resolve word in a text refers back to other ideas in the text

Ex- House climbed up the hill. It was very steep. It got tired.
(House) (Hill)

13/8/19 Knowledge Representation

Objective of research is to feed knowledge instead of data in AI

KR is the method used to encode knowledge in an intelligent system's knowledge base

Types of knowledge

i) Declarative knowledge
- Concepts, Facts, Objects
- Describes what is known about prob
- Includes simple statements
- Includes objects as well

ii) Procedural knowledge
- Rules, strategies, agendas, procedures
- Describes how a problem is solved

iii) Heuristic
- Rules of Thumb
- Describes rule-of-thumb that guides the reasoning process
- Called shallow knowledge
- Based on empirical ~~kno~~ observations

iv) Meta-knowledge
- Knowledge about the other types of knowledge and how to use them
- Used for enhancing efficiency of problem solving.

v) Structural
- Rule sets, concept relationships, concept to object relationships.
- Describes an expert's overall mental model of the problem.

KR Types

i) Logical Representations
- Propositional logic
- Predicate logic (First order, Higher order, Fuzzy logic)

ii) Semantic Data Models (Structural K.)
- Semantic Net
- Conceptual Graphs

iii) Production Rules (Procedural K.)
- if ... then rules

iv) Frames (Structural K.)

Semantic Nets
Intuition base human memory with its high no. of connections & associations

Two types of primitive:
- Nodes : corresponds to obj or class of obj in the world
- Links : Unidirectional connection between nodes to show relationships

⇒ Semantic network is a KR schema that captures knowledge as a graph

Nodes represent:	Links:
- Concepts	- "instance of"
- Objects	- "is a"
- Events	- "has a"
- Feature	- "part of"
- Time	

Relationships

1. Class - superclass

Car —(is-a)— Vehicle
(class) (superclass)

2. Instance class

John's car —(instance of)— Car
(instance) (class)

3. Part - Whole

Door —(Part of)— Car
(Part) (Whole)

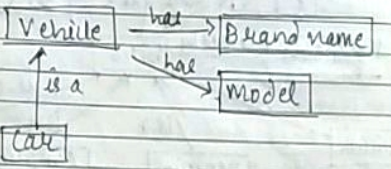
4. Object - Attribute

John's Car —Has— Colour
(Obj.) (Attribute)

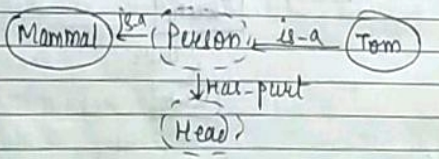
5. Attribute-Value
Colour —Value— Red
(Attribute) (Value)

6. Logical (and, Or, etc.)
7. Linguistic (Prone, Leaves etc.)

Inheritance
The local info of a superclass node is assumed by a class node, a subclass node and an instance node.



Examples:
i) is-a (person, mammal), instance (Tom, person), has_part (person, head)



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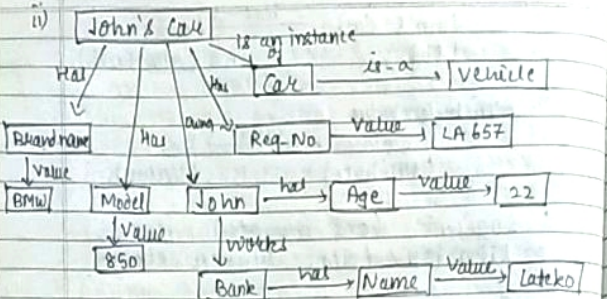

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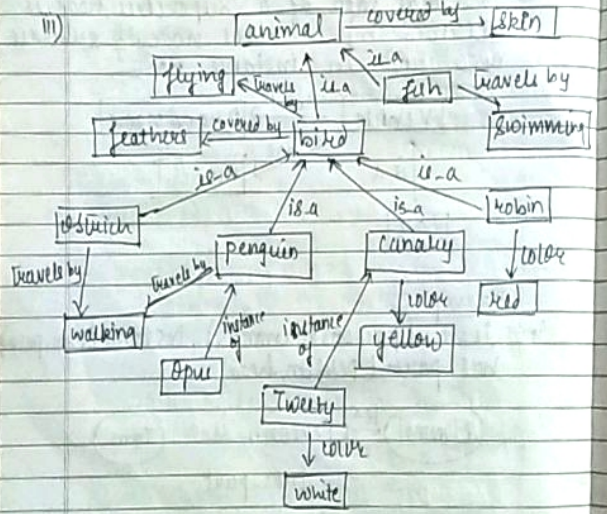
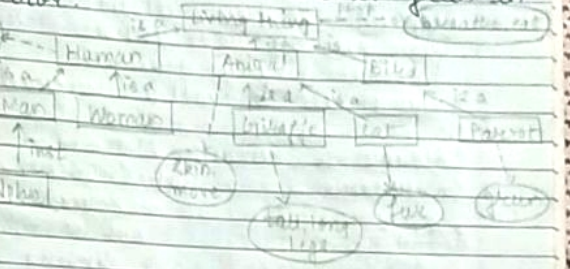


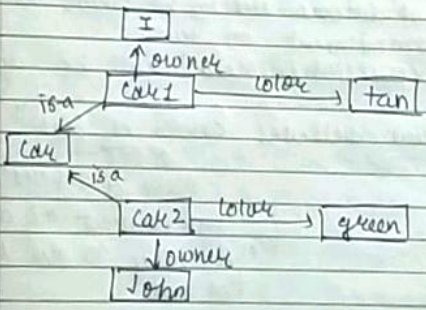
iv) "Every human, animal and bird is living thing who breathe and eat All birds can fly. All man and woman are

humans who have two legs. Cat is an animal & has fur. All animals have skin and can move. Giraffe is an animal who is tall and has long legs. Parrot is a bird and is green in color.



v) Man (Mariam)
Married (Mariam, Madonna)
LoveTo (Madonna, Mariam, Measles)

vi) My car is tan & John's car is green.



20/8/19 Example :-
Predicate logic (Non binary predicates)
man (Shahrukh)
Sol: instance (Shahrukh, man)

Represent N-Place relations (N>3)
Create new obj for entire statement
Introduce binary predicate
This process is called reification.

Inference in Semantic Net
i) Inheritance
A $\xrightarrow{is-a}$ B
B $\xrightarrow{is-a}$ C
Inheritance:
A is-a C

ii) Intersection search
Spreading activation out of two nodes & finding a common or intersection between them

Partitioned net
Allow for:
- Propositions are to be made without commitment to truth
- Expressions need / must be qualified

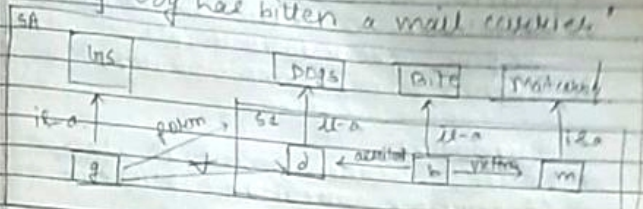
"Andrew believes Earth is flat"
↑
make a separate space and connect as a higher level entity to the rest of the net

Steps: i) Create a general statement, GS, special class

ii) make node q an instance of GS
iii) add with every node q attach 2 attributes.

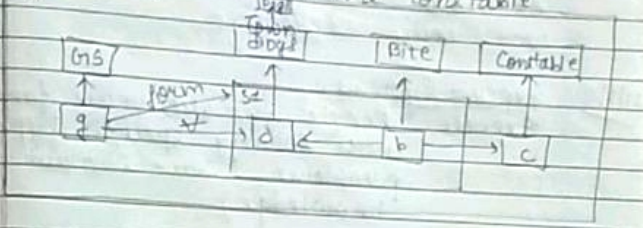
"Every dog has bitten a mail carrier."

SA



"Every dog has bitten the constable"

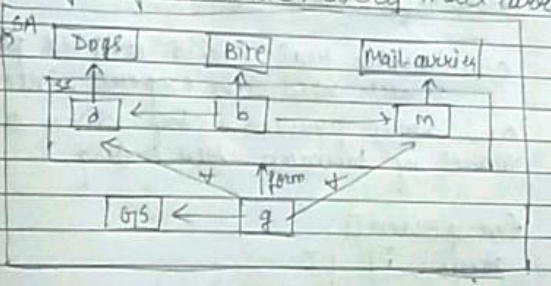
SA



"Every dog has bitten every mail carrier"

(Space after)

SA



Advantages of Semantic nets
→ Despite the variety of entities, they can be shown in some semantic network
→ Related knowledge can be easily clustered
→ Knowledge engineer can arbitrarily define the relationship
→ Inference is simple, natural & efficient

Drawbacks
→ No diff. between individual classes
→ If multiple inheritance present, possible to get conflicting values
→ Only binary relations are easy to express
→ Not very expressive

21/8/19 Expert Systems.

Expert - People who are very familiar with solving specific types of problems (have domain knowledge)

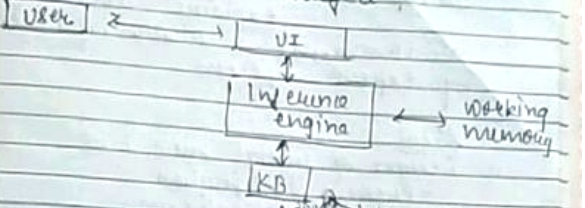
Knowledge-based sys.

ES: handle real-world complex problems which need an expert's interpretation and solve problems by using a comp model of human reasoning.

Components:
Basic: i) UI
ii) Knowledge base
iii) Inference engine

UI - provides comm exchange between user and system.

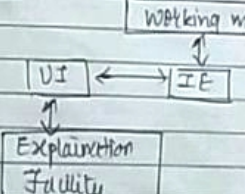
KB - contains expert-level knowledge on particular subject.



Other components:

1) Working memory
   - global database of facts
2) Explaination facility
3) Know acquisition facility
4) Self-training facility

ES Shell



Reasoning Machine - To memorize the reasoning rules and control strategies applied.

Interpreter - Through UI, interpreter explains user's questions via commands & other info. generated by expert system.

Steps:

1) Design of initial knowledge base
   - Problem identification
   - Knowledge Conceptualization
   - Rule formulation
   - Rule validation

2)

3)