Partitioning Students into Cohorts during COVID-19

Richard Hoshino[1] and Irene Fabris[2]

[1] Northeastern University, Vancouver, British Columbia, Canada
r.hoshino@northeastern.edu
[2] Quest University Canada, Squamish, British Columbia, Canada
irene.fabris@questu.ca

Abstract. The COVID-19 pandemic has forced educational institutions to make significant changes to safeguard the health and safety of their students and teachers. One of the most effective measures to reduce virus transmission is partitioning students into discrete cohorts.

In primary and middle schools, it is easy to create these cohorts (also known as "learning groups"), since students in each grade take the same set of required courses. However, in high schools, where there is much diversity in course preferences among individual students, it is extremely challenging to optimally partition students into cohorts to ensure that every section of a course only contains students from a single cohort.

In this paper, we define the Student Cohort Partitioning Problem, where our goal is to optimally assign cohorts to students and course sections, to maximize students being enrolled in their desired courses. We solve this problem by modeling it as an integer linear program, and apply our model to generate the Master Timetable for a Canadian all-boys high school, successfully enrolling students in 87% of their desired courses, including 100% of their required courses. We conclude the paper by explaining how our model can benefit all educational institutions that need to create optimal student cohorts when designing their annual timetable.

Keywords: School Timetabling · Integer Programming · Optimization.

1 Introduction

The COVID-19 virus has led to the worst global pandemic in over a hundred years. Since the first case was identified in December 2019, the disease has spread worldwide, leading to 131 million cases and 2.8 million deaths as of April 1, 2021 [13]. In addition to destabilizing world economies, the pandemic has also had a profound impact on education, with nearly 87% of the world's students, i.e., 1.5 billion learners in over 170 countries, affected by school closures [23]. The switch to Remote Learning has been overwhelming for many students who live in conditions that are not suitable for home study, and has further exacerbated social inequalities such as access to technology [14] [20] .