Use of Genetic Algorithms in Reactive Scheduling for Course Timetable Adjustments

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Abstract

Use of genetic algorithms has been shown effective in providing optimal schedules for course timetabling in a classroom setting. In this presentation, we investigate the application of genetic algorithms for schedule repair in reactive scheduling once initial training schedules have been adopted. In particular, we look at two types of schedule perturbations – surges and encroachments – that are typical of dynamic timetabling changes encountered in military training environments (in our case, the U.S. Navy). Surges represent unanticipated midcourse changes in student load, usually increases in student input, that can affect the number of sessions of a course that must be offered, the number of instructors that must be assigned or reassigned, and the student-instructor ratio typically set as a constraint in timetabling. Encroachments represent carryover from one fiscal year to the next in numbers of students who must repeat classes or who change class assignments based on previous year's performance (affecting the same types of timetabling constraints as listed above for surges).

We describe the performance of a genetic algorithm for class timetabling compared with a rule-based heuristic for optimizing class schedules for a given fiscal year plan (student input, instructor availability, and resource allocation). We assess the feasibility of using the genetic algorithm for schedule repair given an initial baseline schedule that is perturbed by surges, encroachments, or a combination of the two types.

We measure the sensitivity of the genetic algorithm to dynamic changes in resource availability typified by the surge and encroachment phenomena. We show that, for reactive timetabling, the genetic algorithm adapts well to a variety of changes in student load once an optimal starting schedule has been determined by providing a family of feasible alternative timetables quickly. Finally, we discuss potential applications of the reactive scheduling and timetabling method in response to other dynamic changes in types of resources (such as instructors or equipment) originally allocated in fixed schedules.

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