13/8/19

Sessional 2

Knowledge Representation : An Introduction

Think abt knowledge, rather than AI.

→ knowledge repre. is the method used to encode knowledge in an intelligent system's knowledge base.

→ The objective of know. rep. is to express knowledge in computer-tractable form, such that it can be used to help.

→ domain specific knowledge.

Types of knowledge :

(1)	Declarative law	Concepts, Facts, objects.	• Describes what is known abt a problem. • This includes simple statements that are asserted to be either true or false. • This includes object or concepts.
(2)	procedural	Rules, strategies, Agendas, Procedures.	• Describes how a problem is solved. • This type of knowledge provides direction on how to do something.
(3)	Heuristic	Rules of Thumb.	• Describes a rule of thumb that guides the reasoning process.

It is called shallow knowledge.
→ It is empirical & represents the kn compiled by an expert through the experience of solving past problems

(4)	meta knowledge	knows abt the other types of knowledge & how to use them	- Describes know. abt know. - This type of know. is used to pick other know. that is best suited for solving a prob - used for enhancing the efficiency.
(5)	structural	Rule sets, concept relationships, concept to Object relationships	- Describes knowledge structures - Describes ~~overall~~ experts overall mental model of problem The expert's mental model of concepts, sub concepts & objects is typical of this type of knowledge.

Know. Rep. Types :

1) Logical representations → declarative
   - propositional logic
   - predicate logic (First order, Higher order, Fuzzy logic)

2) semantic data models → structured
   - semantic Net
   - conceptual graphs.

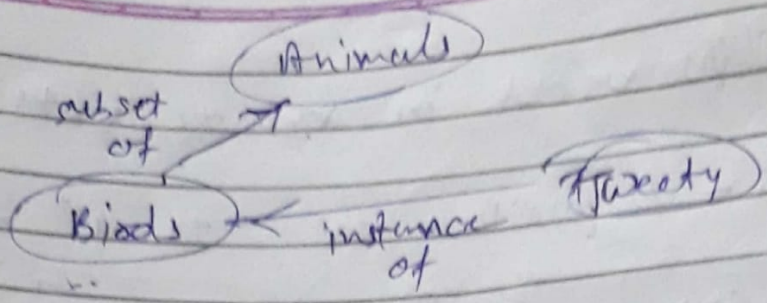
3) Production Rules ← procedural
   - IF ... THEN ... rules

4) Frames. ← structured.

Semantic Networks

- Intuition behind :
  An important feature of human memory is the high no. of connections or associations bet^n the diff. pieces of info. contained in it.

- Two types of primitive.
  - Nodes correspond to objects, or classes of objects in worlds.
  - Links are unidirectional connections bet^n nodes & correspond to relationships bet^n these objects.



Defⁿ of semantic net.

It is know repre. schema that captures know. as a graph. The nodes denote objects & concepts, their properties & corresponding values. The arcs denote relationship.

Name → concepts.

name → - A relationship.

⇒ Both nodes & arcs are labeled
→ Arcs have weights.

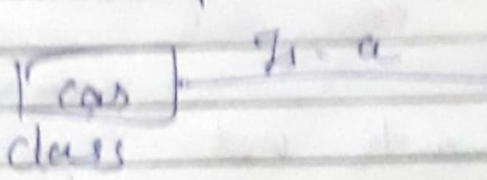
symbols of ...

Nodes
- concepts
- objects
- events
- features
- Time
- etc

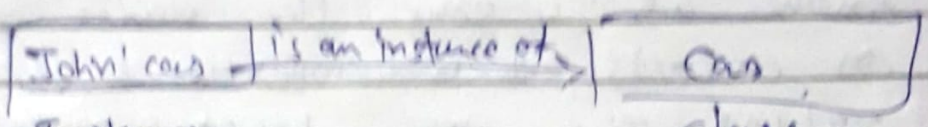
Links or Arcs represents relⁿ ships
- Instance of - set of membership.
- is a - inheritance
- has a - attribute descriptors
- part of - aggregation

↳ Rel" ships used in semantic nets:

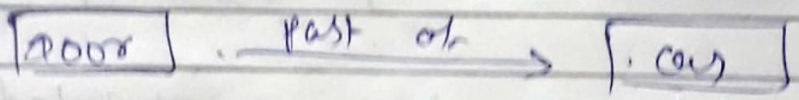
(1) class - Superclass or "is-a" relationship:



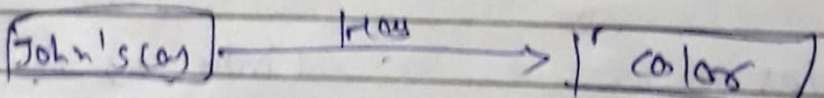
(2) 'Instance class' or "is an instance of",



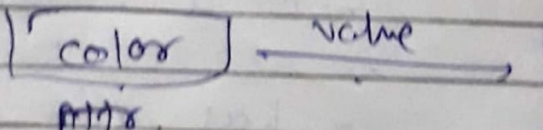
(3) "part-whole" or "part-of" rel" ship.



(4) obj. attribute" or "Has' rel" ship



(5) Attribute-value" or "value" rel" ship.



(6) Logical rel" ships (and, or, not).

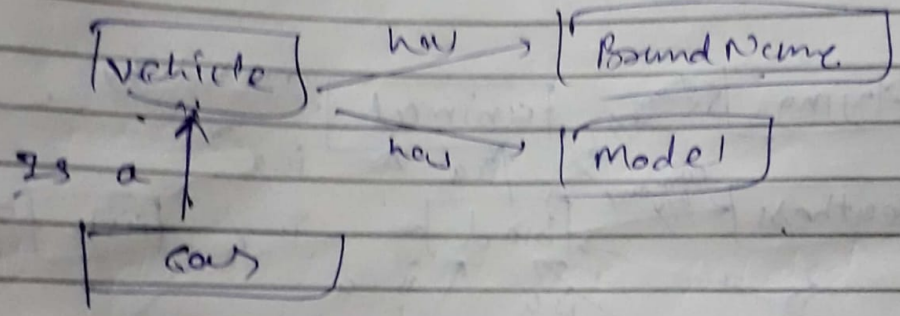
(7) Linguistic rel" ships (Likes, owns, travels, mothers of....)

Inheritance :

It is possible in semantic nets. It is a process by which local info. of superclass node is assumed by a class node, a subclass node & an instance node

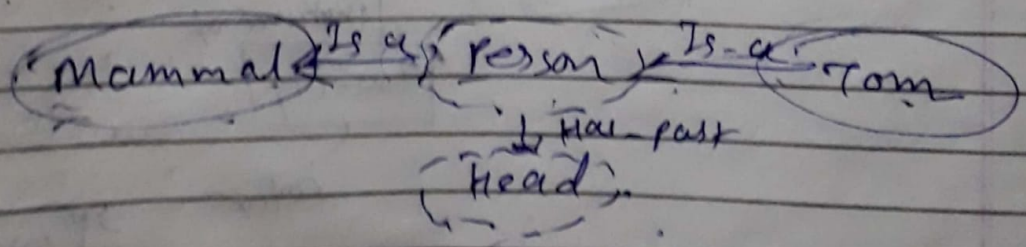
Ex :

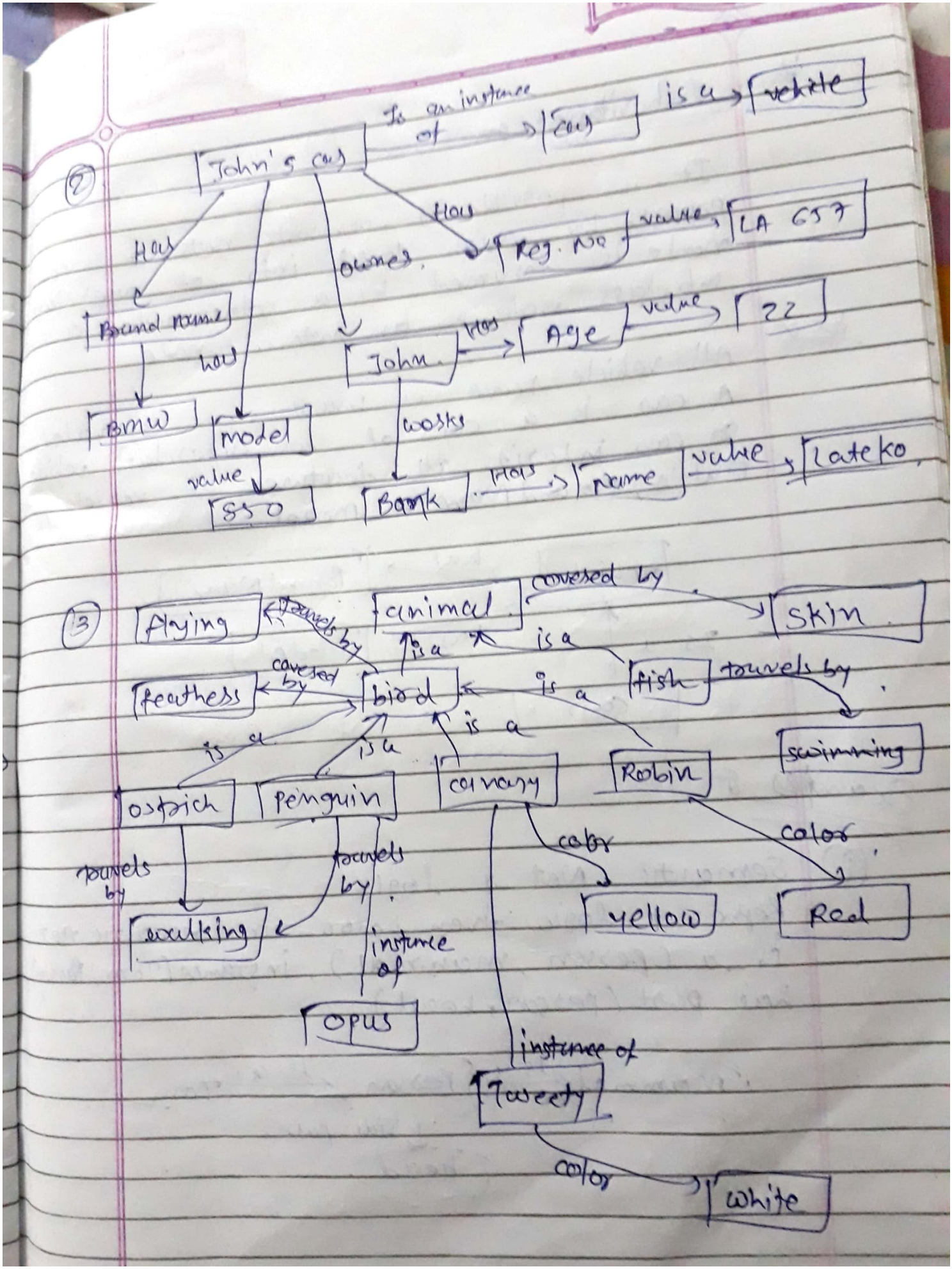
All vehicle have a bound name & model
A car is a class of a superclass vehicle.
So car inherits all features of vehicle,
that is, BoundName + model.



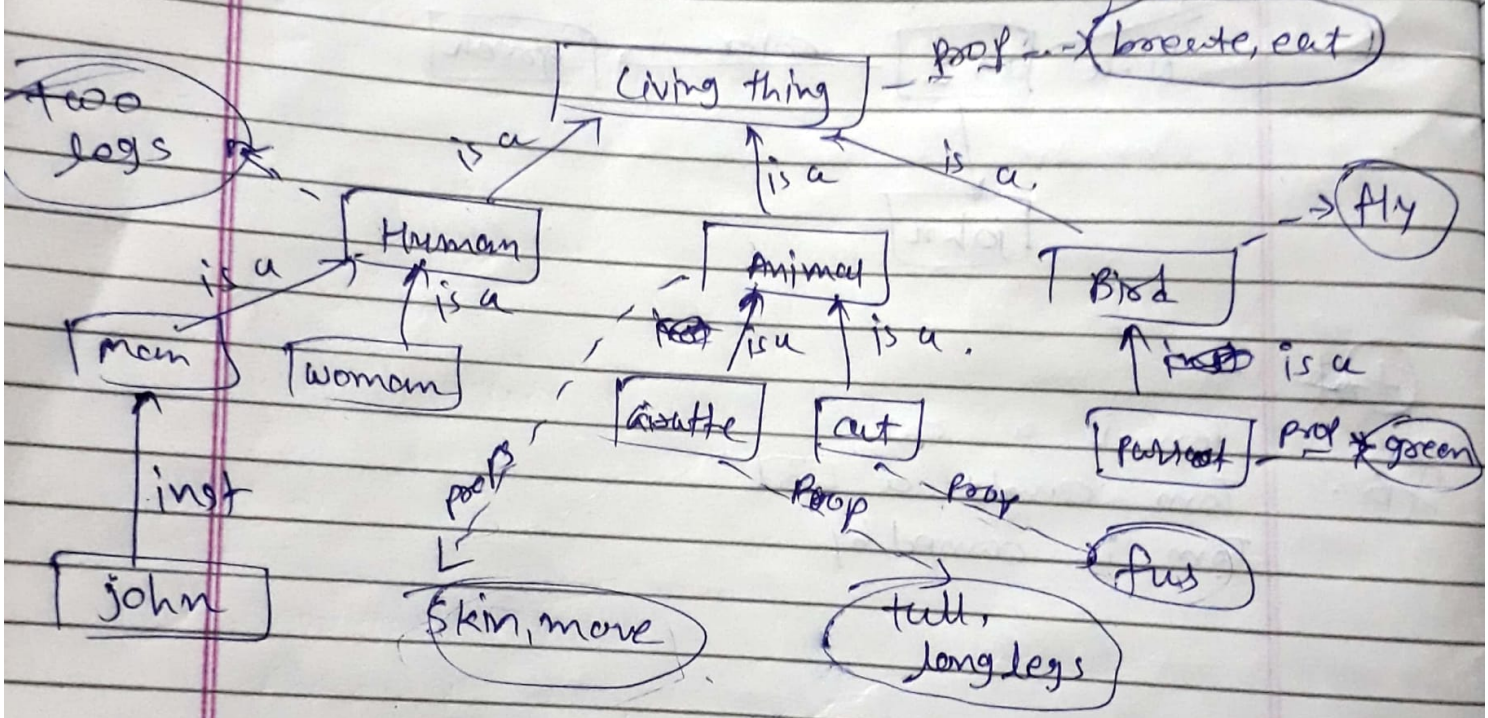
Examples :

(1) Semantic Net & logic
Represent logic given below in semantic net:
is_a (person, mammal), instance (Tom, Person),
has_past (person, head).





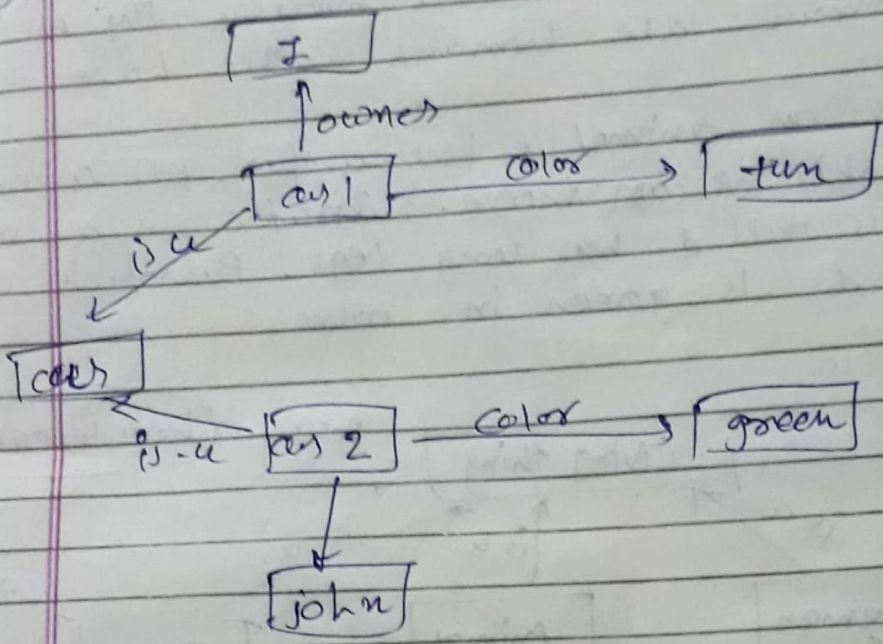
(a) Every human, animal & bird is living thing who breathe & eat. All birds can fly. All men & woman are humans who have two legs.
Cat is an animal & has a fur. All animals have skin & can move. Giraffe is an animal who is tall & has long legs. Parrot is a bird & is green in colors.



(b)

Man (Marcus)
Married (Marcus, Madonna)
HaveTo (Madonna, Marcus, Measles)

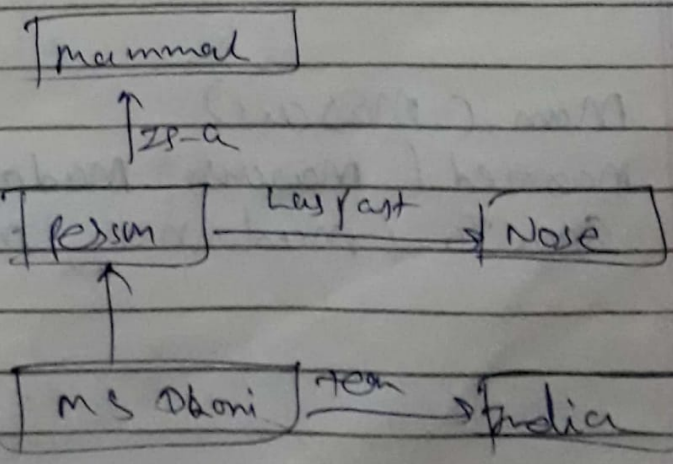
⑥ My car is tom & John's car is green



⑦ for TB.

Tom is a cat.
Tom caught a bird.
Tom is owned by

⑧



↓ Ref° in predicate logic

Ex # 1.

Every human, animal.
∀x [human(x)

+ Representing Nonbinary predicates and.

→ How to represent unary rel°s.
Ex: man (shahrukh).
sol°: human (shahrukh, ram)

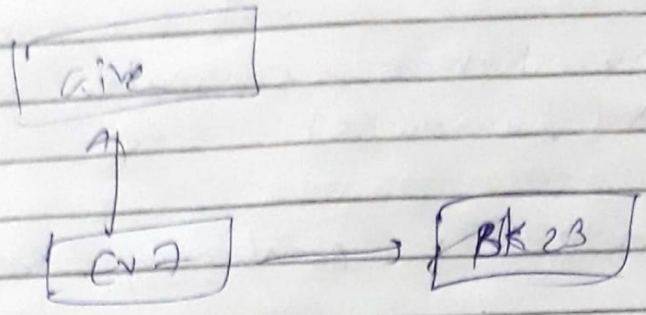
→ How to represent N-place rel° (N ≥ 3)
sol°: create one rel°

Ex # 2

score (india, pak, t-3)
So here create a generalized class T20 to represent games. #

score (T20, I-3), hometeam (T20-india)

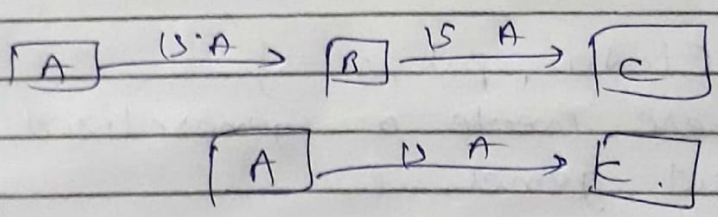
→ John gave a book to Mary.



* Inheritance in a semantic

⇒ 2 methods
① inheritance
② Intersection

①



②

The notion that spreading activation out of two nodes & finding their intersection finds

Ex:

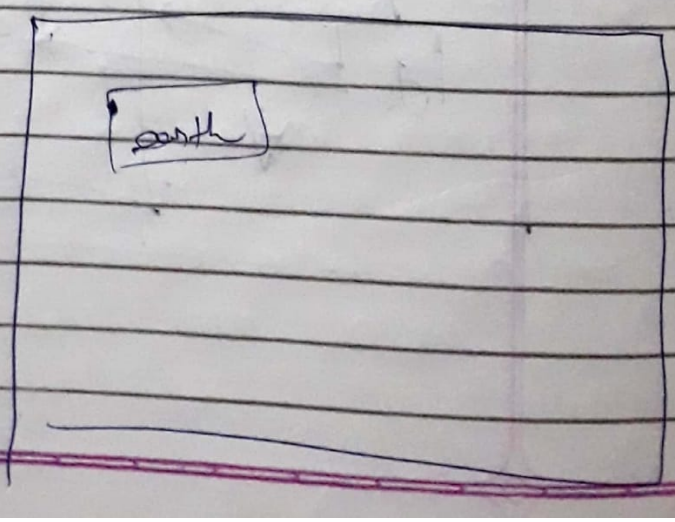
What is the rel^n Set^n two objects
⇒ both are baseball players

Extending semantic nets - Partitioned Nets

→ Extensions to semantic nets that overcome a few problems or extend their expression of knowledge.

→ Partitioned networks

Ex: Andrea believes that ~~South~~ is flat.



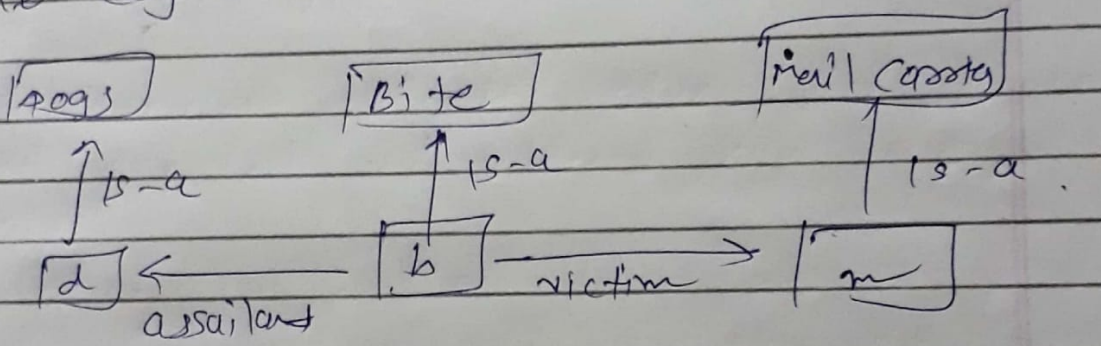
Step: ① Create a general statement, GS, specific dog.

② Make node g an instance of GS

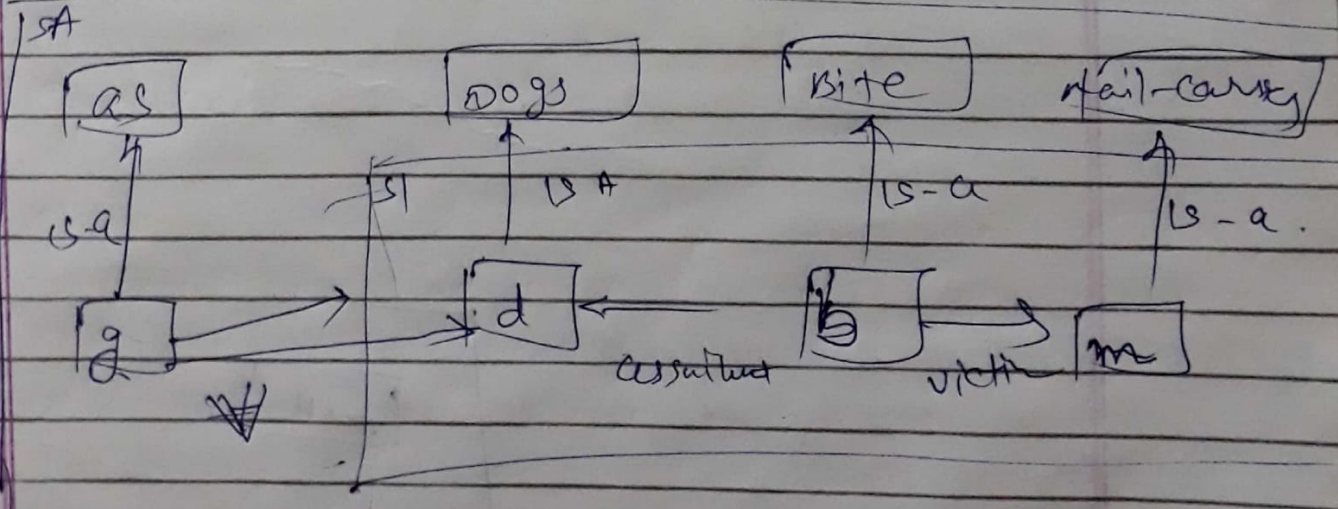
③ Add with Every node g at least 2 attr
① a form that states which set is being asserted.
②

ans

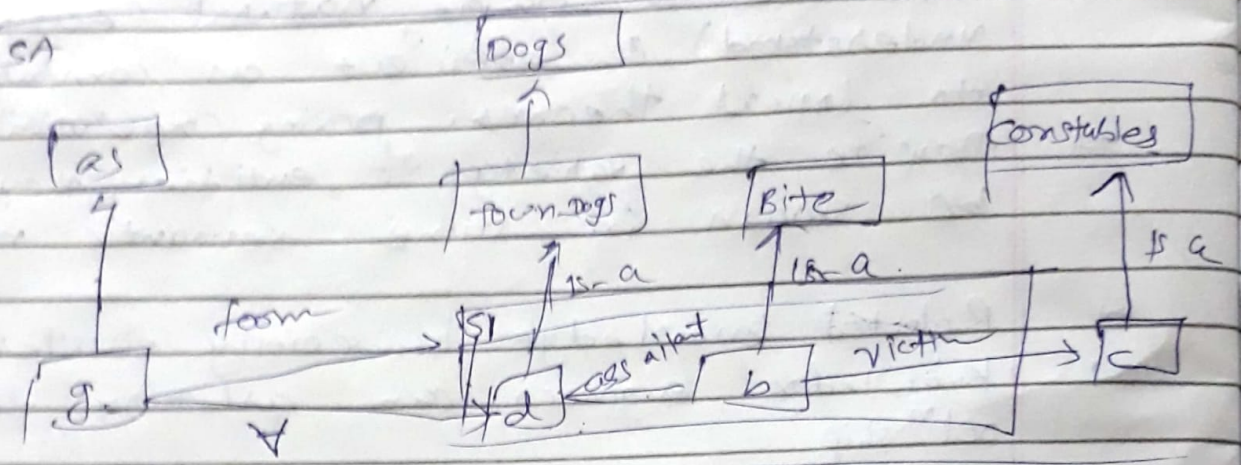
④ The dog bit the mail carries.



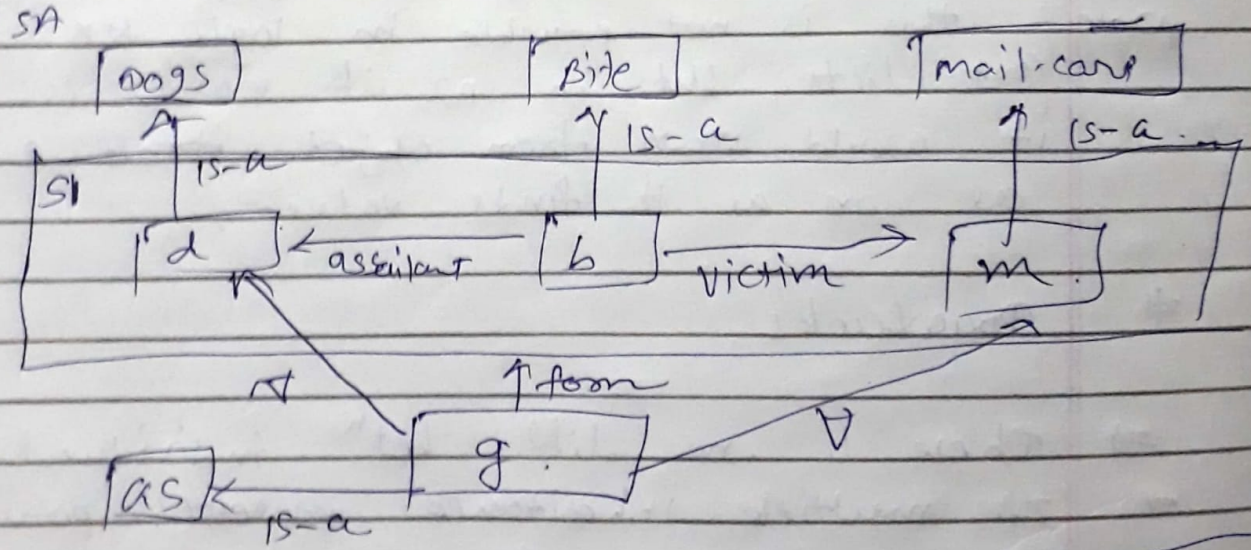
⑤ Every dog has bitten a mail carries



(c) Every dog in town has bitten the constable



(d) Every dog has bitten every mail carries



Advantages of semantic nets

- Inference is simple, natural (easy to understand) & efficient as compared to logical theorem proving (resolution) in logic.
- Despite the variety of entities, they can be shown in same semantic network.
- Related knowledge is easily clustered.
- Knowledge engineer can arbitrary define the rel^n ship
- Can represent default values for classes & still one of its objects can have diff. value.

Eg: Person has 2 legs bt john has 1 leg.

Note: this is not possible in logic KB as it contradicts, but in SN if search is done it would start from object itself & stops as soon as it finds value.

Drawbacks

- There is no diff. bet^n individual classes
- If multiple inheritance present, possible to get conflicting values
- Only binary rel^ns. easy to express, for non binary rel^ns, reification process needed.
- Not very expressive in rep^n of negation, belief, quantified statements etc

Expert Systems

What is the expert system?

→ Experts are ppl who use very familias with solving specific types of problems

→ Expert system
Until now, no unified def^{n} has been given.

→ Knowledge-based system
the fundamental fu^{n} of the expert

Def^{n} = ES can handle real world complex pros which need an expert's interpretation & solve problems by using a computer model of human expert reasoning to reach the same conclusions that the human expert would do

Basic components.

1) uses interface.
2) knowledgebase
3) Inference engine

(1) Uses software.
⇒ s/w that provides communication exchange betⁿ uses & system.

(2)
Contains expert level know on a particular subject stored in a knowledge representational form

(3)

Basic archi.

other components

1) working memory
A global db of facts used by the rules

2) knowledge db → stores set of rules

3) Domain db.

* other components
1) Explanation facility
2) knowledge acquisition facility
3) self training facility

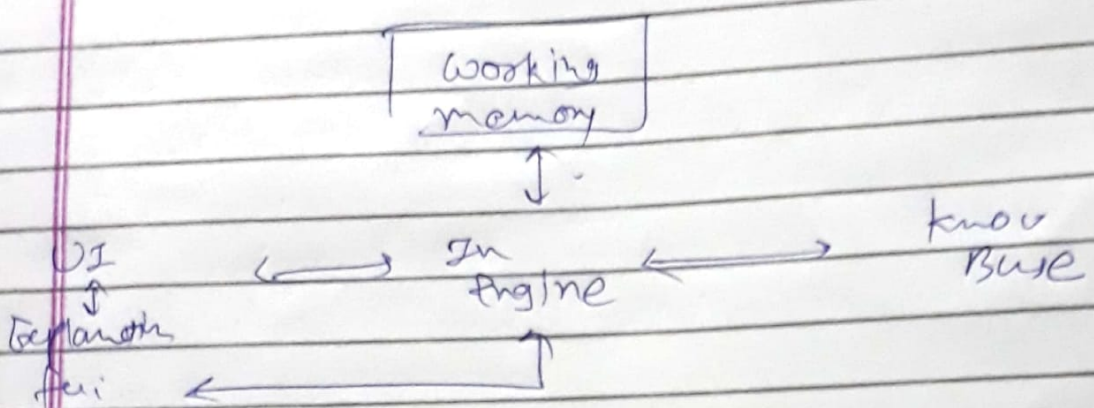


fig - knowledge Base