Knowledge Representation
&
programming in Logic(P)

IT3113(P) & CSH 3143(P)

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Indented Out Comes

- Clear knowledge to solve the practical problems in Computer Science and AI using prolog programming language.
- Comprehensive idea of how the prolog interpreter actually works.

Introduction to Prolog Programming

- **What is Prolog?**
  - Prolog (Programming in Logic) is a high-level programming language rooted in formal logic.

- **Key Characteristics:**
  - Declarative programming language.
  - Focuses on "what" rather than "how."
  - Uses facts, rules, and queries to solve problems.

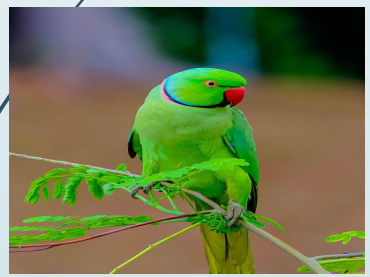
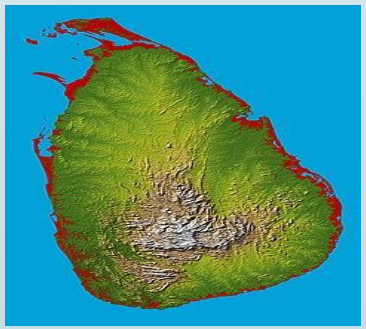
Real World Applications

- Expert System
- Game AIs.
- Natural Language Processing
- Web development
- Bioinformatics
- Financial Applications

What is a Fact?

- **Definition:**
  - A fact is a statement that is always true in the system's knowledge base.
  - A fact is expressed as a predicate with arguments.
  - Facts are used to describe the real world object or relationship between the real world objects.

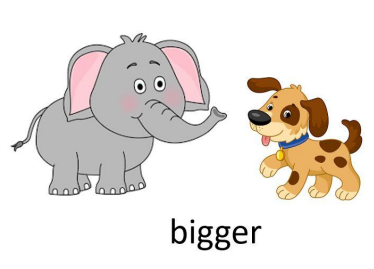
Real World Facts & Prolog Facts

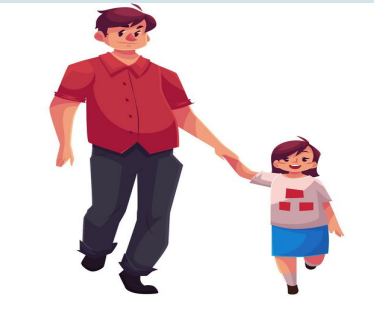
Real World Fact	Prolog Fact
	
Pizza is a food	is_a_food(pizza) / food(pizza)
	
Parrot is a bird	is_a_bird(parrot) / bird(parrot)
	
Srilanka is a island	is_a_island(srilanka) / island (srilanka)

Try to convert the following real world facts into prolog facts

1. Dog is an animal.
2. Kiwi is a fruit.
3. Gun is a weapon.
4. Keyboard is a hardware.
5. Samsung is an android phone.
6. Kamal is a male.
7. John is a student.
8. Elephant is black.
9. Circle is a Shape.
10. Bus is a vehicle.

Real World Facts & Prolog Facts





Real World Fact	Prolog Fact
Elephant is bigger than the dog	bigger_than(elephant,dog)/ bigger(elephant,dog)
Monkey eats banana.	eats(monkey, banana)
Mary is the daughter of John.	is_daughter(mary,john) / daughter(mary,john)

Try to convert the following real world facts into prolog facts

- Q1

1. John likes ann.
2. Charlie studies AI.
3. Collins teaches CS.
4. Vincent loves Mia.
5. October is the next month of September.
6. Jane is a student of Roy.
7. Elephant's color is black.

- Q2: Feed the knowledge about months.

Prolog Rules

- **Definition:**
  - A rule is a predicate expression that uses logical implication (:-) to describe a relationship among facts.
  - Prolog rule form:
    - **left_hand_side :- right_hand_side** .
  - Left hand side should be a single fact & cannot contain logical connectives.
  - This notation known as a "**Horn Clause**". Here left-hand side is conclusion and right-hand side is premises.
  - **Horn clause** calculus is equivalent to the **first-order predicate** calculus.

Examples:

- **friends(X,Y):-likes(X,Y),likes(Y,X).**

  X and Y are friends if they like each other.

- **hates(X,Y) :- not(likes(X,Y)).**

  X hates Y if X does not like Y.

- **enemies(X,Y) :- not(likes(X,Y)),not(likes(Y,X))**

  X and Y are enemies if they don't like each other