

Project Objective

The project aims to develop, validate, and apply a new generalization of interval numbers to enable more precise modeling of uncertainty in various practical contexts. The goal is to overcome the limitations of existing methods and provide decision analysis tools that are both precise and user-friendly.

Research Description

The project is divided into four main phases. The first phase involves theoretical development, where the theoretical framework and fundamental properties of the new generalization of interval numbers will be defined. The behavior of these numbers will be investigated under various mathematical operations such as addition, subtraction, multiplication, and division. An important aspect of this phase is proving theorems related to symmetry and asymmetry, which will ensure a robust mathematical foundation.

The second phase involves computational implementation. Algorithms integrating the new generalization of interval numbers into multi-criteria decision analysis (MCDA) frameworks will be developed. These algorithms will be implemented in user-friendly software tools, which will be tested and refined based on preliminary test results to enhance performance and accuracy.

The third phase focuses on practical application, where the tools will be applied to real-world scenarios to evaluate their practicality and effectiveness. These scenarios will cover various contexts where uncertainty modeling is critical, such as risk analysis or decision-making under uncertainty.

The final phase involves empirical validation. Extensive tests will be conducted across different scenarios and datasets to assess the reliability and accuracy of the tools. Data from these tests will be analyzed to confirm theoretical predictions and introduce any necessary adjustments.

Reasons for Undertaking the Research

The research was undertaken due to significant limitations of currently used uncertainty modeling methods. Existing methods are often either too complex to apply or do not provide sufficient precision. The new generalization of interval numbers aims to combine simplicity with advanced modeling capabilities, allowing for more precise and user-friendly decision analysis tools.

Key Expected Outcomes

The expected outcomes of the project include the development of robust theoretical frameworks and practical tools for uncertainty modeling that can be applied in various fields such as finance, engineering, medicine, and management. The project results will contribute to a better understanding and management of uncertainty, which is crucial in the decision-making process across different practical contexts.