VIỆN CÔNG NGHỆ THÔNG TIN ★ TRƯỜNG ĐẠI HỌC CÔNG NGHỆ THÔNG TIN VÀ TRUYỀN THÔNG

HỘI THẢO QUỐC GIA LẦN THỨ XXIV

THÁI NGUYÊN, NGÀY 13-14 THÁNG 12 NĂM 2021

MỘT SỐ VẤN ĐỀ CHỌN LỌC CỦA CÔNG NGHỆ THÔNG TIN VÀ TRUYỀN THÔNG

Chủ đề: Trí tuệ nhân tạo trong chuyển đổi số

TOÀN VĂN CÁC BÁO CÁO

NHÀ XUẤT BẢN KHOA HỌC VÀ KỸ THUẬT

VIỆN CÔNG NGHỆ THÔNG TIN - TRƯỜNG ĐẠI HỌC CÔNG NGHỆ THÔNG TIN VÀ TRUYỀN THÔNG

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MỤC LỤC

An efficient heuristics algorithm for solving the Student-Project Allocation with Preferences over Projects

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Abstract—In this study, we propose a heuristic search algorithm to solve the MAX-SPA-P problem of large sizes. Our main idea is to start from an empty matching, we find a maximum stable matching based on Gale-Shapely's idea[1] by assigning active students to projects which they prefer most on their rank lists. If a project or lecturer is over-subscribed, we define a heuristic function for selecting a suitable student who is removed from current matching. This assigning process will stop when all students are inactive. Experimental results demonstrate that our algorithm is more efficient than another recent SPA-P-MCH algorithm [2] in terms of execution time and solution quality.

Keywords-Student-Project Allocation problem, Heuristic Search, Perfect Matching, MAX-SPA-P.

I. INTRODUCTION

Assigning projects to students under certain criteria is one of the essential problems at universities around the world. This problem is known as the *Student-Project Allocation* (SPA) problem [3] which is an extension of the Stable Marriage problem [1]. The purpose of the SPA problem is to find a matching between students and projects satisfying all the criteria for the projects and lecturers. Manlove and O'Malley [4] proposed a variant of SPA, called a *Student-Project Allocation with Preferences over Projects* (SPA-P) in which lecturers and students rank the projects in strict order of preference. They proved that the stable matchings may have different sizes. The MAX-SPA-P problem finds a matching that is not only stable but also has a maximum size. The MAX-SPA-P problem has been applied to solve the assignment problem at universities such

Recently, several efficient approximation algorithms have been proposed for solving the MAX-SPA-P problem. Manlove and O'Malley [4] extended the Gale-Shapley algorithm [1] to find an 2-approximation algorithm, namely SPA-P-APPROX. Iwama et al. [8] proposed an 3/2-approximation algorithm, named SPA-P-APPROX-PROMOTION, based on Király's idea [9]. Manlove et al. [10] also modeled SPA-P problem as Integer Programming. In 2020, Viet et al. [2] proposed a heuristics algorithm, named SPA-P-MCH, based on the min-conflicts algorithm [11]. Their experiments showed that their algorithm outperforms the SPA-P-APPROX [4] in both aspects of execution time and solution quality.

In this paper, we propose a heuristics algorithm to find a maximum stable matching of SPA-P problem of large sizes based on Gale-Shapely's idea [1]. Experimental results show that our algorithm is much efficient than the SPA-P-MCH algorithm [2] in terms of execution time and solution quality.

The rest of this paper is organized as follows. Section II presents preliminaries of SPA-P, Section III describes our proposed algorithm, Section IV discusses our experimental results, and Section V concludes our work.

II. DEFINITION OF SPA-P

An instance SPA-P consists of a set $S = \{s_1, s_2, \cdots, s_n\}$ of *students*, a set $\mathcal{P} = $