teachers

Name	Position
Shannon Regan	FDK
Emilie Cocurullo	FDK
Elanna Worrel	Grade 1
Carly Soanes	Grade 1/2
Christine MacDonald-Stirrat	Grade 2
Julie McLeod	Grade 3
Madison Kempf	Grade 3/4
Joan Marshall	Grade 4/5
Tracey Petticrew	Grade 5/6
Marisa Neves	Grade 6
Spencer Taylor	Grade 7
Nathan Stout	Grade 8

The proposed solution will prepare the class schedule and the examination schedule for all the grades within few seconds. This time saved by the school can be utilized for improving quality of education, co-curricular and extra-curricular activities. And this model can be used generally for all the schools around the globe modifying according to the need.

Review of Papers

[1] An Assignment Problem and Its Application in Education Domain: A Review and Potential Path – This paper classifies the assignment problem into two types – timetabling problem and allocation problem. Timetabling problem is again divided into three types – examination, course and school timetabling while allocation problem is divided into – student - project allocation, new student allocation and space allocation problems. It also discusses various approaches to solve them all and the latest techniques along with the constraints.

[2] Feasible solution of the timetable assignment problem to faculty – In this paper, an algorithm is generated for solving the timetabling problem which gives a feasible schedule with the preference to the schedule of faculties. A complete method with all the constraints and variables is specified.

[3] Solving the teacher assignment problem by two Metaheuristics – Timetabling problem at a University in Indonesia is solved in this paper. Simulated annealing (SA) and tabu search (TS) algorithms are used for solving the problem. The results showed that TS performed better that SA.

[4] Teaching Assignment Problem Solver – Back-tracking with look-ahead forward checking method is used for teaching assignment. Teacher preferences and fairness in course distribution to professors are taken into account.

[5] The classroom assignment problem – Examination timetabling problem is reduced in size using Variable Neighbourhood Search algorithm (VNS).

[6] Assignment problem and its application in Nigerian institutions: Hungarian method approach – Adopting Hungarian method for solving assignment problem model increased lecturer's effectiveness by 13.2% in terms of the quality of education.

[7] Linear assignment problems (Martello and Toth) – The shortest augmenting path algorithm can be seen from this paper that is n times faster than Hungarian method for solving an assignment problem.

Model / Algorithm

A genetic algorithm is used for solving the class scheduling and exam scheduling problem. The pseudocode for the genetic algorithm is as follows [8]: -

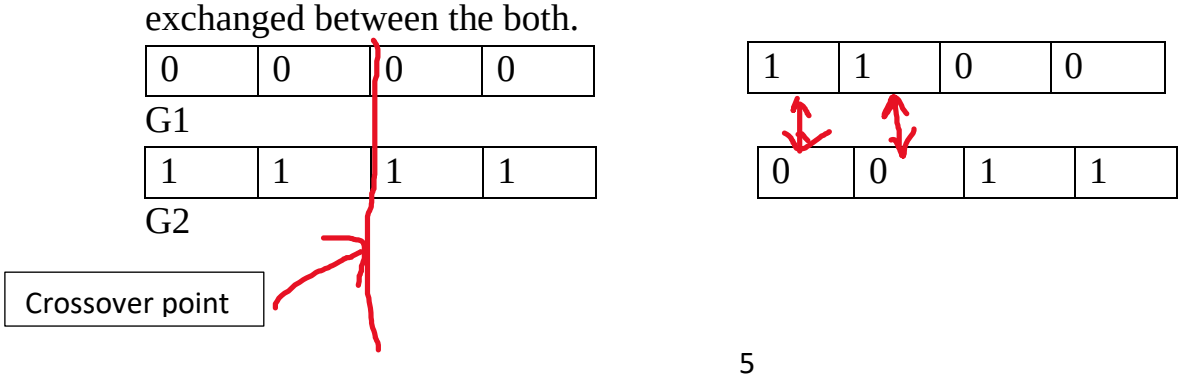
1. START
2. Generate the initial population
3. Compute fitness
4. REPEAT
   a. Selection
   b. Crossover
   c. Mutation
   d. Compute fitness
5. UNTIL population has converged
6. STOP

Initial Population – The algorithm begins with a generation (or initial population). Every individual of the generation in this algorithm gives a solution to the given problem. The difference is of satisfying the given condition (number of conflicts = 0 for this project)

Fitness – This function gives a result of how fit the individual of the generation is i.e. the closeness to satisfy the given condition. It gives a fitness score to each individual.

Selection – This function selects fittest individuals from the generation. So here, two of the fittest individuals are selected and used for producing the next generation.

Crossover – This is the most significant part of genetic algorithm. Any random crossover point is chosen on the individuals and the data till that point is exchanged between the both.



Mutation – This function is used to mutate or flip some of the data of an individual with very low random probability.

Termination – The algorithm terminates if the population of the generation is converged (Number of conflicts = 0 for this project).

Model

Objective:

- To prepare a schedule of classes and exams.

Constraints:

- Number of conflicts = 0
- For a grade, one teacher is assigned

Variables:

- Allocation of a classroom to the course
- Allocation of a time slot to the course

Solution Technique

The model is implemented in python. A class for data is created in which all the data for rooms, courses, instructors, meeting times and grades are given. Then a class Schedule is created that makes a schedule and calculates fitness of each schedule. The genetic algorithm as shown above in the model is implemented in the class Genetic Algorithm in which selection, crossover and mutation is defined. Moreover, separate classes for course, instructor, room, meeting time and department is created linking them according to the requirements such as courses are linked to teachers and departments. The results are displayed in a tabular format using pretty table module. Class Display manager is responsible for printing the data in required format [10].

```
class GeneticAlgorithm:
    def evolve(self, population):
        return self._mutate_population(self._crossover_population(population))

    def _crossover_population(self, pop):
        crossover_pop = Population(0)
        for i in range(NUMB_OF_ELITE_SCHEDULES):
            crossover_pop.get_schedules().append(pop.get_schedules()[i])
        i = NUMB_OF_ELITE_SCHEDULES
        while i < POPULATION_SIZE:
            schedule1 = self._select_tournament_population(pop).get_schedules()[0]
            schedule2 = self._select_tournament_population(pop).get_schedules()[0]
            crossover_pop.get_schedules().append(self._crossover_schedule(schedule1, schedule2))
            i += 1
        return crossover_pop
    def _mutate_population(self, population):
        for i in range(NUMB_OF_ELITE_SCHEDULES, POPULATION_SIZE):
            self._mutate_schedule(population.get_schedules()[i])
        return population

    def _crossover_schedule(self, schedule1, schedule2):
        crossoverSchedule = Schedule().initialize()
        for i in range(0, len(crossoverSchedule.get_classes())):
            if (rnd.random() > 0.5):
                crossoverSchedule.get_classes()[i] = schedule1.get_classes()[i]
            else:
                crossoverSchedule.get_classes()[i] = schedule2.get_classes()[i]
        return crossoverSchedule


    def _mutate_schedule(self,mutateSchedule):
        schedule = Schedule().initialize()
        for i in range(0, len(mutateSchedule.get_classes())):
            if(MUTATION_RATE > rnd.random()):
                mutateSchedule.get_classes()[i] = schedule.get_classes()[i]
        return mutateSchedule

    def _select_tournament_population(self, pop):
        tournament_pop = Population(0)
        i = 0
        while i < TOURNAMENT_SELECTION_SIZE:
            tournament_pop.get_schedules().append(pop.get_schedules()[rnd.randrange(0, POPULATION_SIZE)])
            i += 1
        tournament_pop.get_schedules().sort(key=lambda x:x.get_fitness(), reverse=True)
        return tournament_pop
```

Results

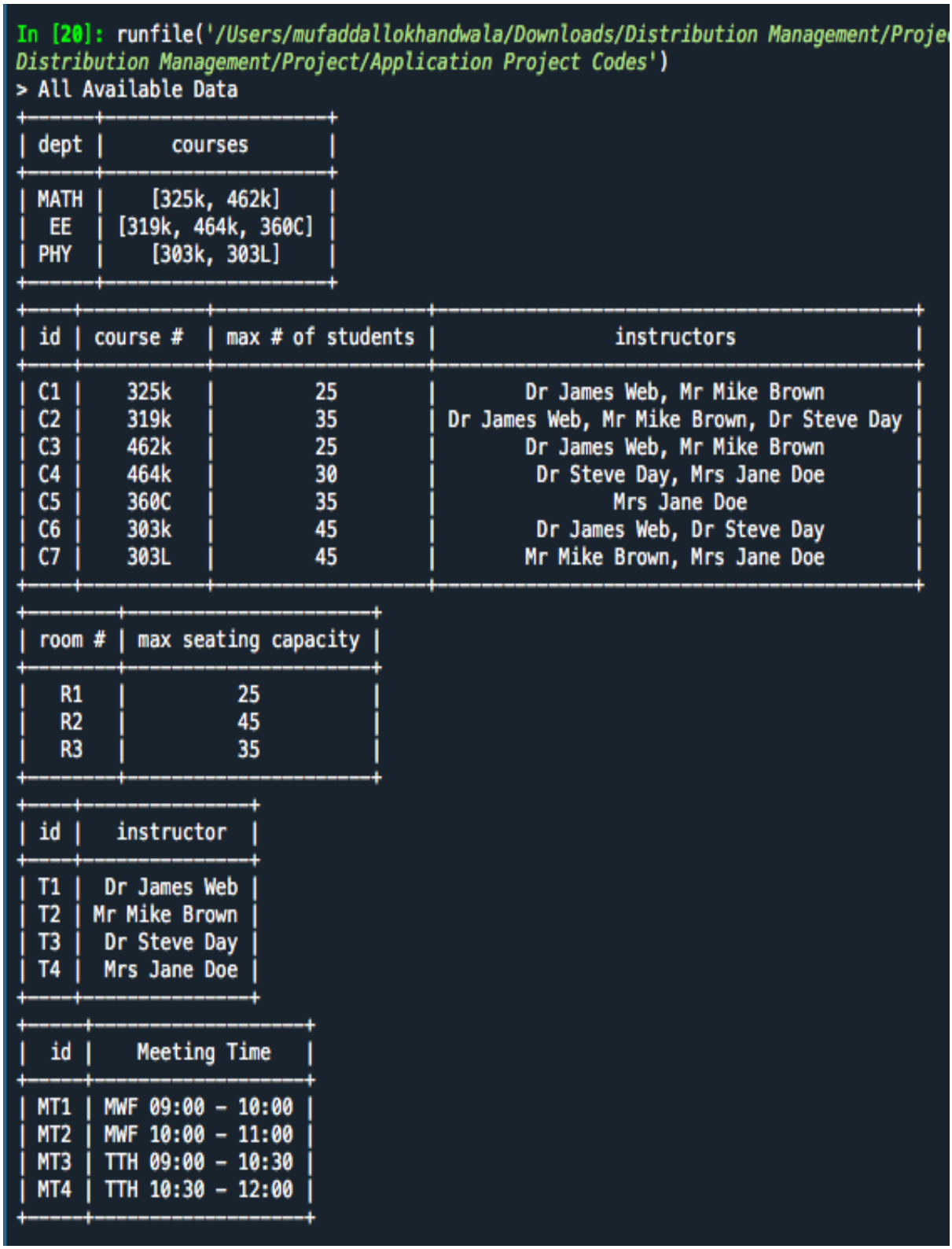
The output of class and exam schedule of St. Paul's school is as below: -

Class #	Dept	Course (number, max # of students)	Room (Capacity)	Instructor (id)	Class Time (id)
0	FDK	Basic Math (C1, 32)	R6 (55)	Shannon Regan (T1)	MWF 11:00 – 12:00 (MT3)
1	FDK	English (C2, 32)	R1 (40)	Shannon Regan (T1)	MWF 09:00 – 10:00 (MT1)
2	Grade 1	Elem Math (C3, 35)	R5 (50)	Elanna Worrel (T2)	MWF 09:00 – 10:00 (MT1)
3	Grade 1	Spoken Eng (C4, 35)	R8 (50)	Elanna Worrel (T2)	MWF 10:00 – 11:00 (MT2)
4	Grade 1	Grammar (C5, 35)	R4 (50)	Elanna Worrel (T2)	MWF 12:00 – 01:00 (MT4)
5	Grade 2	Social Science (C6, 45)	R8 (50)	Carly Soanes (T3)	MWF 12:00 – 01:00 (MT4)
6	Grade 2	Prelim Math (C7, 45)	R7 (45)	Carly Soanes (T3)	TTH 12:00 – 01:00 (MT9)
7	Grade 2	Adv English (C8, 45)	R4 (50)	Carly Soanes (T3)	MWF 01:00 – 02:00 (MT5)
8	Grade 3	Math1 (C9, 55)	R6 (55)	Julie McLeod (T4)	TTH 11:00 – 12:00 (MT8)
9	Grade 3	Basic Science (C10, 55)	R3 (55)	Julie McLeod (T4)	MWF 09:00 – 10:00 (MT1)
10	Grade 3	Geography (C11, 55)	R6 (55)	Julie McLeod (T4)	MWF 01:00 – 02:00 (MT5)
11	Grade 4	Math2 (C12, 50)	R4 (50)	Joan Marshall (T5)	TTH 09:00 – 10:00 (MT6)
12	Grade 4	History (C13, 50)	R3 (55)	Joan Marshall (T5)	MWF 12:00 – 01:00 (MT4)
13	Grade 4	Applied Science (C14, 50)	R8 (50)	Joan Marshall (T5)	MWF 01:00 – 02:00 (MT5)
14	Grade 4	Cooking (C15, 50)	R5 (50)	Joan Marshall (T5)	MWF 11:00 – 12:00 (MT3)
15	Grade 5	Math3 (C16, 53)	R3 (55)	Tracey Petticrew (T6)	TTH 09:00 – 10:00 (MT6)
16	Grade 5	Science1 (C17, 53)	R3 (55)	Tracey Petticrew (T6)	MWF 11:00 – 12:00 (MT3)
17	Grade 5	Civics (C18, 53)	R6 (55)	Tracey Petticrew (T6)	TTH 10:00 – 11:00 (MT7)
18	Grade 5	Moral Science (C19, 53)	R3 (55)	Tracey Petticrew (T6)	TTH 01:00 – 02:00 (MT10)
19	Grade 6	Math4 (C20, 45)	R9 (45)	Marisa Neves (T7)	MWF 10:00 – 11:00 (MT2)
20	Grade 6	Physics (C21, 45)	R2 (45)	Marisa Neves (T7)	TTH 10:00 – 11:00 (MT7)
21	Grade 6	Economics (C22, 45)	R3 (55)	Marisa Neves (T7)	TTH 12:00 – 01:00 (MT9)
22	Grade 6	General Knowledge (C23, 45)	R4 (50)	Marisa Neves (T7)	MWF 09:00 – 10:00 (MT1)
23	Grade 7	Chemistry (C24, 48)	R6 (55)	Spencer Taylor (T8)	TTH 12:00 – 01:00 (MT9)
24	Grade 7	Biology (C25, 48)	R6 (55)	Spencer Taylor (T8)	MWF 12:00 – 01:00 (MT4)
25	Grade 7	Adv Grammar (C26, 48)	R4 (50)	Spencer Taylor (T8)	TTH 01:00 – 02:00 (MT10)
26	Grade 7	Physical Edu (C27, 48)	R3 (55)	Spencer Taylor (T8)	TTH 10:00 – 11:00 (MT7)
27	Grade 8	Adv Math (C28, 37)	R5 (50)	Nathan Stout (T9)	TTH 12:00 – 01:00 (MT9)
28	Grade 8	Adv Science (C29, 37)	R7 (45)	Nathan Stout (T9)	MWF 10:00 – 11:00 (MT2)
29	Grade 8	Computer Science (C30, 37)	R2 (45)	Nathan Stout (T9)	TTH 09:00 – 10:00 (MT6)
30	Grade 8	General Knowledge (C31, 37)	R4 (50)	Nathan Stout (T9)	TTH 10:00 – 11:00 (MT7)

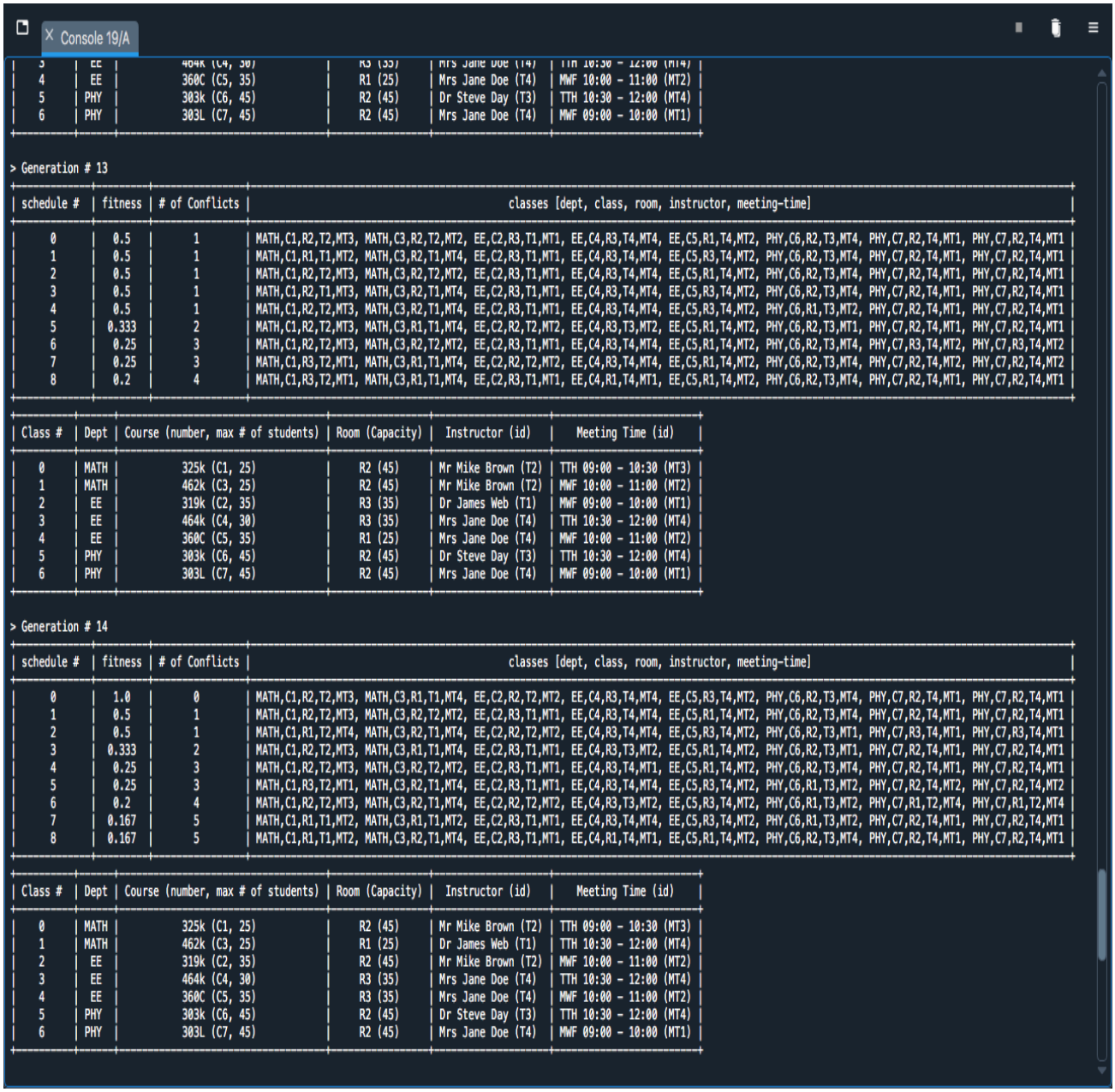
Class #	Dept	Course (number, max # of students)	Room (Capacity)	Invigilator (id)	Exam Time (id)
0	JK	Basic Math (C1, 32)	R2 (45)	Tracey Petticrew (T6)	11/04 MON 10:00 – 12:00 (MT7)
1	JK	English (C2, 32)	R7 (45)	Tracey Petticrew (T6)	14/04 THU 10:00 – 12:00 (MT10)
2	GRADE1	Elem Math (C3, 35)	R5 (50)	Julie McLeod (T4)	08/04 FRI 10:00 – 12:00 (MT5)
3	GRADE1	Spoken Eng (C4, 35)	R4 (50)	Julie McLeod (T4)	05/04 TUE 10:00 – 12:00 (MT2)
4	GRADE1	Grammar (C5, 35)	R9 (45)	Julie McLeod (T4)	07/04 THU 10:00 – 12:00 (MT4)
5	GRADE2	Social Science (C6, 45)	R4 (50)	Joan Marshall (T5)	13/04 WED 10:00 – 12:00 (MT9)
6	GRADE2	Prelim Math (C7, 45)	R3 (55)	Joan Marshall (T5)	15/04 FRI 10:00 – 12:00 (MT11)
7	GRADE2	Adv English (C8, 45)	R7 (45)	Joan Marshall (T5)	09/04 SAT 10:00 – 12:00 (MT6)
8	GRADE3	Math1 (C9, 55)	R6 (55)	Shannon Regan (T1)	04/04 MON 10:00 – 12:00 (MT1)
9	GRADE3	Basic Science (C10, 55)	R3 (55)	Shannon Regan (T1)	05/04 TUE 10:00 – 12:00 (MT2)
10	GRADE3	Geography (C11, 55)	R6 (55)	Shannon Regan (T1)	12/04 TUE 10:00 – 12:00 (MT8)
11	GRADE4	Math2 (C12, 50)	R4 (50)	Elanna Worrel (T2)	07/04 THU 10:00 – 12:00 (MT4)
12	GRADE4	History (C13, 50)	R3 (55)	Elanna Worrel (T2)	12/04 TUE 10:00 – 12:00 (MT8)
13	GRADE4	Applied Science (C14, 50)	R3 (55)	Elanna Worrel (T2)	06/04 WED 10:00 – 12:00 (MT3)
14	GRADE4	Cooking (C15, 50)	R6 (55)	Elanna Worrel (T2)	13/04 WED 10:00 – 12:00 (MT9)
15	GRADE5	Math3 (C16, 53)	R3 (55)	Carly Soanes (T3)	09/04 SAT 10:00 – 12:00 (MT6)
16	GRADE5	Science1 (C17, 53)	R3 (55)	Carly Soanes (T3)	07/04 THU 10:00 – 12:00 (MT4)
17	GRADE5	Civics (C18, 53)	R6 (55)	Carly Soanes (T3)	16/04 SAT 10:00 – 12:00 (MT12)
18	GRADE5	Moral Science (C19, 53)	R6 (55)	Carly Soanes (T3)	14/04 THU 10:00 – 12:00 (MT10)
19	GRADE6	Math4 (C20, 45)	R4 (50)	Spencer Taylor (T8)	09/04 SAT 10:00 – 12:00 (MT6)
20	GRADE6	Physics (C21, 45)	R6 (55)	Spencer Taylor (T8)	15/04 FRI 10:00 – 12:00 (MT11)
21	GRADE6	Economics (C22, 45)	R8 (50)	Spencer Taylor (T8)	08/04 FRI 10:00 – 12:00 (MT5)
22	GRADE6	General Knowledge (C23, 45)	R5 (50)	Spencer Taylor (T8)	04/04 MON 10:00 – 12:00 (MT1)
23	GRADE7	Chemistry (C24, 48)	R6 (55)	Nathan Stout (T9)	06/04 WED 10:00 – 12:00 (MT3)
24	GRADE7	Biology (C25, 48)	R5 (50)	Nathan Stout (T9)	16/04 SAT 10:00 – 12:00 (MT12)
25	GRADE7	Adv Grammar (C26, 48)	R4 (50)	Nathan Stout (T9)	15/04 FRI 10:00 – 12:00 (MT11)
26	GRADE7	Physical Edu (C27, 48)	R4 (50)	Nathan Stout (T9)	04/04 MON 10:00 – 12:00 (MT1)
27	GRADE8	Adv Math (C28, 37)	R4 (50)	Marisa Neves (T7)	12/04 TUE 10:00 – 12:00 (MT8)
28	GRADE8	Adv Science (C29, 37)	R1 (40)	Marisa Neves (T7)	08/04 FRI 10:00 – 12:00 (MT5)
29	GRADE8	Computer Science (C30, 37)	R7 (45)	Marisa Neves (T7)	15/04 FRI 10:00 – 12:00 (MT11)
30	GRADE8	General Knowledge (C31, 37)	R4 (50)	Marisa Neves (T7)	06/04 WED 10:00 – 12:00 (MT3)

The class schedule is prepared with 0 conflicts at generation 801 (30.58 secs) while the exam schedule is prepared at generation 523 (17.82 secs). But the number of generations may vary every time the program is executed as it prints the generations till all the conflicts are removed.

Following pictures are output of generations for small set of sample data [10]: -



```
In [20]: runfile('/Users/mufaddallokhandwala/Downloads/Distribution Management/Proje
Distribution Management/Project/Application Project Codes')
> All Available Data
+------+--------------------+
| dept |      courses       |
+------+--------------------+
| MATH |    [325k, 462k]    |
|  EE  | [319k, 464k, 360C] |
| PHY  |    [303k, 303L]    |
+------+--------------------+
+----+----------+------------------+-----------------------------------------+
| id | course # | max # of students |               instructors               |
+----+----------+------------------+-----------------------------------------+
| C1 |    325k  |        25        |       Dr James Web, Mr Mike Brown       |
| C2 |    319k  |        35        | Dr James Web, Mr Mike Brown, Dr Steve Day |
| C3 |    462k  |        25        |       Dr James Web, Mr Mike Brown       |
| C4 |    464k  |        30        |        Dr Steve Day, Mrs Jane Doe       |
| C5 |    360C  |        35        |              Mrs Jane Doe               |
| C6 |    303k  |        45        |        Dr James Web, Dr Steve Day       |
| C7 |    303L  |        45        |       Mr Mike Brown, Mrs Jane Doe       |
+----+----------+------------------+-----------------------------------------+
+--------+----------------------+
| room # | max seating capacity |
+--------+----------------------+
|   R1   |          25          |
|   R2   |          45          |
|   R3   |          35          |
+--------+----------------------+
+----+--------------+
| id |   instructor |
+----+--------------+
| T1 |  Dr James Web |
| T2 | Mr Mike Brown |
| T3 |  Dr Steve Day |
| T4 |  Mrs Jane Doe |
+----+--------------+
+-----+------------------+
|  id |    Meeting Time  |
+-----+------------------+
| MT1 | MWF 09:00 - 10:00 |
| MT2 | MWF 10:00 - 11:00 |
| MT3 | TTH 09:00 - 10:30 |
| MT4 | TTH 10:30 - 12:00 |
+-----+------------------+
```



Note: The Displayed data and generations for the small data set is attached as for the large amount of data, the tables are not organized well to be displayed.

Experiments

In the above class scheduling model, for each course of a grade, one instructor is assigned i.e., according to the requirement of St. Paul's school. But if some courses are assigned multiple option of instructors, following is the output for it:

Class #	Dept	Course (number, max # of students)	Room (Capacity)	Instructor (id)	Class Time (id)
0	FDK	Basic Math (C1, 32)	R3 (55)	Elanna Worrel (T2)	TTH 12:00 – 01:00 (MT9)
1	FDK	English (C2, 32)	R1 (40)	Shannon Regan (T1)	MWF 01:00 – 02:00 (MT5)
2	Grade 1	Elem Math (C3, 35)	R3 (55)	Elanna Worrel (T2)	MWF 09:00 – 10:00 (MT1)
3	Grade 1	Spoken Eng (C4, 35)	R4 (50)	Shannon Regan (T1)	MWF 10:00 – 11:00 (MT2)
4	Grade 1	Grammar (C5, 35)	R4 (50)	Elanna Worrel (T2)	MWF 12:00 – 01:00 (MT4)
5	Grade 2	Social Science (C6, 45)	R3 (55)	Elanna Worrel (T2)	TTH 11:00 – 12:00 (MT8)
6	Grade 2	Prelim Math (C7, 45)	R6 (55)	Carly Soanes (T3)	TTH 10:00 – 11:00 (MT7)
7	Grade 2	Adv English (C8, 45)	R8 (50)	Carly Soanes (T3)	TTH 09:00 – 10:00 (MT6)
8	Grade 3	Math1 (C9, 55)	R6 (55)	Elanna Worrel (T2)	MWF 11:00 – 12:00 (MT3)
9	Grade 3	Basic Science (C10, 55)	R3 (55)	Julie McLeod (T4)	TTH 10:00 – 11:00 (MT7)
10	Grade 3	Geography (C11, 55)	R6 (55)	Julie McLeod (T4)	MWF 12:00 – 01:00 (MT4)
11	Grade 4	Math2 (C12, 50)	R4 (50)	Joan Marshall (T5)	MWF 11:00 – 12:00 (MT3)
12	Grade 4	History (C13, 50)	R8 (50)	Joan Marshall (T5)	TTH 12:00 – 01:00 (MT9)
13	Grade 4	Applied Science (C14, 50)	R4 (50)	Marisa Neves (T7)	TTH 11:00 – 12:00 (MT8)
14	Grade 4	Cooking (C15, 50)	R6 (55)	Joan Marshall (T5)	MWF 10:00 – 11:00 (MT2)
15	Grade 5	Math3 (C16, 53)	R6 (55)	Tracey Petticrew (T6)	MWF 09:00 – 10:00 (MT1)
16	Grade 5	Science1 (C17, 53)	R6 (55)	Tracey Petticrew (T6)	TTH 11:00 – 12:00 (MT8)
17	Grade 5	Civics (C18, 53)	R3 (55)	Joan Marshall (T5)	TTH 01:00 – 02:00 (MT10)
18	Grade 5	Moral Science (C19, 53)	R3 (55)	Tracey Petticrew (T6)	MWF 10:00 – 11:00 (MT2)
19	Grade 6	Math4 (C20, 45)	R8 (50)	Tracey Petticrew (T6)	MWF 12:00 – 01:00 (MT4)
20	Grade 6	Physics (C21, 45)	R6 (55)	Marisa Neves (T7)	MWF 01:00 – 02:00 (MT5)
21	Grade 6	Economics (C22, 45)	R2 (45)	Marisa Neves (T7)	MWF 10:00 – 11:00 (MT2)
22	Grade 6	General Knowledge (C23, 45)	R9 (45)	Tracey Petticrew (T6)	MWF 11:00 – 12:00 (MT3)
23	Grade 7	Chemistry (C24, 48)	R8 (50)	Spencer Taylor (T8)	MWF 01:00 – 02:00 (MT5)
24	Grade 7	Biology (C25, 48)	R4 (50)	Marisa Neves (T7)	TTH 10:00 – 11:00 (MT7)
25	Grade 7	Adv Grammar (C26, 48)	R4 (50)	Spencer Taylor (T8)	TTH 12:00 – 01:00 (MT9)
26	Grade 7	Physical Edu (C27, 48)	R8 (50)	Spencer Taylor (T8)	TTH 10:00 – 11:00 (MT7)
27	Grade 8	Adv Math (C28, 37)	R5 (50)	Nathan Stout (T9)	MWF 01:00 – 02:00 (MT5)
28	Grade 8	Adv Science (C29, 37)	R5 (50)	Nathan Stout (T9)	MWF 10:00 – 11:00 (MT2)
29	Grade 8	Computer Science (C30, 37)	R6 (55)	Marisa Neves (T7)	TTH 01:00 – 02:00 (MT10)
30	Grade 8	General Knowledge (C31, 37)	R2 (45)	Nathan Stout (T9)	TTH 12:00 – 01:00 (MT9)

This output is obtained at generation 1202 (39.03 secs).

This is not a feasible solution for a school as it may give conflicts within a grade and in the school, every student of a grade takes same schedule of classes. In the above picture, the biology and physical education class of grade 7 occurs at the same time i.e., on Tuesday and Thursday, 10:00 – 11:00 (MT7). But this model can be used for university course scheduling as in the university, students have option to choose various subjects and any two options may have conflict with one another.

In the exam scheduling model, a department can be fixed with an invigilator. this reduces efforts on assigning invigilators for each course and saves a lot of time in execution too.

Class #	Dept	Course (number, max # of students)	Room (Capacity)	Invigilator (id)	Exam Time (id)
0	JK	Basic Math (C1, 32)	R4 (50)	Tracey Petticrew (T6)	05/04 TUE 10:00 - 12:00 (MT2)
1	JK	English (C2, 32)	R8 (50)	Tracey Petticrew (T6)	07/04 THU 10:00 - 12:00 (MT4)
2	GRADE1	Elem Math (C3, 35)	R5 (50)	Julie McLeod (T4)	14/04 THU 10:00 - 12:00 (MT10)
3	GRADE1	Spoken Eng (C4, 35)	R9 (45)	Julie McLeod (T4)	12/04 TUE 10:00 - 12:00 (MT8)
4	GRADE1	Grammar (C5, 35)	R2 (45)	Julie McLeod (T4)	15/04 FRI 10:00 - 12:00 (MT11)
5	GRADE2	Social Science (C6, 45)	R4 (50)	Joan Marshall (T5)	15/04 FRI 10:00 - 12:00 (MT11)
6	GRADE2	Prelim Math (C7, 45)	R9 (45)	Joan Marshall (T5)	08/04 FRI 10:00 - 12:00 (MT5)
7	GRADE2	Adv English (C8, 45)	R8 (50)	Joan Marshall (T5)	06/04 WED 10:00 - 12:00 (MT3)
8	GRADE3	Math1 (C9, 55)	R6 (55)	Shannon Regan (T1)	12/04 TUE 10:00 - 12:00 (MT8)
9	GRADE3	Basic Science (C10, 55)	R3 (55)	Shannon Regan (T1)	13/04 WED 10:00 - 12:00 (MT9)
10	GRADE3	Geography (C11, 55)	R3 (55)	Shannon Regan (T1)	06/04 WED 10:00 - 12:00 (MT3)
11	GRADE4	Math2 (C12, 50)	R6 (55)	Elanna Worrel (T2)	13/04 WED 10:00 - 12:00 (MT9)
12	GRADE4	History (C13, 50)	R4 (50)	Elanna Worrel (T2)	12/04 TUE 10:00 - 12:00 (MT8)
13	GRADE4	Applied Science (C14, 50)	R8 (50)	Elanna Worrel (T2)	14/04 THU 10:00 - 12:00 (MT10)
14	GRADE4	Cooking (C15, 50)	R6 (55)	Elanna Worrel (T2)	09/04 SAT 10:00 - 12:00 (MT6)
15	GRADE5	Math3 (C16, 53)	R3 (55)	Carly Soanes (T3)	14/04 THU 10:00 - 12:00 (MT10)
16	GRADE5	Science1 (C17, 53)	R6 (55)	Carly Soanes (T3)	04/04 MON 10:00 - 12:00 (MT1)
17	GRADE5	Civics (C18, 53)	R6 (55)	Carly Soanes (T3)	08/04 FRI 10:00 - 12:00 (MT5)
18	GRADE5	Moral Science (C19, 53)	R3 (55)	Carly Soanes (T3)	09/04 SAT 10:00 - 12:00 (MT6)
19	GRADE6	Math4 (C20, 45)	R3 (55)	Spencer Taylor (T8)	04/04 MON 10:00 - 12:00 (MT1)
20	GRADE6	Physics (C21, 45)	R8 (50)	Spencer Taylor (T8)	09/04 SAT 10:00 - 12:00 (MT6)
21	GRADE6	Economics (C22, 45)	R2 (45)	Spencer Taylor (T8)	08/04 FRI 10:00 - 12:00 (MT5)
22	GRADE6	General Knowledge (C23, 45)	R3 (55)	Spencer Taylor (T8)	05/04 TUE 10:00 - 12:00 (MT2)
23	GRADE7	Chemistry (C24, 48)	R6 (55)	Nathan Stout (T9)	15/04 FRI 10:00 - 12:00 (MT11)
24	GRADE7	Biology (C25, 48)	R4 (50)	Nathan Stout (T9)	11/04 MON 10:00 - 12:00 (MT7)
25	GRADE7	Adv Grammar (C26, 48)	R8 (50)	Nathan Stout (T9)	05/04 TUE 10:00 - 12:00 (MT2)
26	GRADE7	Physical Edu (C27, 48)	R4 (50)	Nathan Stout (T9)	14/04 THU 10:00 - 12:00 (MT10)
27	GRADE8	Adv Math (C28, 37)	R2 (45)	Marisa Neves (T7)	13/04 WED 10:00 - 12:00 (MT9)
28	GRADE8	Adv Science (C29, 37)	R9 (45)	Marisa Neves (T7)	11/04 MON 10:00 - 12:00 (MT7)
29	GRADE8	Computer Science (C30, 37)	R8 (50)	Marisa Neves (T7)	04/04 MON 10:00 - 12:00 (MT1)
30	GRADE8	General Knowledge (C31, 37)	R2 (45)	Marisa Neves (T7)	14/04 THU 10:00 - 12:00 (MT10)

This output is obtained at generation 124 (4.67 secs).

Conclusions

This project shows a very feasible and fast model for removing conflicts from class and exam schedules of a school. This model can be used by any school around the globe with variations according to the need. Moreover, the models formed while experimenting are also very useful even for universities. The meaning and deep understanding of genetic algorithm is gained from this project.

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