

## Abstract

This study addresses the University Course Timetabling Problem (UCTP) which is a typical problem encountered in most academic institutions. UCTP is a hybrid optimization problem in the class of Np-hard complete constraint optimization problem that consists of scheduling lectures, students and classrooms at the beginning of each academic period of the university. The existent formulations include particular requirements from different educational levels and institutions, as in our case. we focus on the university course timetabling problem with the assignment of Teachers/students-course-time slot for Technical University of Mombasa The courses should be scheduled in a way that the empty timeslots of both teacher and student to be minimized and both teachers and students are satisfied. In this work, we propose an Optimized Timetabling System Software for Technical University of Mombasa (OTGSS-TUM)

## Introduction and Background Information

The goal of the university courses timetabling problem (UCTP) is to find a method to allocate whole events to a fix predefined timeslots and rooms, where all constraints within the problem must be satisfied. Before we continue further, we first introduce the basic definitions to the reader.

- I. Event: a scheduled activity, like: teacher, course, and student.
- II. Timeslot: a time interval in which each event is scheduled, like: weekly timeslot such as there are 4 time slots in a day (7-10am, 10am-1pm, 2pm-5pm, 5pm-8pm).
- III. Resource: resources are used by events, like: equipment's, rooms, timeslots and etc.
- IV. Constraint: a constraint is a restriction in scheduling of events, categorized into two types of hard and soft constraints, like the capacity of classrooms, given timeslot and etc.
- V. People: people include lecturers, students and are a part of events.
- VI. Conflict: the confliction of two events with each other, like: scheduling of more than one teacher for one classroom at the same time.
- VII. Class: A set of students that are grouped and taught different courses.
- VIII. Course: A unit of teaching that typically lasts one academic term/semester, is led by one or more instructors (teachers or professors), and one class might have at least 7 courses.

Events include students, teachers and courses where resources encompass the facilities and equipment's of classrooms such as theoretical and practical rooms. Also timeslots include two

main components, namely daily and weekly timeslots which it varies from one institution to another. However, each classroom also has its own components including audio-visual equipment's (video projector), number of chairs necessary for courses allocated to those classrooms (the capacity of theory and practical rooms), number of blackboards and whiteboards related to each theory and practice classroom and etc. UCTTP is a hybrid optimization problem in the class of NP-hard problems occur at the beginning of each semester of universities and includes the allocation of events (courses, teachers and students) to a number of fixed timeslots and rooms. This problem must satisfy constraints during allocation of events to resources, so that the possible timetables are obtained after full satisfaction of whole constraints to increase and promote the quality of possible generated timetables as necessary (Asmuni, 2008; Obit, 2010; Redl, 2004). There are some problems and complexities in UCTP process; firstly, the scheduling process is an NP-complete problem, then it could not be solved in the polynomial time classes because of the exponential growth of this problem and the existence of some variations in the fast growth of students' numbers in this problem, so we must seek heuristic approaches. Secondly, the number of constraints in this problem differs from one institution to another. Therefore, the main aim of the problem is that all of the courses should be scheduled in a way that the empty timeslots of both teacher and student is minimized and are all satisfied.