Introduction to Artificial Intelligence

Jaderick P. Pabico
Institute of Computer Science, College of Arts and Sciences
University of the Philippines Los Baños, College 4031, Laguna

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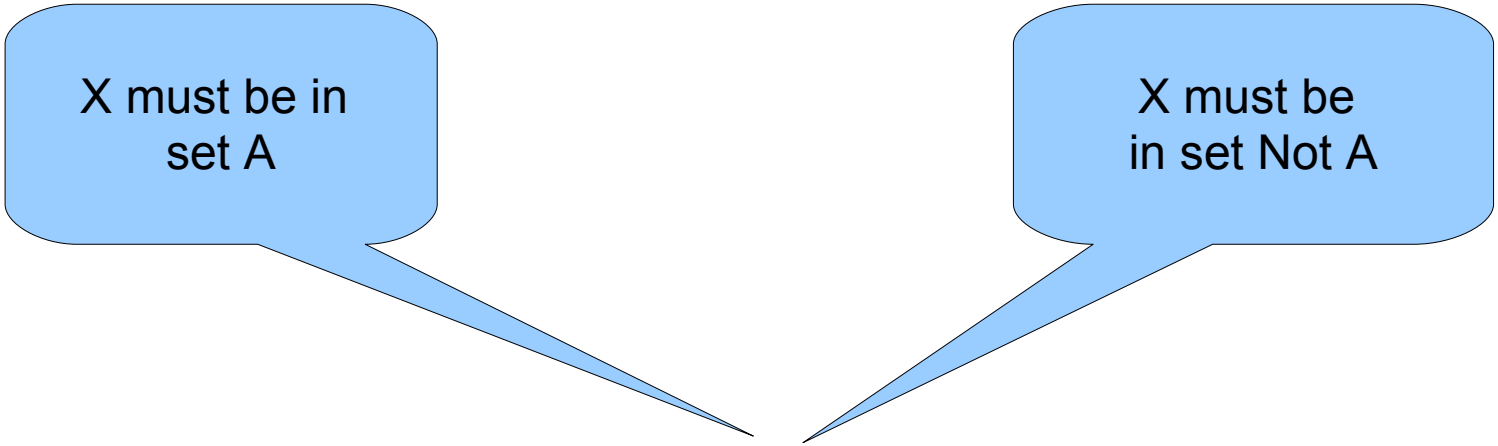
Fuzzy Logic

- History of logic
  - 300 BC Aristotle
  - Principle foundation of mathematics
  - Law of excluded middle
  - X = A U ~A



Fuzzy Logic

- Traditional Logic
  - Crisp logic

A rose is either RED...

... or NOT RED!

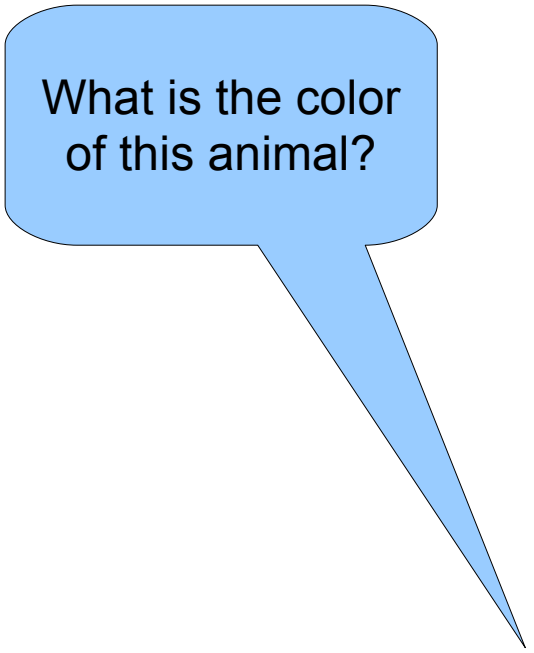
Fuzzy Logic

- Traditional Logic
  - Problem with crisp logic

But... what about this rose?

Fuzzy Logic

- Traditional Logic
  - Problems with crisp logic

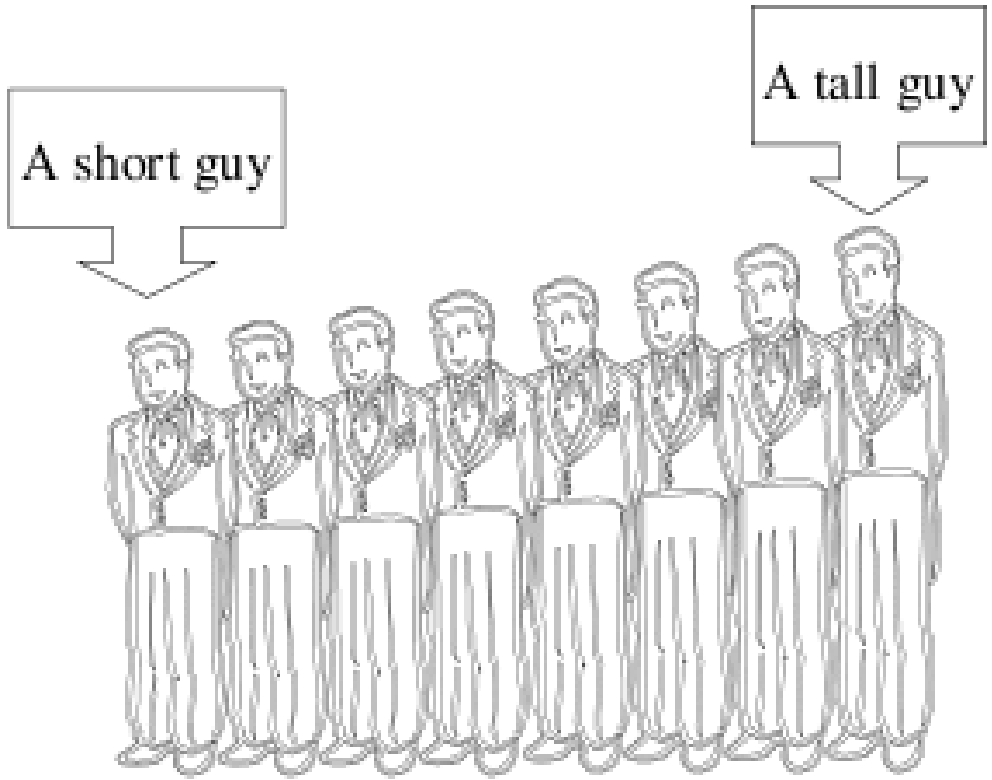


Fuzzy Logic

- Traditional Logic
  - Problems with crisp logic

Fuzzy Logic

- Traditional Logic
  - Problems with crisp logic



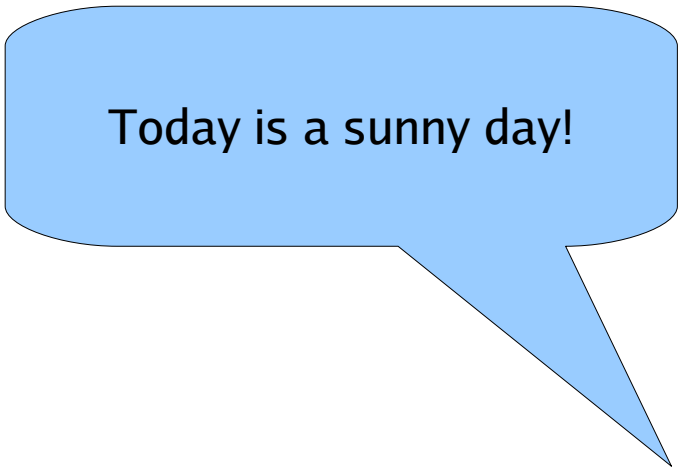
At what point short person becomes tall?

What is Fuzzy Logic?

- Superset of traditional (or conventional or Boolean) logic
- Conventional logic extended to handle the concept of partial truth
- Partial truth
  - Truth values between completely true and completely false

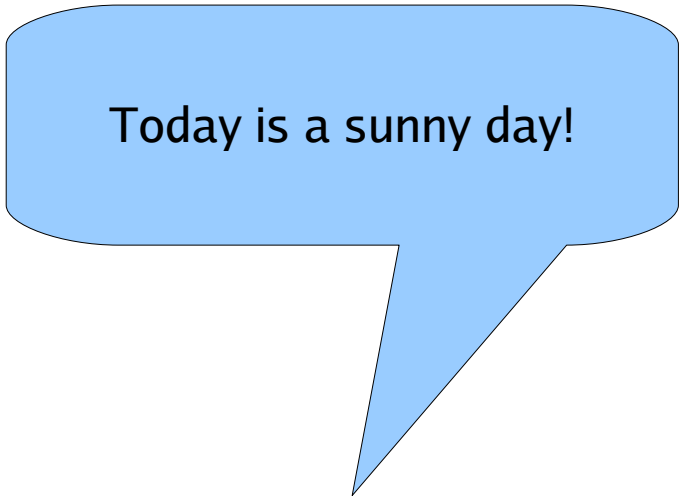
What is Fuzzy Logic?

- Logic that recognizes more than simple true and false values
- Prepositions are represented with degree of truthfulness and falsehood
- Example:



What is Fuzzy Logic?

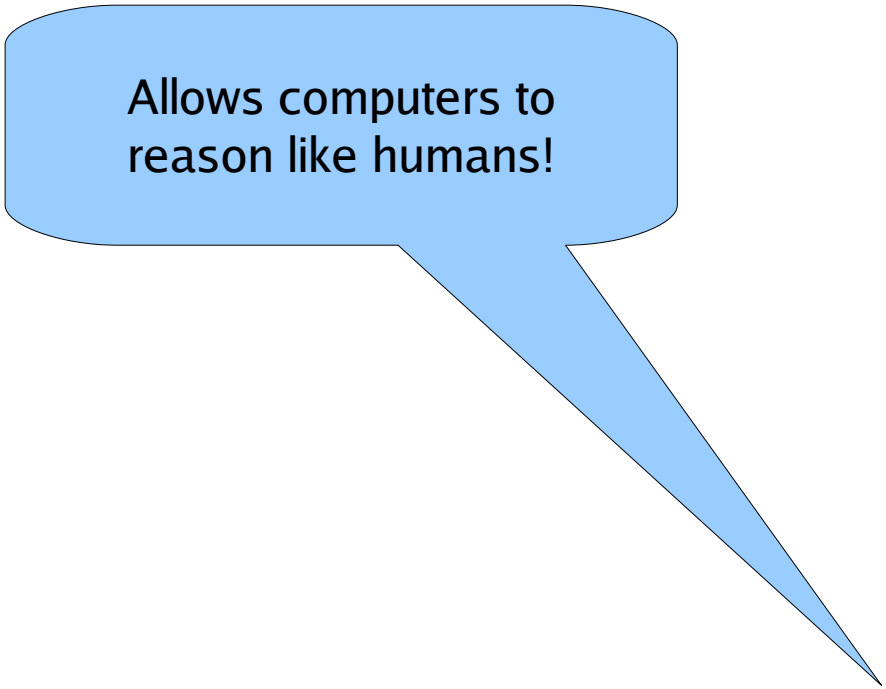
- Example:



- 100 % true if there are no clouds
- 80% true if there are few clouds
- 50% true if hazy
- 0% true if it rains all day!

What is Fuzzy Logic?

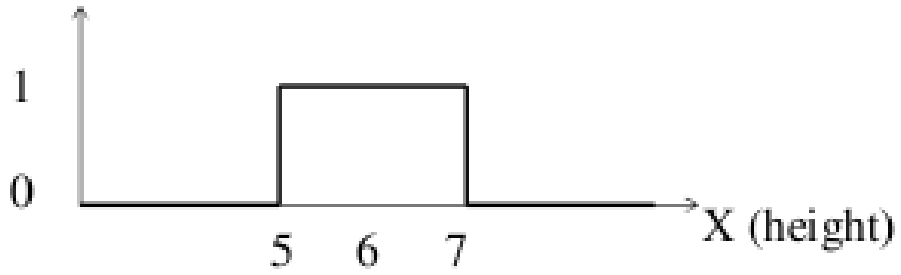
- A form of knowledge representation suitable for notions that can not be defined precisely, but whose definition depends on the context.



Classical vs. Fuzzy

- In crisp set, the membership of element x of set A is defined as:

$$\mu_A(x) = \begin{cases} 0, \text{if } x \notin A, \\ 1, \text{if } x \in A. \end{cases}$$



Example: Set of heights from 5 to 7 feet

Classical vs. Fuzzy

- Define the mathematical notations for the following:
  - Male and Female in the set of Gender
  - Freshman, Sophomore, Junior, and Senior in the set of Student Classification
    - Can you further find subclass/superclass for this and define the notation?
  - Single, In A Relationship, Married, Separated, Divorced, Widow/Widower in the set of Civil Status
    - Where will “It's complicated” be classified?