MOBILE SERVICES FOR EXAM AND CLASS SCHEDULING USING GENETIC ALGORITHMS

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Abstract— There are high number of constraints and criteria for allocation classrooms, instructor in timetable prediction for exams and lectures. This paper presents a method of solution and is about with the implementation of a software which employs Genetic Algorithms (GAs) in the quest for an optimal class timetable generator and serves as mobile service. The automated class timetable is developed at the department of Computer Engineering, Abant İzzetBaysal University, Bolu, Turkey as part of Scientific Research Project.

Keywords— Scheduling, Timetabling, Genetic Algorithm, Heuristic Approach.

I. INTRODUCTION

One of the most complex problems in colleges and universities is scheduling and building timetable for exams and lectures.There are still serious problems like generation of high cost time table are occurring while scheduling and these problems are repeating frequently [1]. A. Wren defines timetabling as follows: "Timetabling is the allocation, subject to constraints, of given to objects being placed in space time, in such a way as to satisfy as nearly as possible a set of desirable objectives [2].
This paper presents a method of solution and is about with the implementation of a software which employs Genetic Algorithms (GAs) in the quest for an optimal class timetable generator and serves as mobile service.

II. STRUCTURE OF THE SYSTEM

A lecture timetable problem is concerned with finding the exact time allocation within limited time period of number of events (courses-lectures) and assigning to them number of resources (teachers, students and lecture halls) while satisfying some constraints. The constraints are classified into hard constraints and soft constraints. Hard constraints are those that must be adhered to, while soft constraints can be violated if necessary [3, 4].
The genetic algorithms are search algorithms based on natural selection and genetics of Darwinian paradigm of the evolution of species. The advantage of GA is that they can explore the solution space in multiple directions at once [5].
In this study, there are 24 academic personnel, 6 classrooms and 30 classes are used. Days of week from Monday to Friday are separate to individual blocks. Each day has 5 blocks from beginning 08:00 AM to 17:00 PM given in **Table 1**.

Table1: Time Blocks of Days

DAY	HOUR
MONDAY	08:00 – 10:00
MONDAY	10:00 – 12:00
MONDAY	13:00 – 15:00
MONDAY	15:00 – 17:00
TUESDAY	08:00 – 10:00
TUESDAY	10:00 – 12:00
TUESDAY	13:00 – 15:00
TUESDAY	15:00 – 17:00
WEDNESDAY	08:00 – 10:00
WEDNESDAY	10:00 – 12:00
WEDNESDAY	13:00 – 15:00
WEDNESDAY	15:00 – 17:00
THURSDAY	08:00 – 10:00
THURSDAY	10:00 – 12:00
THURSDAY	13:00 – 15:00
THURSDAY	15:00 – 17:00
FRIDAY	08:00 – 10:00
FRIDAY	10:00 – 12:00
FRIDAY	13:00 – 15:00
FRIDAY	15:00 – 17:00

Problem Conditions:

- Academic personels should not be at the same class at the same time, confliction should be avoided.
- An academic personel should be only at one class at a specific time.
- A class should not be at two different hours and classrooms at the same time.
- Confliction of classes at the same time and same classroom should be avoided.
- Placement to the classrooms should be done regarding to their weights in an ordered manner.
- Preferences of academic personel for a class at a specific time should be considered.

Program Specifications:

- During the execution of the program, fitness value of individuals in populatin for each generation can be seen.
- Best fitness value for each generation is stated.
- Mutation probability of each generation can be changed if needed during execution.

2.1. Chromosome Structure

Each chromosome contains the number academician's genes. Every location at chromosome represents a specific class, classroom and academician. The value of a gene in chromosome is an integer between 0 and (number of days x number of classrooms -1). Each of these values represents an empty time space in classrooms. Determination of which academician will be at which classroom and at which time is done by this way. Since the values of genes at chromosome are different, confliction of two academicians at the same classroom at the same time is prevented.

2.2. Selection

Fitness proportionate selection, also known as roulette wheel selection is used in this study. Reproduction is used for making better strings in a new generation. Individual solutions are selected through fitness-based process, where filter solutions are typically more likely to be selected presented by Goldberg and Corne [6, 7].

2.3. Mutation and Crossover

In this study, a standard mutation operator is used. The probability of a gene's mutation is taken as 0.01. It allow the algorithm to avoid local minima by preventing the population of chromosomes.

Table 2: Crossover Individuals

P1	1 0 1 1 0 0 1	C1	1 0 1 1 1 0 1
P2	0 0 1 0 1 0 0	C2	0 0 1 0 0 0 0
	↑ ↑ ↑ ↑		↑ ↑ ↑ ↑
	1 1 0 1 0 0 1		

One point crossover operator is applied for genes.A crossover operator is used to recombine two strings to get a better string. Once parents have been chosen, breeding itself can then take place. A new creature is produced by selecting, for each gene in the chromosome, an allele from either the mother or the father. The process of combining the genes can be performed in a number of ways. The simplest method of combination is called single point cross-over stated by Davis [8].

The reaction to the constraints is checked by genetic algorithms. GA governance the way of constraints reactions to events. In a case that structure is a part of constraint built fractionally using another process, there can be also another level. This rational level can also checks several parts of GA, restart and reschedule when it needed. This architecture can also be embedded in more complex systems. When an event/action language is necessary for the building of an agent type system, this method can be used for a subset of the events and the actions of the system. This simplifies the design and reduces testing and maintenance times when compared to a deterministic ruleset with many conditions and checks [9].

2.4. Mobile Services

Mobile applications have very large widespread usage among students.Android and iOS version of the application is being developed.

Fig.1. Mobile Application Screen

With these mobile services, a student can see his class schedule. When he clicks the course code, he can see the course details such as instructor and course definition. Timetable is shown in a weekly day format.

III. RESULTS AND CONCLUSION

Timetabling and scheduling problem is being though problem that it is would take more than just implementation of any one rule. It may only be

solved when the constraints and partitioning is clearly defined and simplified. This study is intended to achieve to reduce manual effort being used to create and develop university timetables. The timetable automation system currently is a conceptual study still in development progress as part of scientific research project in Abant Izzet Baysal University.

It is a comparatively simple and convenient way to use genetic algorithms to achieve a course timetabling problem. With a quick convergence speed, time period has a relatively uniform distribution.

As the population gets larger, it will take more time in between each selection for die out so lower performance chromosomes have more chance to increase. It would be expected to get better performance on a parallel machine for larger populations. ~

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