

**AN ADAPTIVE STABLE MATCHING ALGORITHM FOR
THE ADVISER-ADVISEE ASSIGNMENT PROBLEM**



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**AN ADAPTIVE STABLE MATCHING ALGORITHM FOR
THE ADVISER-ADVISEE ASSIGNMENT PROBLEM**

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ABSTRACT

This study provides a methodology for the development of an adaptive stable matching algorithm for assigning advisers to advisees, who are conducting their thesis or senior projects, as applied to the Computer Studies Division of the Ateneo de Davao University. Two constraints were effectively integrated into the stable matching algorithm: ranked order list of preferences (by field of interest) and maximum capacity for the advisers. Stability is measured by the ability of the matching algorithm to match all advisees to at least one adviser. The one-to-many (advisee-advisees) stable matching algorithm presented in this study was based on the Gale Shapley Algorithm and was modified using the two constraints mentioned above.

Keywords:

Gale-Shapley Algorithm, Stable Matching, Assignment Problem

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

In universities, advisees are required to conduct an independent study that focuses on one particular topic in which their learnings in past are to be applied. In most cases, an adviser is assigned to an advisee or group of advisees. He or she is to assist the advisees with the work, provide them advice and guide them in the steps that they take. The process of designating an adviser to every advisee or group of advisees is, most often, done randomly although the advisees may be asked to choose an adviser. However, the problem happens when a large number of advisees prefer a certain adviser and the latter may not be able to attend to every one of them. Usually, the solution is to randomly assign an adviser to advisees. When random designation is done, both adviser and advisee may be discontented with the match and they are not able to work together. The discontentment could be because the adviser assigned to the advisee does not have that much interest in the topic that the latter has chosen or either the former has very little background on the topic, or it is just not his or her specialty or field of interest. As a result, the advisees are left with no choice but to seek help from other faculty members who have more knowledge and interest about the topic, taking some of their time which is supposed to be spent to the others who have already been

assigned to these particular advisers. Because of this, there is a need to build a new stable matching for the adviser-advisee assignment problem; not only to decrease the dissatisfaction of the two towards the other but to match them with real basis, such as the field of interest and adviser's capacity.

The problem of designating an adviser to advisees is more likely identical to the Stable Marriage Problem (SMP), as it also searches for the stable matching. The existing solution is an algorithm developed by Gale and Shapley, the Gale-Shapley Algorithm. Though the matching produces a stable match, the matching is between two elements exclusively, i.e. one male to one female and both parties should have equal number of elements. However, to solve the adviser-advisee assignment problem, the proponents suppose that the Gale-Shapley Algorithm can be extended or modified to match the needs of the given problem.

1.2 Statement of the Problem

The research sought to answer the general problem: How can a stable matching algorithm be developed to solve the adviser-advisee assignment problem?

Specifically, it sought to answer the following questions:

- How can the adviser-advisee assignment problem be modeled?
- What algorithm can be used to implement such model?

- How can the constraints of fields of interest and adviser's capacity be integrated into that algorithm?
- Can a matching algorithm be modified to produce stable matches given the constraints?
- How can the algorithm be tested and evaluated?

1.3 Objectives of the Study

The general objective of the study was to develop and implement a stable matching algorithm for the adviser-advisee assignment problem.

The specific objectives are:

- To describe and model the adviser-advisee assignment problem
- To identify an existing matching algorithm that can be used to solve the adviser-advisee assignment problem
- To modify the algorithm to integrate the constraints: fields of interest and adviser capacity
- To test and evaluate the algorithm

1.4 Significance of the Study

This study is significant for both advisees and advisers. It could produce a stable matching between the advisers and the advisers. Since dissertation studies are a requirement in most courses in universities today, maximizing the satisfaction not only of the advisees but that of the

adviser as well will eventually be a necessary step. If advisers are assigned to advisees in such a way that both the parties share a common interest in the topic chosen, if it exists, dissatisfaction is minimized and the performance of the team will be better since the satisfaction of both parties is high. Both parties could interact with each other for they are related in terms of the field of interests. They could share to each other their common information and ideas about the topic. The adviser could entertain the questions of the advisees and share with them their knowledge and insights and could give enough educational advises that the advisees needed the most. The advisees would also get to solve most the problems they encounter faster.

1.5 Scope and Limitations

The study focused on the development of an algorithm which would produce a stable matching of adviser and advisee based on their fields of interest and adviser capacity. The algorithm was based on the existing Gale-Shapley algorithm. It was implemented in Java using the Computer Studies Division Methods of Research class as test data.

1.6 Definition of Terms

1.6.1 Stable Matching

Matching is a mapping of elements from one set of elements to another set of elements. Stable matching is a solution to produce a stable match between two sets of elements. Stable in a sense that all the advisers are matched to at least one advisee, and both parties are matched based on their field of interest.

1.6.2 Graph

An abstract representation of a set of objects or vertices where some pairs are connected through links or edges. In the paper, the vertices are the advisers and the advisees. The edge is when both are matched inside the hashMap.

1.6.3 Bipartite Graph

Set of vertices in a graph in which no pair of vertices are connected to each other by an edge. In the study, the elements shall be presented in a bipartite graph: two sets of vertices (the advisers and the advisees) connected by an edge.

1.6.4 Adviser

The adviser, a member of a faculty, assigned to its respective advisee to give educational advises.

1.6.5 Advisee

An advisee is a group of students that is assigned to an adviser for educational purposes.

1.6.6 Assignment Problem

The assignment problem is the case where both elements (e.g. advisers and advisees) are mismatched.

1.6.7 Adviser Capacity

The capacity of an adviser is the number of advisees that he/she can handle. The capacity can be fixed or variable.

1.6.8 Fields of interest

These are topic fields in a list that which both the advisers and the advisees are interested of.