

ANALYSIS REPORT

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In this assignment, we were asked to implement fuzzy operations and design a fuzzy inference system. The problem statement given was as follows:

1. Consider any two Fuzzy numbers A and B of your own choice and perform Fuzzy Addition, Subtraction, Multiplication and Division on them.
2. Design a fuzzy inference system using Mamdani and Sugeno methods for solving any problem of your choice.

Colab Links :

Problem - 1:

https://colab.research.google.com/drive/173jFvnGO5adidsTgsj52QRU54ybja_r?usp=sharing

Problem - 2:

https://colab.research.google.com/drive/1MJxOBESmEMQ49o6tAZ9jgvCRm6_YYQkx?usp=sharing

Problem - 1:

The arithmetic operations were implemented as discussed in the class and analysis was drawn based on the implementation and values of the implemented functions was cross-checked with the example used in class.

It was analyzed that the fuzzy addition and fuzzy multiplication showed **commutative property** while fuzzy subtraction and fuzzy division did not display commutative property.

It was also analyzed that the fuzzy addition stretched the plot of the result to the right in comparison with the plots of A and B numbers on the same axis. By stretching, here it is meant that the range of the values is increased on the right end.

It was also analyzed that the fuzzy subtraction stretched the plot of the result to the left in comparison with the plots of A and B numbers on the same axis. By stretching, here it is meant that the range of the values is increased on the left end.

It was also analyzed that the fuzzy multiplication stretched the plot of the result on both sides in comparison with the plots of A and B numbers on the same axis.

Problem - 2:

For the second problem, I took up the **restaurant tipping problem**.

In restaurant tipping problem, we need to find the amount to be tipped to the server based on the service and food quality.

The fuzzy inference system was implemented for both the mamdani method and the sugeno method.

I used **two input membership functions** : one for service quality and the other for food quality. The **one output membership function** for the type mamdani is the tip value.

The service quality score ranges from 0 to 10 with a step value of 0.5.

The food quality score ranges from 0 to 10 with a step value of 0.5.

The tip value ranges from 0 to 25.

The rules used were as follows: **[1]**

- IF the *service* was good *or* the *food quality* was good, THEN the tip will be high.
- IF the *service* was average, THEN the tip will be medium.
- IF the *service* was poor *and* the *food quality* was poor THEN the tip will be low.

For example, the input given was

For the **Mamdani method**, the output tip value was : 18.38.

For the **Sugeno method**, the output tip value was : 17.07.

References:

1. <https://thesocialcomment.com/project/full/Fuzzy-Control-Systems--The-Tipping-Problem?pid=5e0b52a22a37d20505da2a49>