

Application of (Genetic – Tabu Search) Algorithms for Subsequent Lease Schedule

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Abstract. Submission of information relating to college scheduling in college is very important and is usually done on a semester by the academic section. One of these universities is Universitas Komputer Indonesia (Unikom) which became object of case study. In determining the scheduling of many aspects that must be considered include the components of the course, lecturer, class, space, and time. All of these components are considered so that the schedule of lectures that will be formed does not happen clashing with each other. In addition, scheduling problems will be more complex if there are many additional terms or constraints. In this study aims to be able to make lecture class scheduling replacement with a combination of genetic algorithms and tabuo search. The first step is done by separating the hard and soft constraints that exist in the lecture problem, and then the best individual search is done by cross-over or cross-breeding process to produce new individual and perform the process of mutation or exchange of individual position in order to produce the best fitness value of the previous individual. The advantage of using a tabu search algorithm allows for the absence of duplicate individual processes. Therefore, the combination of these two algorithms is capable of producing good scheduling and the clashing rate of a schedule can be handled.

1. Introduction

Scheduling [1-5] is a difficult issue with many aspects to be aware of. Aspects in determining scheduling include aspects of lecturer, class, space, and time. With a combination of genetic algorithms and tabu search can help solve the problem of scheduling. In this case, a combination of genetic algorithms and tabu search can make replacement schedules with different times and rooms for a limited time [6]. The replacement time in this case is 1 week from the schedule to be replaced. However, in this case, the lecturer's replacement scheduling is not replaced by a different lecturer.

Many studies have reported how difficult it is to make scheduling as it has been widely studied as in university [5, 7], machine scheduling [1, 6, 8, 9], or other scheduling [2-4, 8, 10-15]. Difficulty in scheduling [8] is when plotting the allocation of several subjects into a set of timeslots and lecturers with the existing restrictions. In addition, the solutions obtained may not be satisfactory in some aspects. The impact of making a manual lecture is when the prerequisites change, then the entire work becomes unusable. For example [10] Sonawane and Ragha show that the scheduling problem included in the combinatorial optimization problem [10, 11] is solved by finding the optimal solution for each instance.

In this study aims to be able to make lecture class scheduling replacement with a combination of genetic algorithms and tabuo search.



2. Experimental method

Chromosome models [9] are applied to analyze based on the aspects that exist on the scheduling. Then the chromosome models are compared with the literature, such as [10] and [11]. In summary as in the previous literature and the metaheuristics [14] present in the genetic algorithm are used for the selection of each aspect to be related to the constraints of the scheduling requirements. While the metaheuristics [12] that exist on the tabu search algorithm is used when each individual swap the best individuals. The results of computation with both genetic algorithms and tabu search illustrate that the resulting chromosome will become the replacement scheduling that is by using the best individual approach that has been selected [10, 11].

3. Results and discussion

3.1. Research flow

Here is the presentation of this research design (See Figure 1):

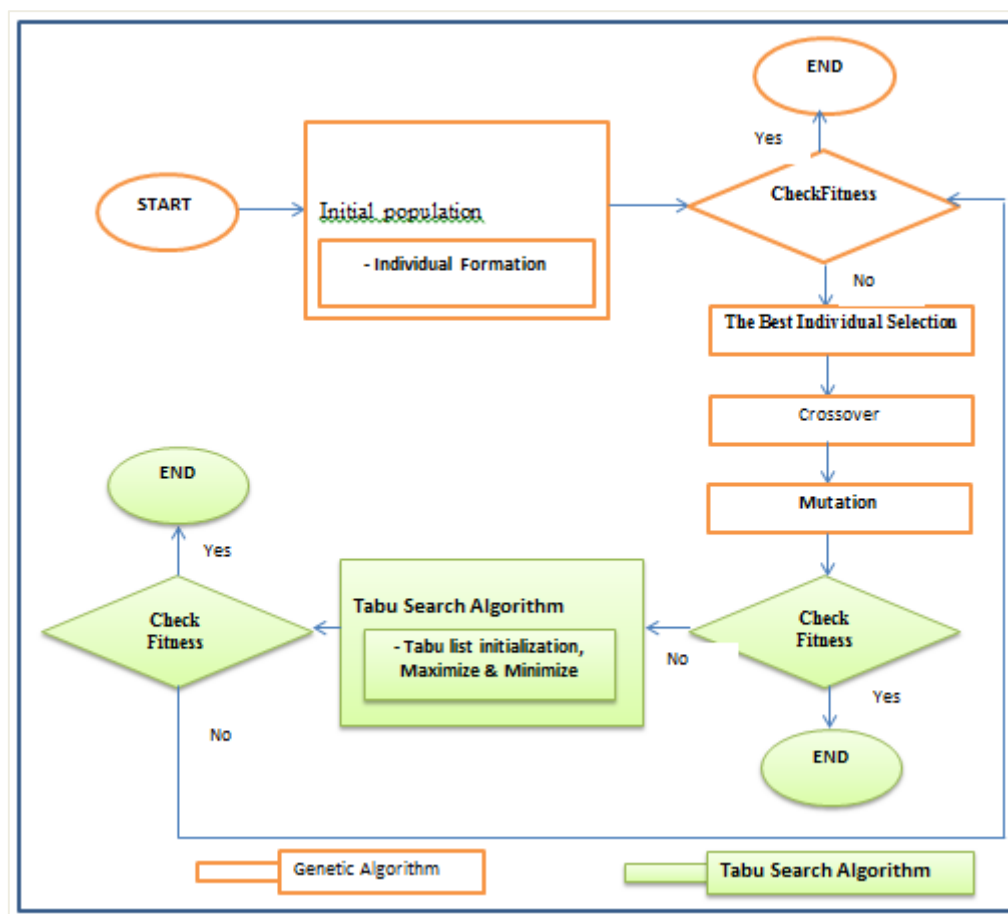


Figure 1. Research flow.

Figure 1 is a flow chart of genetic algorithms and tabu search. Starts with the initialization of the population based on the size or number of individuals that have been determined. Individual formation is determined according to random lecture time, random lecture days, random lecture rooms, and lecturers according to the class they are taught. Then checking based on fitness values based on hard constraints and soft constraints that have been determined as the initial limitation of scheduling. Then the best individual selection resulting from the process of comparison between individuals based on soft constraints that successfully met. If the selected chromosome [7] is not suitable then crossover and

mutation to determine the new individual. To save on searching for new individuals, the search tab algorithm serves to store the results of the best individual before so there is no duplicate search [6] between individuals. Thus, the best individuals produced from the two algorithms are produced.

3.2. Research model

Scheduling schedules at the Universitas Komputer Indonesia include several components, including lecturer modules, student modules, and module lecture rooms. In the case of scheduling it also uses data relating to the scheduling system of lectures from the academic year 2015/2016 even semester on the Communication Studies program at the Universitas Komputer Indonesia. Here table 1 is the data entity used: (See Table 1).

Table 1. Research data.

Number Of Lecturers Teaching	47
Courses	38
Lecture Session	138
Days Of Scheduling	6

3.3. Genetic algorithm and tabu search algorithm implementation

Each of the best individual chromosomes can be defined in terms of the $m \times n$ matrix [10], where m is the number of days scheduled and n is the number of time slots available. With the number of available slots is 14 time range. The time slot starts at 07.00 WIB until 17.30 WIB. With the provision of 1 time slot of about 45 minutes. Here table 2 is a representation of the chromosome results that exist: (see Table 2).

Table 2. Chromosom representation.

Time Slot	Days					
	Mon	Tue	Wed	Thu	Fri	Sat
1						
...						
n						

Each representation is defined by the name of the lecturer, the room, the course code. In 1 slot will produce some individuals, because the available space is 12. So with the selection process [7, 9] from the best individuals will produce some results. The results of the best individuals will certainly be stored into the tabu list [13, 15], so that the best individual results that have been selected are not lost and no duplication in the individual search process.

3.4. Comparison of result with previous research

The alternate course scheduling can give results if the problem is used by only one algorithm [1-3], then the results of its performance is not as good as when using a combination of two genetic algorithms and tabu search [10, 11]. Both of these algorithms support each other in the individual search process of crossover [7, 9] and mutation [7, 9]. Therefore, since the algorithm used is a combination of genetic algorithm and tabu search, it can schedule substitute lectures in quiet weeks as much as possible with

the accomplishment of all aspects [10] involved with the constraints of both soft constraints and hard constraints that have been determined.

4. Conclusion

Genetic algorithms and tabu search are able to provide optimal solutions with completed combinatorial problems. The applications of these two functions can be used to create different applications with different times and the same time. Lecture scheduling is usually done in the first semester, but at this stage lecture scheduling is done with the existing stage. The problems that exist will be more difficult because between lecturers, space, time, and students need to be analyzed by what is in the genetic algorithm. That in itself, while the tabu search algorithm also has a list of tabus that fit as the best individuals the result of a settlement with no data missing or duplicate.

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