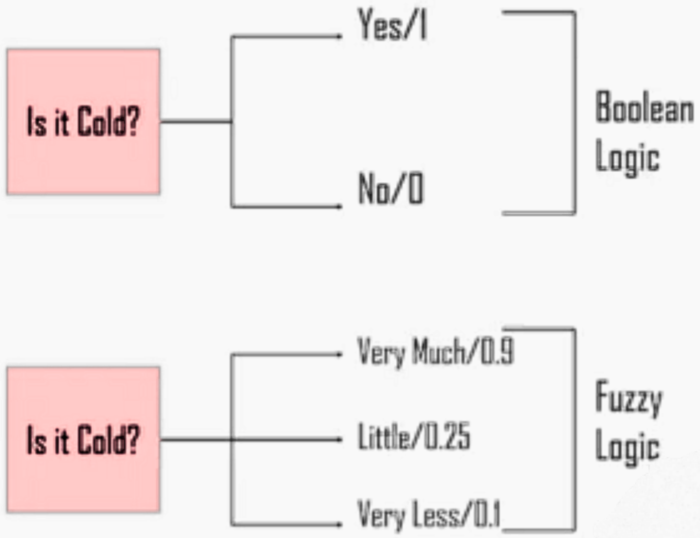
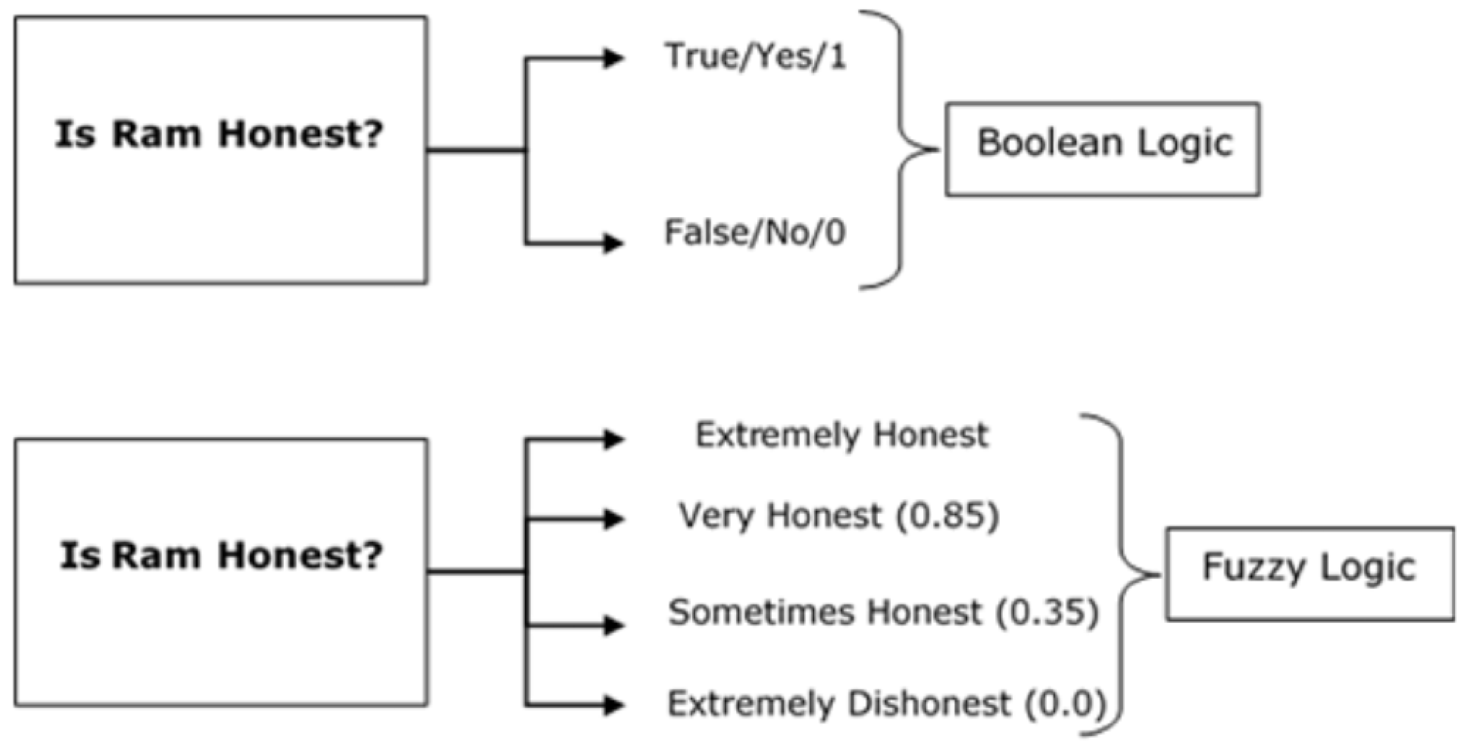
WHAT IS FUZZY LOGIC?

Fuzzy Logic (FL) is a method of reasoning that resembles **human reasoning**. This approach is similar to how humans perform decision making. And it involves all intermediate possibilities between **YES** and **NO**.




Is Ram Honest?
True/Yes/1
False/No/0
Boolean Logic
Is Ram Honest?
Extremely Honest
Very Honest (0.85)
Sometimes Honest (0.35)
Extremely Dishonest (0.0)
Fuzzy Logic

In other words, we can say that fuzzy logic is not logic that is fuzzy, but logic that is used to describe fuzziness. There can be numerous other examples like this with the help of which we can understand the concept of fuzzy logic.

Fuzzy Logic was introduced in 1965 by Lofti A. Zadeh in his research paper “Fuzzy Sets”. He is considered as the father of Fuzzy Logic.

Introduction

- The word “fuzzy” means “vaguness (ambiguity)”.
- Fuzziness occurs when the boundary of a piece of information is not clear-cut.
- Fuzzy sets - 1965 Lotfi Zadeh as an extension of classical notation set.
- Classical set theory allows the membership of the elements in the set in **binary terms**.
- Fuzzy set theory permits membership function valued in the interval [0,1].

Fuzzy Sets

- **Fuzzy Logic** is derived from fuzzy set theory
- Many degree of membership (between 0 to 1) are allowed.
- Thus a membership function $\mu_{\tilde{A}}(x)$ is associated with a fuzzy sets Ã such that the function maps every element of universe of discourse X to the interval [0,1].
- The mapping is written as: $\mu_{\tilde{A}}(x): X \rightarrow [0,1]$.

- Fuzzy Logic is capable of handing inherently imprecise (vague or inexact or rough or inaccurate) concepts

Fuzzy Sets (Continue)

Example

- Let X = {g_1, g_2, g_3, g_4, g_5} be the reference set of students.
- Let Ã be the fuzzy set of "smart" students, where "smart" is fuzzy term.

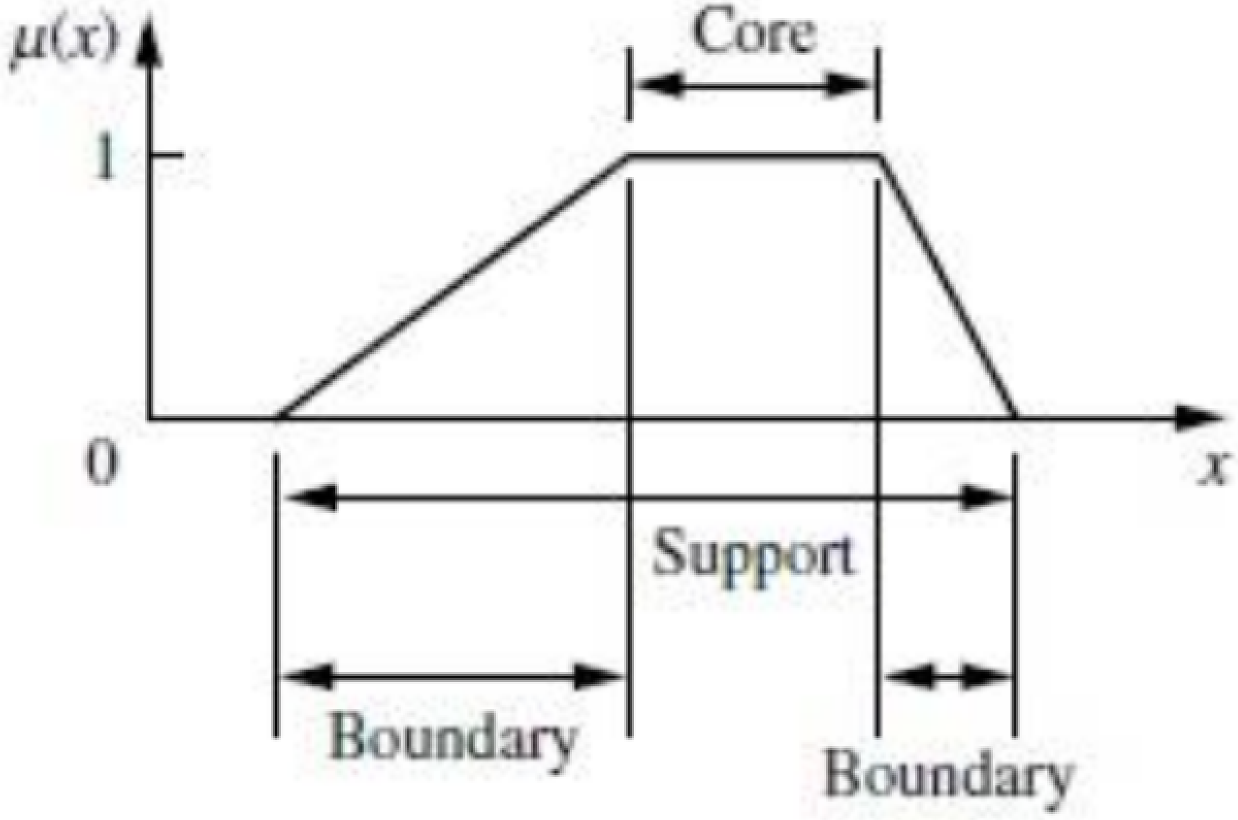
$$\tilde{A} = \{(g_1,0.4)(g_2,0.5)(g_3,1)(g_4,0.9)(g_5,0.8)\}$$

Here Ã indicates that the smartness of g_1 is 0.4 and so on

MEMBERSHIP FUNCTIONS

Definition: a membership function for a fuzzy set A on the universe of discourse X is defined as $\mu_A: X \rightarrow [0,1]$, where each element of X is mapped to a value between 0 and 1. This value, called membership value or degree of membership, quantifies the grade of membership of the element in X to the fuzzy set A.

FEATURES OF THE MEMBERSHIP FUNCTION



μ(x)
Core
1
0
x
Support
Boundary
Boundary

The ***core*** of a membership function for some fuzzy set A~ is defined as that region of the universe that is characterized by complete and full membership in the set A~. That is, the core comprises those elements x of the universe such that $\mu_{A\sim}(x) = 1$.

The ***support*** of a membership function for some fuzzy set A~ is defined as that region of the universe that is characterized by nonzero membership in the set A~. That is, the support comprises those elements x of the universe such that $\mu_{A\sim}(x) > 0$.

The ***boundaries*** of a membership function for some fuzzy set A~ are defined as that region of the universe containing elements that have a nonzero membership but not complete membership. That is, the boundaries comprise those elements x of the universe such that $0 < \mu_{A\sim}(x) < 1$. These elements of the universe are those with some *degree* of fuzziness, or only partial membership in the fuzzy set A~. Figure 5.1 illustrates the regions in the universe comprising the core, support, and boundaries of a typical fuzzy set.

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- A Core
- B Support
- C Boundary
- D Fuzzy

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- A True
- B False

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- B Graphical Form
- C Mathematical Form
- D Logical Form

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- B Fuzzy Algorithm, Neural network, Genetic Algorithm
- C Core, Support , Boundary
- D Weighted Average, center of Sums, Median

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B. Between 0 & 1, either 0 or 1

C. Between 0 & 1, between 0 & 1

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B. degree of membership

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b) Crisp set logic

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12. Traditional set theory is also known as Crisp Set theory.

a) True

b) False

View Answer Answer: a

Explanation: Traditional set theory set membership is fixed or exact either the member is in the set or not. There is only two crisp values true or false. In case of fuzzy logic there are many values. With weight say x the member is in the set.