ABSTRACT

Decision making is a process of selecting best alternative as a logical choice from the available options to get a solution to a problem. When the effectiveness of various alternatives are to be studied by a group of experts, the problem of Multi Person Decision Making (MPDM) arises. A MPDM can be interpreted as a decision situation in which a best alternative to a given problem is to be chosen based on the information provided by group of people or experts.

In a MPDM problem, the experts may provide their own preferences about the alternatives in the form of different preference formats. The most popularly used structures are preference ordering, utility functions and preference relations. Of these structures preference relations are very commonly used for the sake of convenience and representing simplicity.

Many different decision making methods have been proposed by researchers working in the field of decision making problems. Among them the two main widely used methods are, Analytic Hierarchy Process (AHP) by Saaty (1980) and fuzzy majority based selection scheme by Kacpryzk (1986).

Saaty introduced decision making based on Analytic Hierarchy Process (AHP), with the ratio scales of [1/9, 9] from paired comparisons. Even though AHP is a significant method in finding the consistency it does not handle the uncertainty associated with the judgement. To overcome this, fuzzy majority scheme is used to improve the decision making. In AHP reciprocal Multiplicative Preference Relation (MPR) is taken as the

preference representation whereas in fuzzy majority based selection Fuzzy Preference Relation (FPR) is taken as uniform representation element. So there is a need to transform the multiplicative preference relation to fuzzy preference relation.

In this research work a generalized transformation function is defined to convert MPR to FPR. In general, the preference relations in the form of Pairwise Comparison Matrices (PCMs) are rarely consistent, and the inconsistent judgments may lead to unreasonable decisions. So it is important to verify the consistency of the preference relation obtained. As a result, the parameters that are required for consistent judgements, the consistency ratio and consistency index are calculated and compared with the existing transformation function in literature. Further, the proposed function is also verified to be as strongly consistent.

To rank the alternatives in a decision making problem prioritization methods are found to be very effective. In prioritization methods, deriving a reliable priority vector is essential. Several similarity measures are used to derive a priority vector. The Cosine Similarity Measure (CSM) is a widely used similarity measure by the researchers due to its simplicity. In this work, the fuzzy preference relation is obtained using the generalized transformation function and using CSM the priority vectors are derived for the obtained fuzzy preference relation and the condition for perfect consistency is verified.

Distance measure is another important tool used in decision making. Some of the existing measures have limitations in satisfying the required axioms of a distance measure. So in this work, a distance measure between Intuitionistic Fuzzy Sets (IFSs) (Atanassov, 1986) based on absolute difference between membership and non- membership functions is proposed. The proposed distance measure satisfies the required axioms. To check the

effectiveness of the proposed distance measure a comparative study is made with the existing measures and further it is applied to medical diagnosis problem.

Interval-Valued Intuitionistic Fuzzy Sets (IVIFSs) are the extension of Intuitionistic Fuzzy Sets (IFSs) (Atanassov & Gargov, 1989). The ranking of the alternatives of Intuitionistic Fuzzy Sets (IFSs) and interval-valued intuitionistic fuzzy sets (IVIFSs) plays a significant role of decision making process. To rank the IVIFSs various accuracy functions were defined in literature. For some cases, the existing accuracy functions handle the limitations of the score functions which fail to produce adequate information about IVIFS in the decision process. In decision making process, the assessment of attribute weights plays a vital role for ranking the alternatives. The ordering of the alternatives were vastly depends on the attribute weights in multi criteria decision making. In this work, a new accuracy function based on Euclidean inner product and Euclidean norm is defined to find the ranking and to get the best alternative. By applying an illustrative example, from literature it is verified that the proposed accuracy function is valid and reasonable.