

UNIVERSITI TEKNOLOGI MARA

**MODIFIED HUNGARIAN METHOD
BASED BINARY INTEGER GOAL
PROGRAMMING MODEL FOR
OPTIMUM ALLOCATION AND
ASSIGNMENT LECTURERS TO
COURSES CONSIDERING AREAS
OF MATHEMATICS**

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ABSTRACT

The assignment problem involves determining optimal assignments when assigning n subjects to m jobs under varying degrees of efficiencies. Specifically, lecturer-to-course assignment in Mathematics is a complex problem as lecturers possess different competency, preferences, level of experience and expertise. Existing studies have never considered integrating the optimization of preferences, competency and lecturers' training costs for upskilling as multiple objective functions when solving lecturers to courses allocation and assignment problem. In addition, incorporating the areas of Mathematics (AOM) and analyzing the training needs for Mathematics lecturers upskilling were lacking in these past studies. Thus, this study proposes the enhanced Modified Hungarian Method (MHM) model based mathematical programming model to identify lecturers' AOM and clustering the courses involved accordingly. Subsequently, multi-objective Binary Integer Goal Programming (BIGP) models with three variants were formulated, where the first one is CT-BIGP model (Variant 1 or V1) that maximizes the total competency scores of lecturers for course assigned and minimizes the total training costs for lecturers' upskilling. Next is CCPT-BIGP (V2) which maximizes the combined competency and preference scores of lecturers for the assigned courses and minimizes total training costs for lecturers' upskilling. Meanwhile, the third variant is CPT-BIGP (V3) which maximizes the competency scores of lecturers for the assigned courses, maximizes the preference scores of lecturers for the courses assigned and minimizes the total training costs for lecturers' upskilling, in this order. Data were collected through surveys and interviews with Mathematics lecturers and academic administrators at Universiti Teknologi MARA (UiTM) Shah Alam and UiTM Seremban. The BIGP models were solved using a preemptive goal programming approach via MATLAB intlinprog Solver. Results revealed that the CCPT-BIGP (V2) model was most effective for UiTM Shah Alam, while CPT-BIGP (V3) model performed best for UiTM Seremban. The findings offer optimal workload distribution strategies, identify lecturers requiring upskilling and contribute to improving teaching quality and lecturer well-being within Mathematics departments.

Keywords: Lecturer-to-course assignment; Modified Hungarian Method; Binary Integer Goal Programming; competency; preferences.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter presents the key components of the study. It begins by describing the background of the study. This is followed by the discussion on the motivation for conducting this study which focuses on the allocation and assignment of lecturers to courses considering areas of Mathematics (AOM) towards enhancing the quality, efficiency and productivity in teaching and delivering knowledge to the students. The problem statement is presented along with the research questions and research objectives of the study. On top of that, the scope and limitations are explained next. Besides that, this chapter also presents the novelty of the study and its significance in terms of the study's contribution to academics, society, industry and the government.

1.2 Research Background

Headlines such as "Times Higher Education Awards," "Rankings of Award-Winning Asia Pacific University (APU)," and "Ranking of Top Private Universities" have become prevalent, reflecting the increasing focus of universities on achieving top rankings and recognition. To maintain and enhance the best quality and productivity of the university, the allocation and assignment of lecturers to courses considering AOM should be considered to achieve the goal and standard of the university. A lecturer is defined as a person who gives lectures, particularly as a profession or in connection with teaching activities (Collins Dictionary, 2024c). A study from Nurwahidin (2018) stated that lecturers are intellectuals whose noble mission is to educate students for them to achieve a bachelor's, master's or doctoral degree. A lecturer plays an important role in various aspects to produce a quality graduate not just in the form of studies but in other aspects too such as morale, disciplines and skills. Mailool et al. (2020) corroborated this assertion, stating that in the 21st century, every prospective worker must prepare and fulfill the skill standards demanded by the working sector to compete in the more difficult labor recruiting. Hence, lecturers contribute a huge impact on the