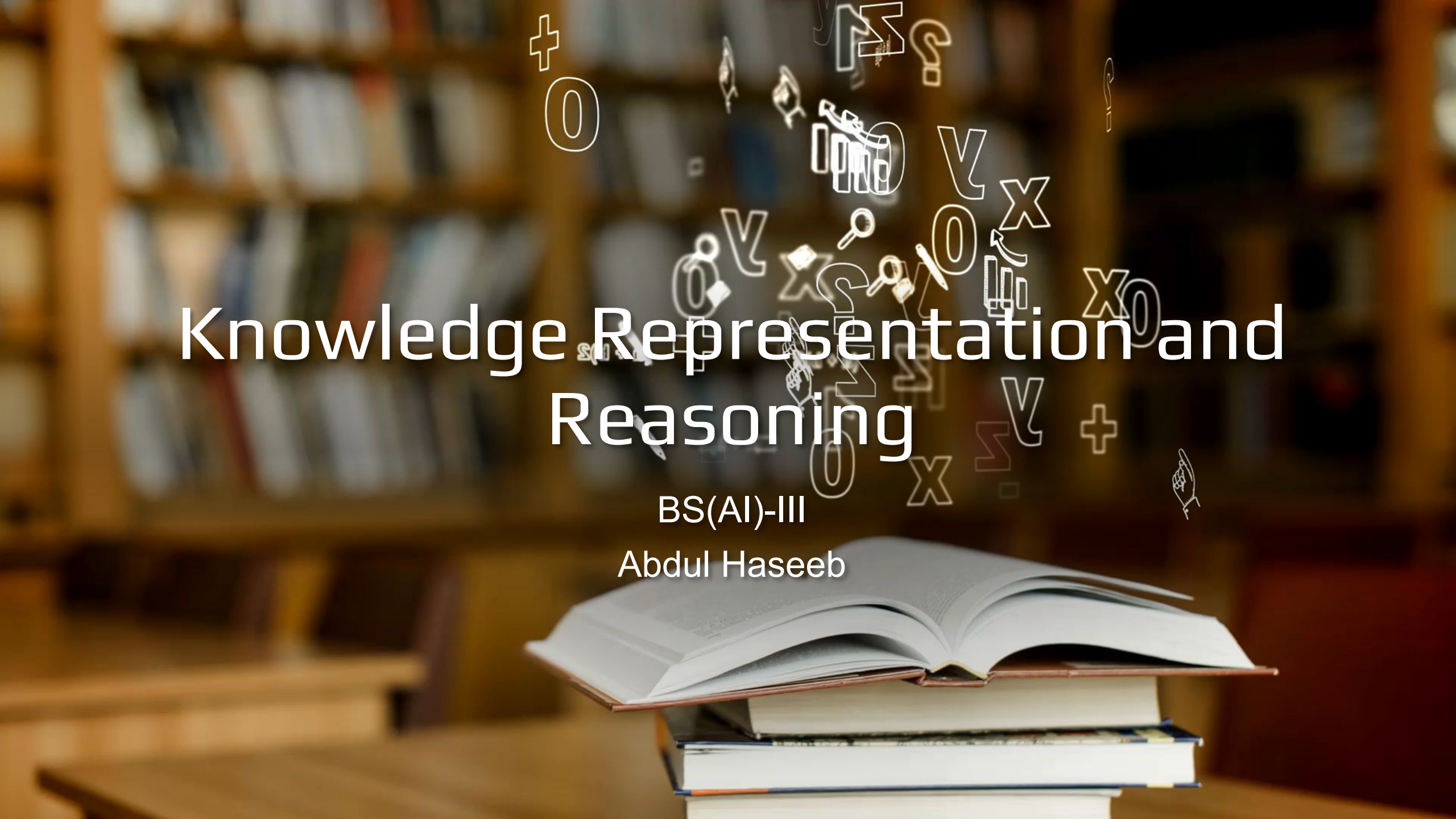


Knowledge Representation and Reasoning

BS(AI)-III

Abdul Haseeb

Introduction

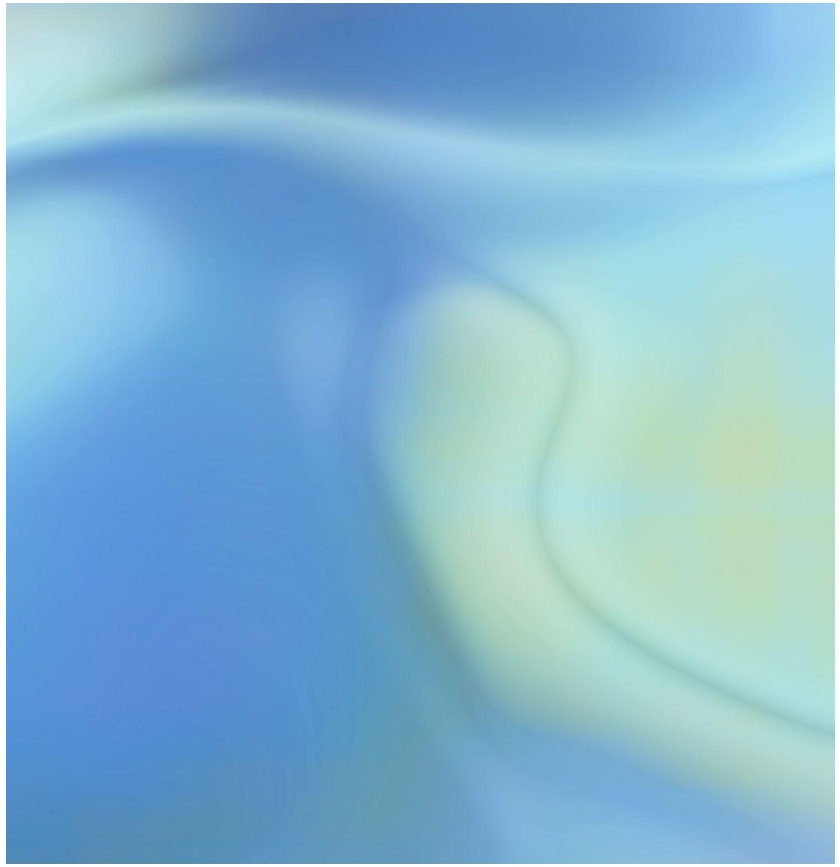
Key factor to make machines intelligent is knowledge

Knowledge and Intelligence:

- Facts and skills that we accumulate through education and experience is knowledge
- Ability to use that knowledge at right time is intelligence
- Accurate representation of knowledge allows machines to make intelligent decisions

Incorrect Representation of Knowledge Leads to:

- Syntax Errors
- Semantic Errors



Methods for Representation of Knowledge

Logic:

Propositional Logic
Predicate Logic

Rules:

If-then

Semantic Net (Meaningful Graph)

Think of cow, it has four legs, elephant also has four legs

- Increase the knowledge and use it at right time

Google Graph

Frames:

Slots (Objects) and fillers(Attributes)

Script:

Like Movie has a script

We give script to agent and it makes decision

Propositional Logic

Proposition:

- Sentence: Sky is Blue
- Expression: 1+1=2

Logic:

- Refers to Reasoning

In propositional logic the outcome is either true or false:

- Exp:1+1=2 True
- 5-2=4 False
- Sky is Black False
- Some Employees are lazy True/False….(can not be a part of propositional logic)

Types of Errors

- In propositional logic we have two kinds of errors:
  - Semantic
  - Syntax

Syntax Error

- These arise when we violate the grammatical rules
- Keeping the syntax in view:
    - We can represent two types of propositions in PL
        - **Atomic:**
            - Single, Don’t write any symbol like:
                - Sky is Blue
                - 1+1=2
        - **Complex:**
            - Two or more sentences
            - There are some symbols which allow us to make connections

Symbols

- Negation(¬):
  - Today is Friday=P
  - ¬ P
- Disjunction (∨):
  - You should eat or watch TV at a time
  - P V Q
- Conjunction(∧):
  - Please like my video and subscribe my chanel
  - P ^ Q

Symbols

- If-then ($\rightarrow$):
  - If there is rain, then roads are wet
  - P $\rightarrow$ Q
- Iff($\leftrightarrow$):
  - I will go to mall if I have to do shopping
  - P $\leftrightarrow$ Q

Lets see an Example

- You can access the internet from campus if you are a CSE Student or you are not a fresh man.
- P=You can access the internet from campus
- Q=You are a CSE Student
- R=You are a fresh man

Answer

- (Q → P) ∨ (¬R → P)

Practice Problem 1

- You can borrow books from the library if you are a graduate student or are a member of the book club

Answer

- Let G: You are a graduate student.
- Let B: You are a member of the book club.
- Let L: You can borrow books from the library.
- Translation: $(G \vee B) \rightarrow L$

Practice Problem 2

- You can participate in the internship program if you are a junior or you have completed the introductory course, provided that you are not on academic probation."

Answer

- Let J: You are a junior.
- Let C: You have completed the introductory course.
- Let P: You are on academic probation.
- Let L: You can participate in the internship program.
- Translation: $(\neg P \wedge (J \vee C)) \rightarrow L$

Practice Problem 3

- You can apply for the scholarship if you are a full-time student and you have a GPA above 3.5, or if you are a part-time student with a GPA above 3.8, but only if you have submitted all required documents.

Answer

- Let F: You are a full-time student.
- Let P: You are a part-time student.
- Let G_F : Your GPA is above 3.5.
- Let G_P : Your GPA is above 3.8.
- Let D: You have submitted all required documents.
- Let S: You can apply for the scholarship.
- Translation: $(D \wedge ((F \wedge G_F) \vee (P \wedge G_P))) \rightarrow S$