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Title : Ranking Trapezoidal Fuzzy Numbers Based On Set Theoretic Indices With Hurwicz Criterion

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Ranking of fuzzy numbers (FNs) is an important procedure for many applications in fuzzy theory, in particular, decision-making. Various methods of ranking fuzzy numbers (RFNs) have been developed but no method can rank overlapped trapezoidal fuzzy numbers (TrFNs) satisfactorily in all cases and situations. Some methods produce non-discriminate and non-intuitive results, limited to normal TrFNs and only consider neutral decision makers' perspective. Some methods also have complex computation and cannot discriminate the ranking of TrFNs having the same mode and symmetric spread. The objective of this thesis is to develop new ranking indices (NRI) based on Sokal & Sneath, Dice and Ochiai set theoretic similarity measure (STSM) indices, and formulate the procedures for ranking overlapped TrFNs where the overlapped TrFNs are classified into seven main types. Eight phases are involved in the development of the NRI which consist of determining the fuzzy maximum (FMax), fuzzy minimum (FMin), evidences, total evidences, pair wise ranking, transitivity of relation and ranking of *n* TrFNs. The TrFNs involved are taken from the benchmark cases in the literature. The usage of second function principle in determining the FMax and FMin enables the NRI to rank non-normal TrFNs and this has overcome the limitations in some of the previous ranking indices which can only rank normal TrFNs. This study investigates on the development of the NRI and based on that, two observations and three algorithms are created. The determination of ranking results of the NRI involved three stages which are by comparing the values of total evidences in the development phase, by using the observations and by using the algorithms. The observations had rendered the NRI as advantageous method in RFNs since the ranking results can be obtained for all with , and represent pessimistic, neutral and optimistic decision makers' perspective respectively. Based on the algorithms, the ranking of each type of overlapped TrFNs can be determined merely by the point wise operations. This study evaluates the performance of NRI in terms of rationality, consistency and robustness criteria. The NRI satisfies five axioms on the rationality properties which is similar with some of the previous ranking indices. Most of the ranking results for NRI which are independent with decision makers' perspective have consistent ranking with the previous methods. The ranking results for some TrFNs with included TrFNs having the same mode and symmetric spread (which cannot be discriminated by a number of the previous methods) are affected by the decision makers' perspective and this shows that the NRI has strong discrimination ability. For the robustness criterion of the NRI, type of changes of the TrFNs and conditions for robustness are proposed, and these have been applied to the *Anugerah Kualiti Naib Canselor* (AKNC) case study. The findings show that the NRI is robust for solving AKNC case study with the Dice and Ochiai ranking indices have less computing time compared with some of the previous methods. As the NRI can rank all types of FNs and all types of decision makers' perspective, and the ranking can be determined merely by the point wise operations, NRI becomes an advantageous ranking method for solving multi-criteria decision-making (MCDM) problems in fuzzy environment. 1 ,05 .0,05 .01 ,5.0