

## Case Study: University Lecture Timetabling Without Pre-registration Data

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### Abstract

This paper focuses on university lecture timetabling at Faculty of Computer Science and Information Technology (FCSIT), Universiti Malaysia Sarawak (UNIMAS). In this case study, course pre-registration is not a practice. Therefore, there is no precise estimation on course registration and causes faculty's experienced planner to arrange the timetable by *curriculum-based*. However, *curriculum-based* timetable will create a lot of changes after the semester has started. Besides, students are increasing consistently from semester to semester although the number of venue resources remains the same. Due to all these issues, the objective of this study is to develop a computerised algorithm to minimise the clashes issue and increase venue utilisation. Data pre-processing algorithm was carried out to predict course registration. Then, a two-stage heuristic method is proposed to solve the faculty course timetabling problem by *student-based*. The simulator was tested with three real semesters' data from FCSIT. All the timetable solutions generated by the simulator are no-clash solution with minimum unallocated courses. In term of venue utilisation, two-stage heuristic solution manages to allocate exactly with the demand up to 98% but real solution can perform best at only 75%.

**Key words:** lecture timetabling; heuristic; post-enrolment

### Introduction

University course timetabling is an important practical problem that is regularly needed to be solved in institutions [1]. Degree of difficulty for course timetabling increases enormously with an increasing number of students and courses [2]. It is tough enough to produce a feasible solution, not to mention a solution that satisfies people who rely on it [3].

Course timetabling is complex with uncertainties as course requests of students are unknown at the point in time when the timetable is created [4]. The number of students who participate in each course which indicates the course size for suitable venue allocation remains unknown for timetabling. Moreover, the problem becomes much more complex when it involves large number of students because the individual freedom of the students to choose courses grows along [5].

During the second International Timetabling Competition (ITC) in the year 2007, the competition proposed to split university course timetabling problem into two formulations, namely *curriculum-based* [6] and *post-enrolment* [7]. Since then, these two formulations have received more attention than others among academic researchers. The difference between two formulations is that the constraints and objectives in

*curriculum-based* course timetabling are based on the concept of *curriculum*, which is a set of courses particularly for a group of students (usually grouped by intake and programme). On the other hand, the constraints and objectives are based on the course registration for *post-enrolment* course timetabling (also known as *student-based* course timetabling).

### Case Study

The timetabling problem as described in this study is a real problem identified at Faculty of Computer Science and Information Technology (FCSIT), Universiti Malaysia Sarawak (UNIMAS). FCSIT offers a total of five undergraduate programmes. All five programmes are four-year programmes with a total of seven semesters on campus and one semester of industrial training. FCSIT has designed different course plans for each programme with a list of courses to enrol for each semester.

Similar to the policy implemented in most universities, student has to pass all courses in order to graduate. Some advanced courses require students to pass certain prerequisite courses before they can enrol them. These situations cause that particular group of students to have a different list of course registrations than other students from the same batch and programme. Students who failed a course in the previous semester and repeat the course in current semester are called "repeaters". For FCSIT course timetabling problem, "repeaters" are defined as students with course registrations which are not tally with the course plan. Thus in this case, "repeaters" include student who fail and repeat a course or student who enrol courses without following the course plan.

Generally, universities or institutions solve their course timetable either through curriculum-based timetabling formulation or student-based post-enrolment timetabling formulation. Previous solving method in FCSIT is a manual method developed by experienced timetable planners. Starting from semester 1 (2014/2015), the faculty utilised a commercial timetabling software to assist the timetabling process. Both timetabling means are based on list of courses in the course plan to design a curriculum-based timetabling.

There are several issues with the current FCSIT course timetabling problem:

- Inconsideration of "repeaters" in curriculum-based timetabling
- Inconsideration of "critical students/graduating student"
- No course registration data for post-enrolment timetabling
- Insufficient large capacity venues

The number of students' intake for FCSIT has increased tremendously in the last 5 years (as shown in Figure 3.1). Existing venue resources at the faculty are more on smaller size