Oriental Institute of Science and Technology, Bhopal

Roll No. ..... Scholar No. .....

Assignment - 02

Q. What is the difference between predicate logic and propositional logic?

Ans

Feature	Propositional	Predicate
Focus	The truth value of entire statement (propositions) and how they are connected by logical operators	The internal structure of statements including subjects, predicates and variables
Statements	Treated as indivisible units, represented by variables (e.g., P, Q)	Broke down into predicates (e.g., P(x)) and variables
Variables	Do not exist in propositional logic; statements are either true or false	Used to represent objects, enabling reasoning with a statem
Key components	Propositions and logical (e.g., ¬, ∧, ∨, →, ↔)	Predicates variables quant

Roll No. ..... Scholar No. .....

Complexity	Simpler, deals with the logic of connectives	More powerful and complex can analyze scope and relationships b/w objects
Ex	$P \wedge Q$	$\forall x(cat(x) \rightarrow likes Mice(x))$

Q. Define semantic network with example

Ans A semantic network consists of:

- Nodes: Represent concepts, objects or entities (e.g., "Dog", "Animal", "Bark").
- Edges (Links): Represent relationship b/w these concepts (e.g., "is a", "has", "can").

These networks help machines and humans understand and how different ideas are connected, enabling reasoning, inference and knowledge retrieval.

Example:
[Dog] - is an - [Animal]
[Dog] - has → [Tail]
[Dog] - can → [Bark]
[Animal] - needs → [Food]

Advantages:
- Natural Language Processing (NLP): Understand sentence meaning
- Expert Systems: Represent domain knowledge
- Search Engines: Enhancing query understanding
- Cognitive Modeling: Simulating human memory and learning

Q.8 Explain different knowledge representation technique in detail
Logical Representation:-
- Uses formal logic (propositional or predicate logic) to represent facts and rules.
- Propositional logic: Deals with simple declarative (e.g., "It is raining").
- Predicate logic: More expressive, includes objects, properties and relation (e.g., "Raining(City)").

Advantages:
- Precise and unambiguous
- Supports inference through rules (e.g. Modus Ponens)

Limitations
- Difficult to scale for large, real world problems
- No intuitive for representing uncertain or incomplete knowledge

Semantic Network Representation
Represents knowledge as a graph of nodes (concepts) and edges (relationships)

Structure:
- Nodes: Entities or concept (e.g., "Dog", "Animal").
- Edges: Relationships (e.g., "is-a", "has-part").

Example:
- Dog → is-a → Animal
- Dog → has → Tail

Pros:
- Intuitive formal semantic
- Good for hierarchical knowledge.

3. Frame-Based Representation
Uses data structures called frames to represent stereotypical situations or objects.

- Structure:
  - Each frame has slots (attributes) and fillers (values)

- Example:
  Frame: Dog
  - Type: Animal
  - Sound: Bark
  - Legs: 4

- Pros:
  - Modular and structured
  - Easy to update and extend

Cons:
- Less flexible for abstract reasoning.
- Can become complex with deep hierarch

Production Rules (Rule-Based Systems)
What it is: Represent knowledge as a
set of - then rules.

Structure:
IF condition(s) THEN action/conclusio

- Example:
  - IF "temperature > 100°C "THEN" wate
    is boiling"

Roll No. ..... Scholar No. .....

- Pros:
  - Simple and intuitive
  - Easy to implement and modify
- Cons:
  - Rule conflicts can arise
  - Hard to scale for knowledge bases

Q Write characteristics of good knowledge representation system.

1. Representational Adequacy
   - It should be capable of representing all kinds of knowledge - facts, concepts, procedures and relationships - relevant to the domain.
   - Example: A medical KR system should represent symptoms, diseases, treatments and causal relationships.

2. Inferential Adequacy
   The system should support reasoning mechanisms to derive new knowledge from existing facts using logical inference.

3. Inferential Efficiency
   It must allow fast and accurate retrieval and manipulation of knowledge, enabling quick decision making.

posterior probability P(D|T) using Bayes' theorem. With the given values for P(D), P(¬D), P(T|D), total probability of testing positive P(T) is calculated as (0.95 · 0.01) + (0.05 · 0.99) = 0.059.

Applying Bayes' theorem,

$$P(D|T) = \frac{P(T|D) \cdot P(D)}{P(T)} = \frac{0.0095}{0.059}$$

$$\approx 0.161 \text{ or } 16.1\%.$$

Q. Distinction b/w Script scheme and frames in detail.

	Frames	Scripts
Focus	Represents static objects, concepts or situation	Represent dynamic sequences of events
Structure	Uses slots and fillers to describe attributes of an object. Support inheritance.	Includes component like entry conditions, roles, props, scenes and result
Knowledge type	Captures declarative knowledge (facts)	Captures procedural knowledge (actions and order)

Roll No ..... Scholar No .....

purpose	used for object recognition and reasoning about properties	used for language understanding and predicting event sequences

Q4 What is fuzzy logic and how it is to solve complex problems.

Ans Fuzzy logic is a method of reasoning used in computers that allows values to be partially true instead of only true or false like traditional logic. It deals with uncertainty and approximate decisions similar to human thinking

How it solves complex problems

It uses IF-THEN rules to make decisions based on imprecise data it useful where exact solution are difficult.

Ex: Automatic AC adjusts temperature by understanding degree like cool warm hot instead of only on/off.

used in:

- smart appliances (AC, washing machine)
- self driving cars
- Medical diagnosis