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AN INTEGRATED FUZZY APPROACH TO SOLVING MULTI-CRITERIA DECISION MAKING PROBLEMS

NOR HANIMAH KAMIS

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CANDIDATE'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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Name of Candidate : Nor Hanimah Kamis
Candidate's ID No. : 2007240204
Programme : CS780
Faculty : Faculty of Computer & Mathematical Sciences
Thesis Title : An Integrated Fuzzy Approach to Solving
Multi-criteria Decision Making Problems.

Signature of Candidate : *Nor Hanimah*
Date : 10 December 2009

ABSTRACT

Multi-criteria decision making (MCDM) method is a technique where alternatives or options are assessed based on a set of criteria. Criteria weights determination and ranking of alternatives are two important aspects in solving MCDM problems. The evaluation of criteria importance by decision makers and performance rating towards alternatives often involve subjective preferences, which are normally vague and imprecise. This study proposed an improvised algorithm in criteria weights determination based on consistent fuzzy preference relations (CFPR). CFPR requires only $(n-1)$ pair-wise comparisons from a given n criteria as compared to other some existing pair-wise-based comparison approaches. We improvised Herrera-Viedma's et. al (2004) algorithm by introducing fuzzy numbers to represent input values for the entries of decision matrix. However, application of fuzzy numbers in representing importance of criteria requires tedious calculation. Therefore, centroid-index formula (Chen & Chen, 2000, 2003) was utilized in order to transform fuzzy numbers into crisp values, which indirectly gives lesser computation. The generalized Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method by Wang and Lee (2007) with some modification on criteria weights determination procedure using our proposed algorithm was employed in ranking the alternatives. An example problem on new staff selection in the Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA (UiTM) Malaysia is given to demonstrate the computational parts of this proposed model. This model can be used as an alternative tool in solving MCDM problems.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

This chapter provides a general overview of decision making, multi-criteria decision making (MCDM) and elaboration of some conventional MCDM approaches and fuzzy-based decision making methods.

1. 1 Decision Making

Decision making can be defined as a process of specifying a problem, identifying and evaluating criteria or alternatives and selecting a preferred alternative among possible ones (Chen, 2005). Starr and Zeleny (1977) defined common terminologies in decision making as follows:

a) Alternatives – a set of objects, products, actions or strategies.

b) Attributes – each alternative is defined by a set of characteristic.

c) Objectives – a collection of attributes selected by the decision maker(s) to be used as a goal.

d) Weights – the relative importance of each attribute or the relative importance of an instance of an attribute.

Most common decision making methods can be categorized as multiple objective decision making (MODM), multi-attribute decision making