Ch: 9 Weak Slot and filler Structures

⇒ Slot & filler structures are the devices to support property inheritance along isa & instance links. (Knowledge Representation Technique)

* "is a" "instance" rel. fig in previous (Inheritance).

Slot and filler structures

- Weak slot & filler structure
  - Semantic nets
  - frames
- Strong slot & filler structure
  - Conceptual Dependency
  - Scripts

* **Weak slot & filler structures:-** are "knowledge-poor" or "weak" as very little importance is given to the specific knowledge.

Slot = Attribute
filler = Value of Attributes.

⇒ **Advantage of slot & filler structure:-**

1. Monotonic reasoning can be performed more effectively. ~~there with more~~
2. Makes it easy to describe properties of relations.
3. form of object oriented programming and has advantages such as modularity & easy of viewing by people.

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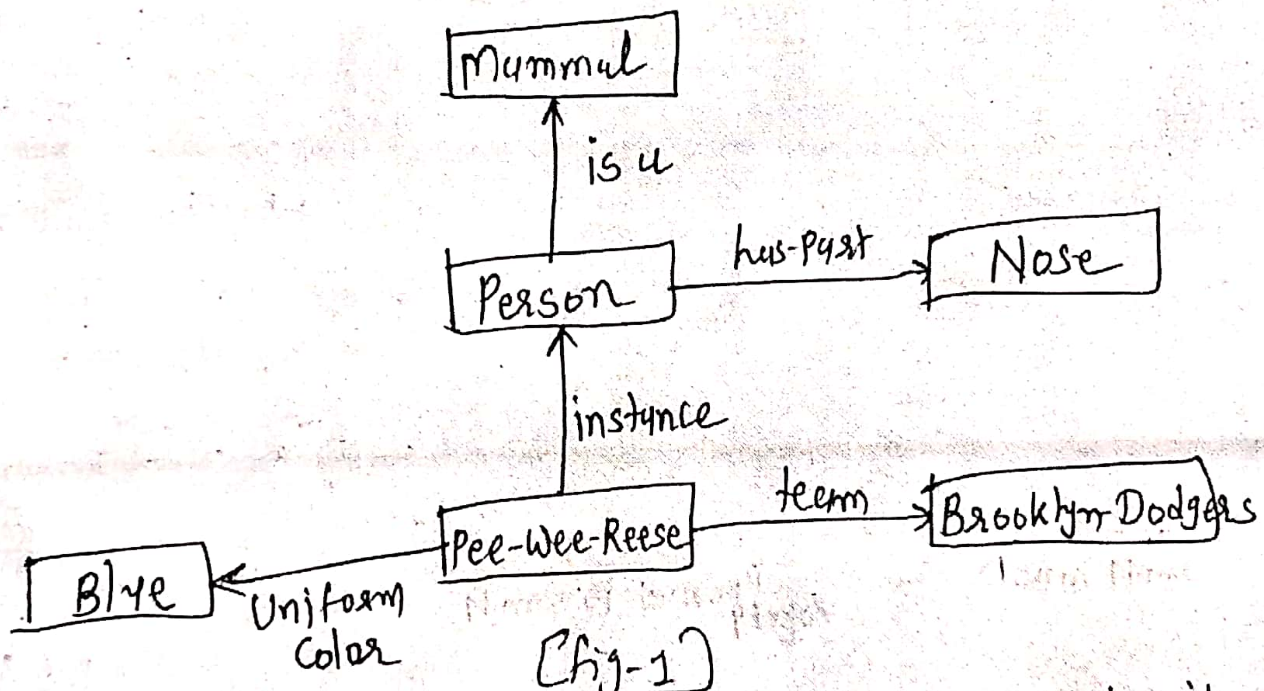
9.1 * Semantic Nets :-

↳ In Semantic Nets information is represented as : - set of nodes connected to each other by a set of labelled arcs.

- Nodes Represents : Various objects / values of the attributes of object.

- Arcs represent : Relationships among nodes.



[fig-1]

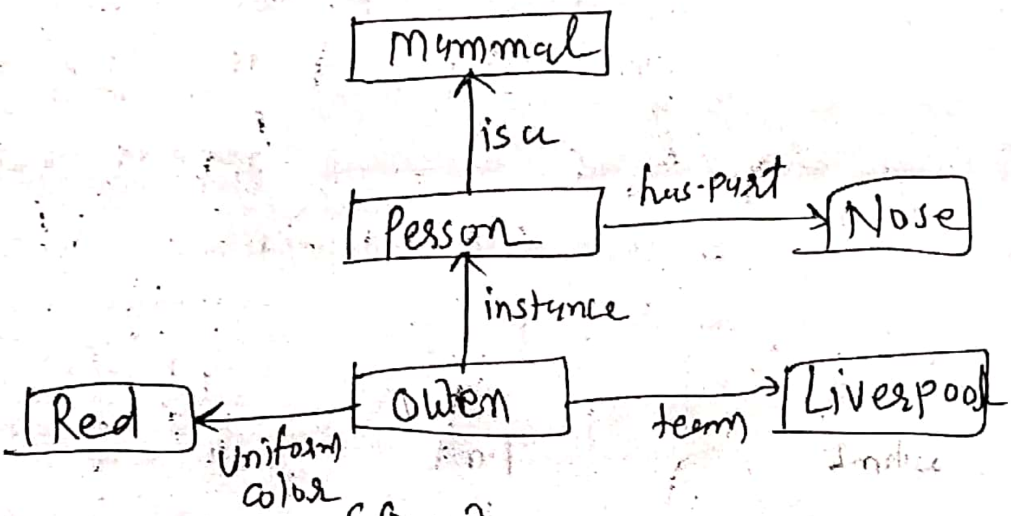
↳ In this network we could use inheritance to derive the additional info :

$\boxed{\text{has\_part (Pee-Wee-Reese, Nose)}}$

Intersection Search

↳ one way to find relationships among objects is to spread the activation (links) out from two nodes & find out where it meets.

Ex:1 relation between Red and liverpool.



[fig-2]

Ex. 2

↳ In fig-1 "What is the connection between the Brooklyn Dodgers & blue?"

9.1.2 ⟹ Representing Nonbinary Predicates:

↳ Semantic nets are a natural way to represent relationships that would appear as ground instances of binary predicates in predicate logic.

for Ex:, Some of the arcs from fig. 9.1 could be represented in logic as:

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isa (Person, Mammal)
instance (Pee-wee-Reese, Person)
team (Pee-wee-Reese, Brooklyn-Dodgers)
uniform-color (Pee-wee-Reese, Blue)

↳ But the knowledge expressed by predicates of other arities can also be expressed in Semantic nets.

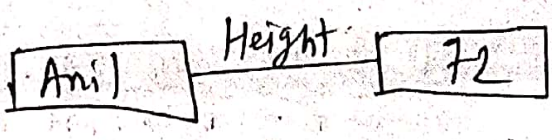
Ex:

Man(marcus)

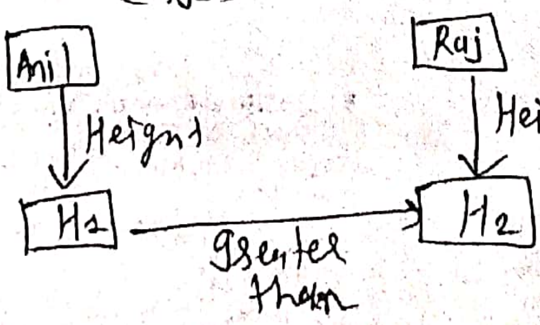
Could be rewritten as.

in semantic net } ⇒ instance(marcus, Man)

9.1.3 Making Some Important Distinctions:



(fig3)-Semantic Network



(fig-4) Semantic Network

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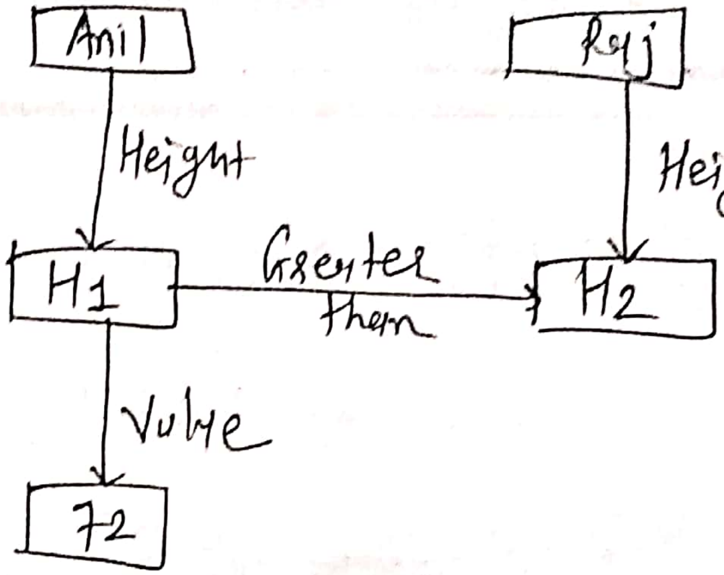

[fig-5- Representing distinction in semantic network]

↳ There should be a difference between the link that defined a new entity & one that relates two existing entities:

↳ Suppose we want to represent the fact like "Anil" is taller than "Raj."

↳ The nodes H_1 and H_2 represent Anil's and Raj's Height respectively.

→ Sometimes it is useful to introduce the arc value to make the distinction clear. [In fig-5]

↳ Some arcs ~~such~~ such as height define New entities. ~~and~~ whereas some arcs like greater than and value describes the relation among existing entities.

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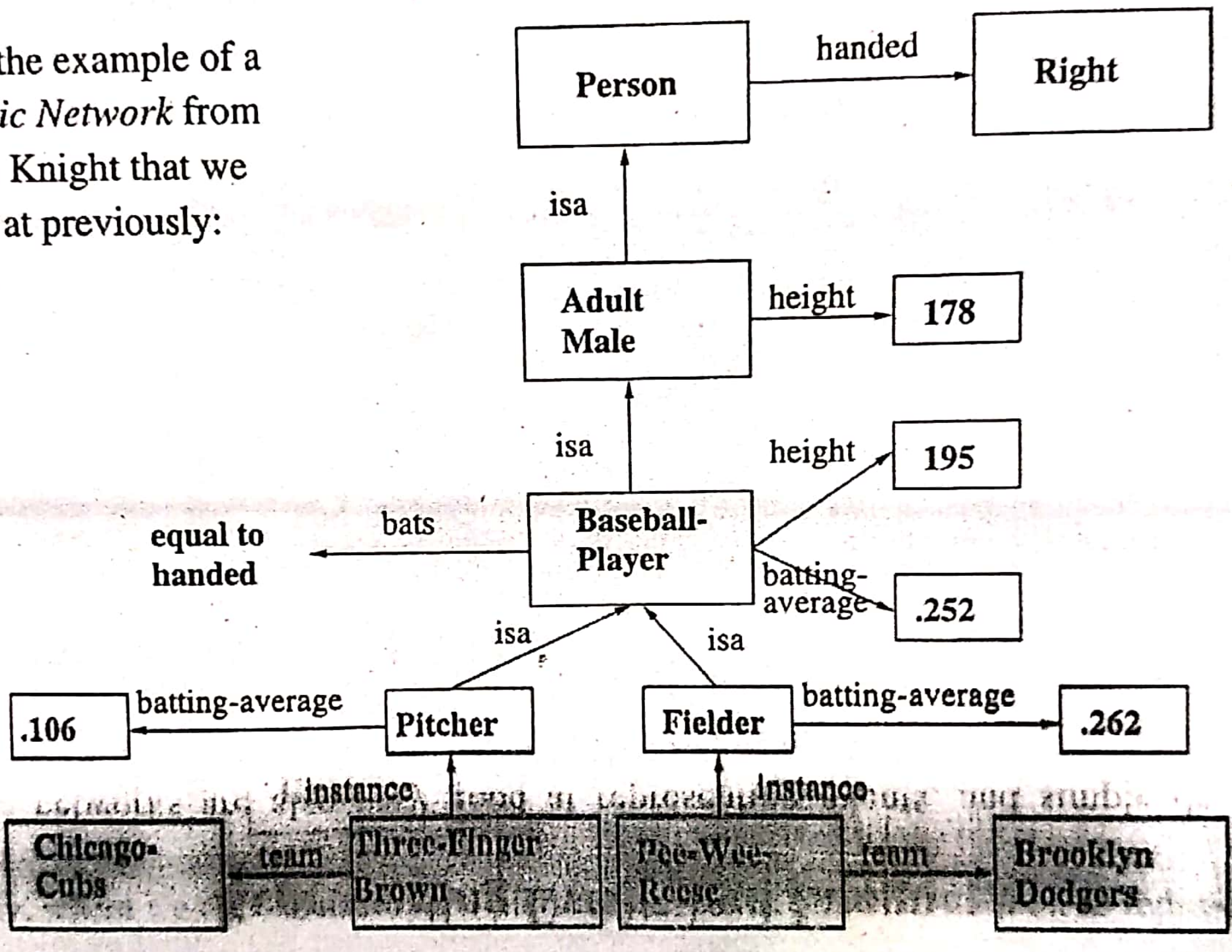
A Typical Mixed-Type Semantic Network

Here's the example of a *Semantic Network* from Rich & Knight that we looked at previously:



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(8)

Components of a Semantic Network

We can define a *Semantic Network* by specifying its fundamental components:

Lexical part
- nodes – denoting objects
- links – denoting relations between objects
- labels – denoting particular objects and relations

Structural part
- the links and nodes form directed graphs
- the labels are placed on the links and nodes

Semantic part
- meanings are associated with the link and node labels (the details will depend on the application domain)

Procedural part
- constructors allow creation of new links and nodes
- destructors allow the deletion of links and nodes
- writers allow the creation and alteration of labels
- readers can extract answers to questions

Clearly we are left with plenty of flexibility in creating these representations.

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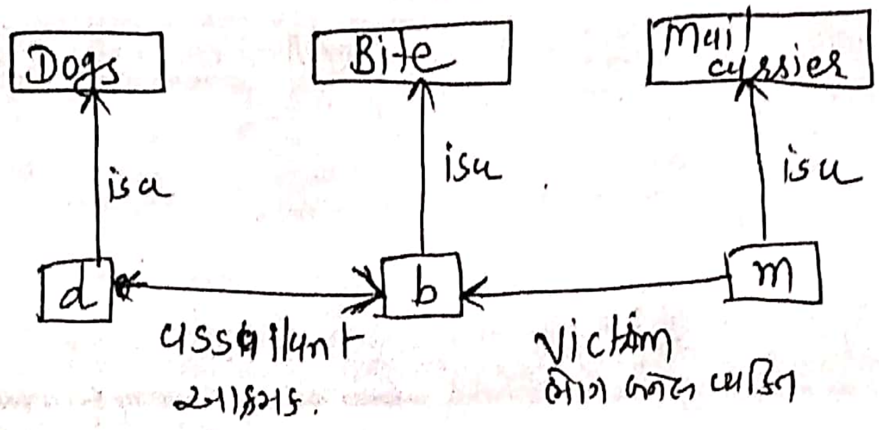
2.4 Partitioned Semantic Nets

↳ Suppose we want to represent simple quantified expressions in semantic nets. One way to do this is to partition the semantic net into a hierarchical set of spaces, each of which corresponds to the scope of one or more variables.



[fig. 6]

⇒ To see how this works, consider ~~first~~ fig 6. This net corresponds to the statement

"The dog bit the mail carrier"

↳ The nodes Dogs, Bite and Mail-carrier represent the classes of dogs, bitings and mailcarriers respectively.

↳ While the nodes d, b and m represent a particular dog, a particular biting and a particular mail-carrier. This fact can easily be represented

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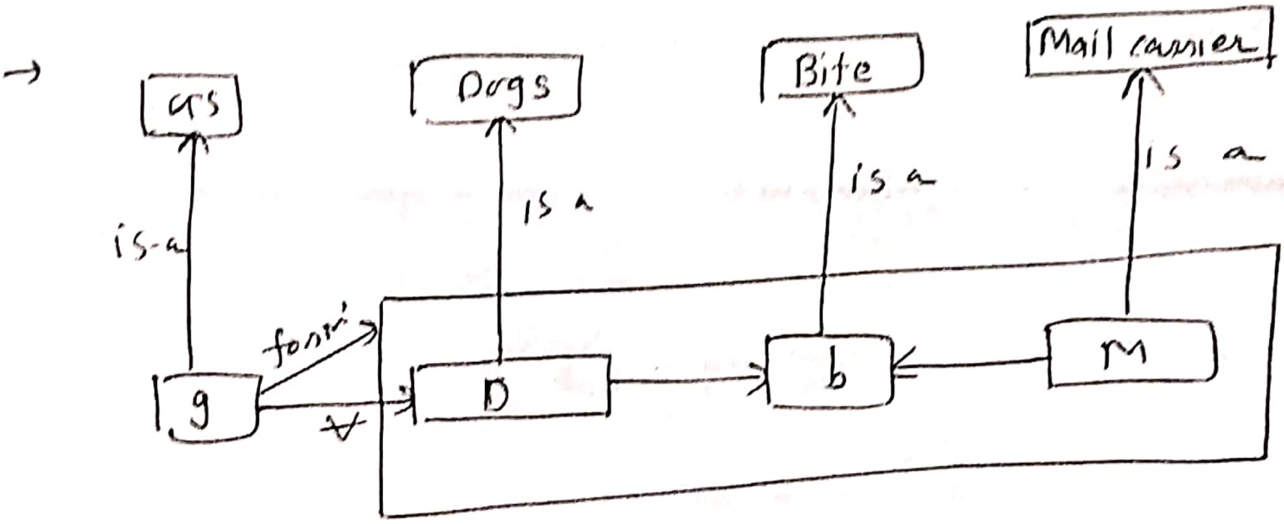
⇒ But now suppose that we want to represent the fact
"Every dog has bitten a mail carrier"
or in logic:

2) Every dog has bitten a mail carrier.



↳ To Represent this fact, it is necessary to encode the scope of the universally quantified variable x.

↳ This can be done using partitioning as shown in fig-7.

↳ Node g is an instance of the special class GS of general statements about the world.

↳ Every element of GS has at least two attributes

(1) a form, which states the relation that is being asserted

(2) one or more ∀ connections

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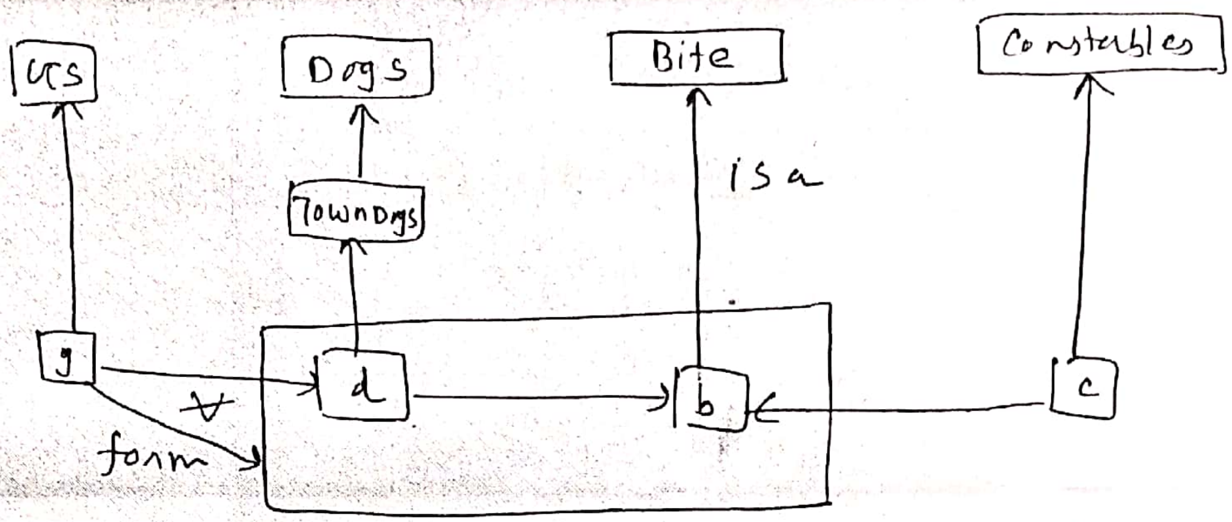
To see how partitioning makes variable quantification explicit, consider next the similar sentence:

3) Every Dog in town has bitten the Constables



↳ The representation of this sentence is shown in fig-8.

→ In this net, the node c representing the victim lies outside the form of the general statement.

⇒ figure 9 shows how yet another similar sentence:

"Every dog has bitten every mail carrier"

↳ In this case g has two ∀ links, one pointing to d, which represents any dog and one pointing to m, representing any mail carriers.

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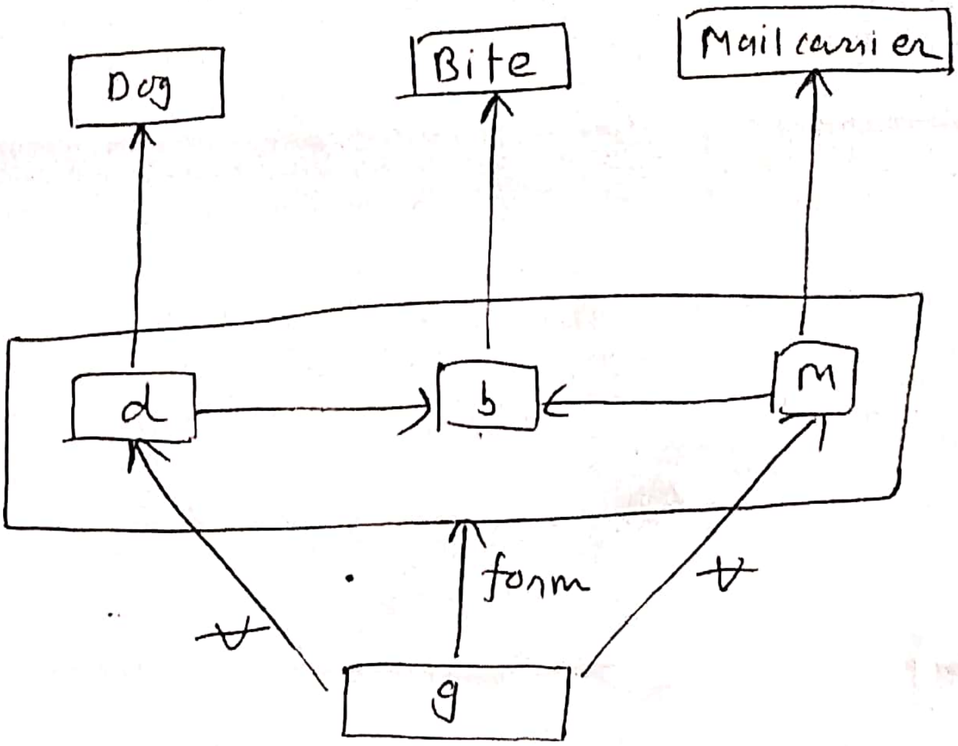
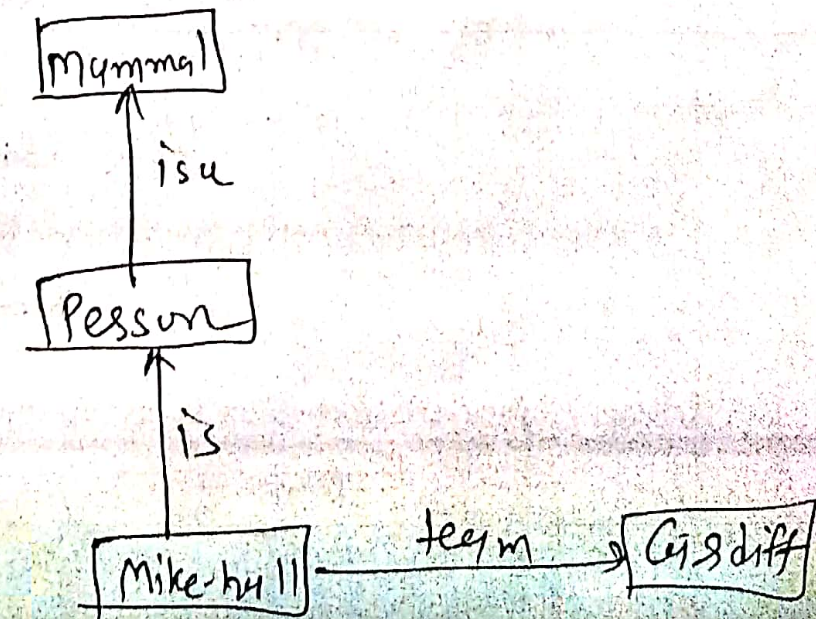
4) Every Dog has bitten every mail carrier.



Example ⇒ Represent following sentences using Semantic networks.

isa (Person, mammal), instance (mike-Hall, Person), team (mike-Hall, Cardiff) all in one graph

→



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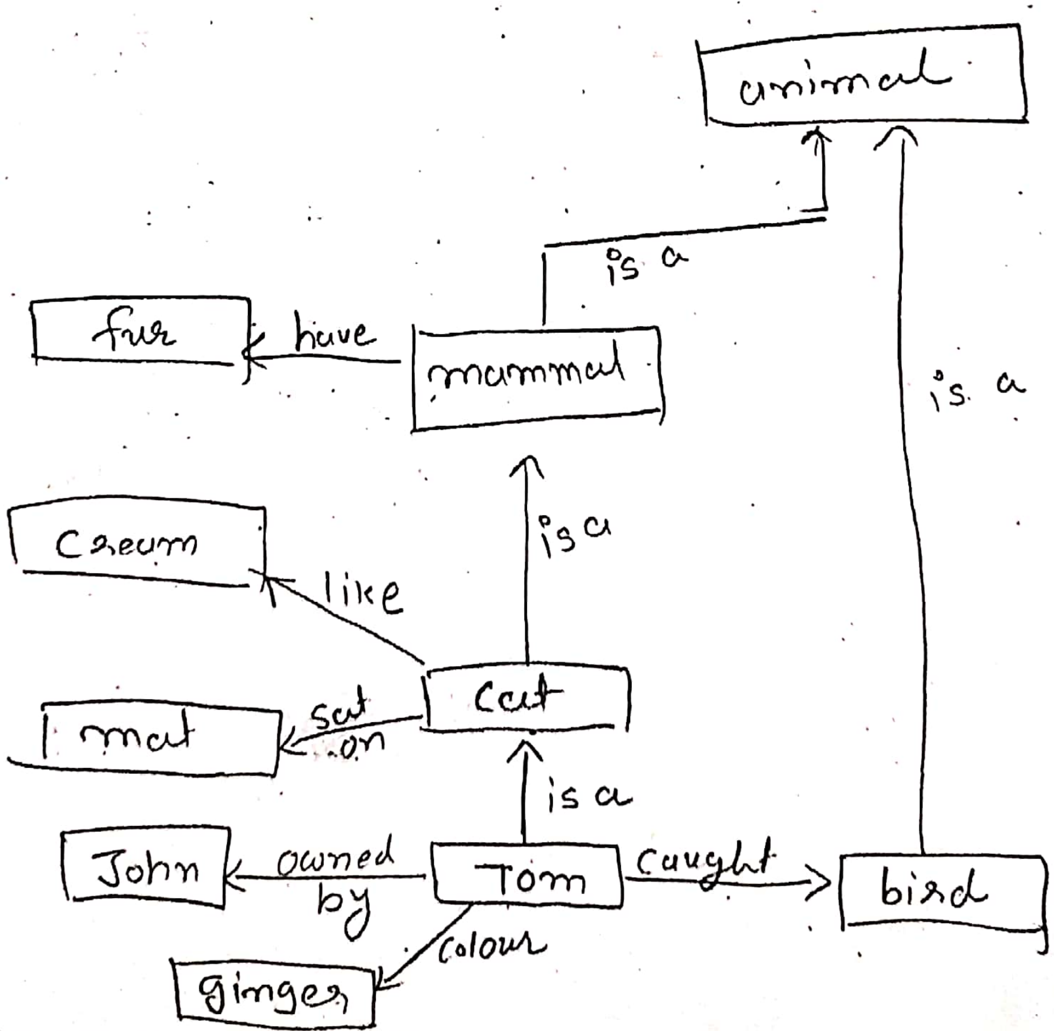
Que. Draw semantic net of following statements.

- Tom is a cat
- Tom caught a bird
- Tom is owned by John
- Tom is ginger in color
- Cats like cream
- The cat sat on the mat
- A cat is a mammal
- A bird is an animal
- All mammals are Animals
- Mammals have fur



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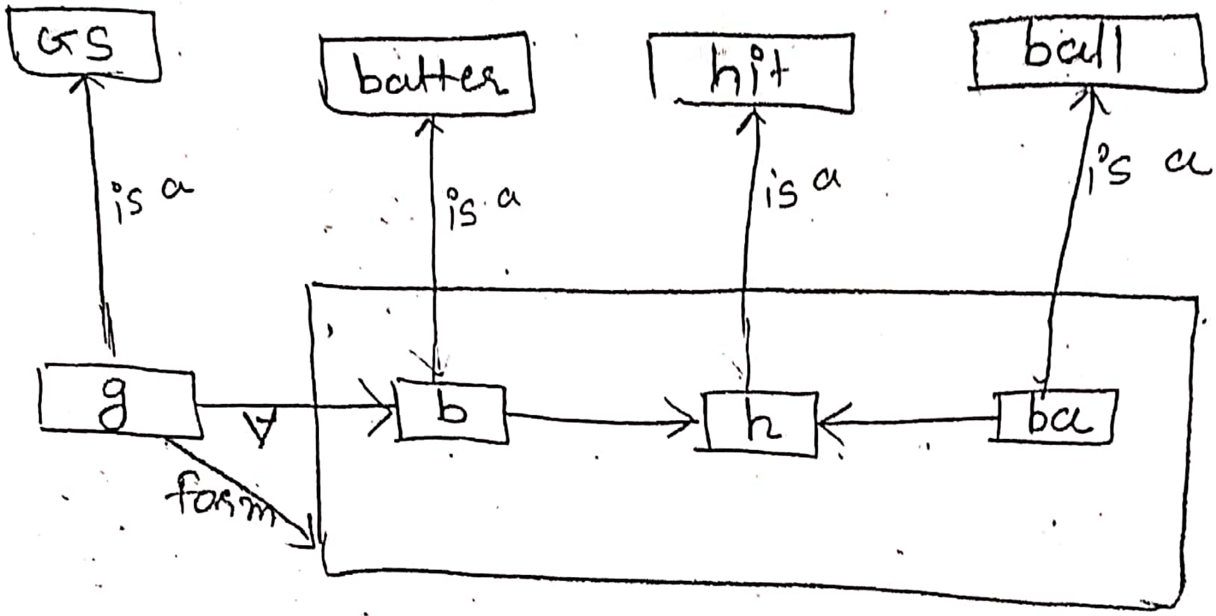
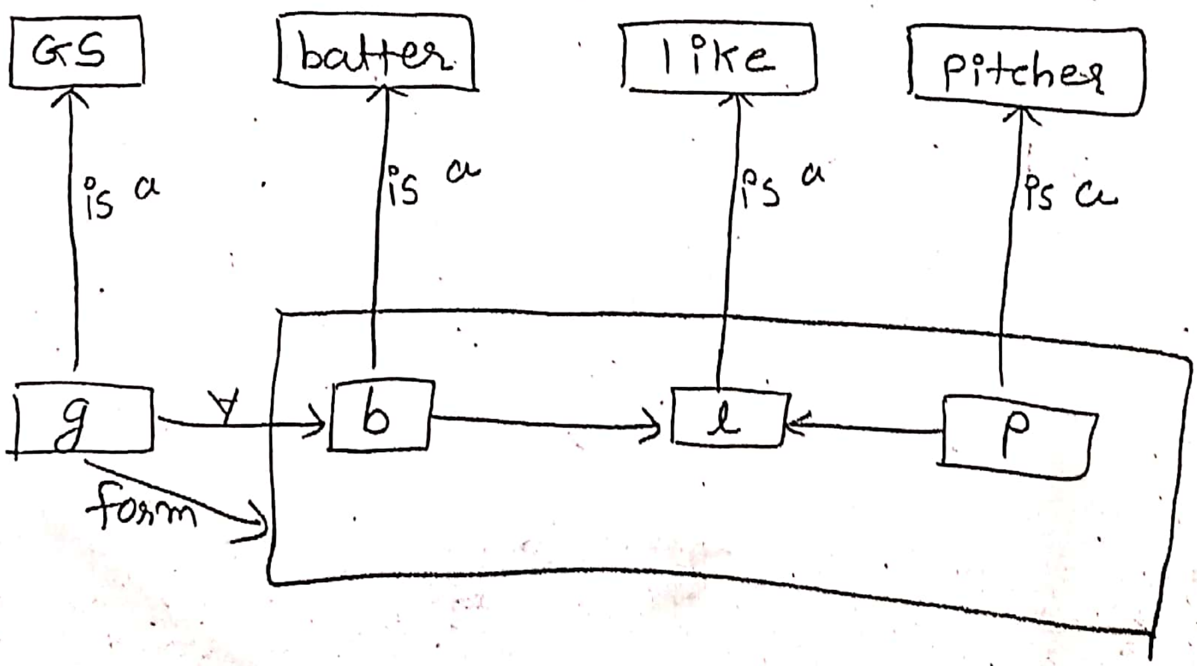
Que

Construct partitioned semantic net for the following!

(1) Every batter hit a ball



(2) All the batter like a the pitches



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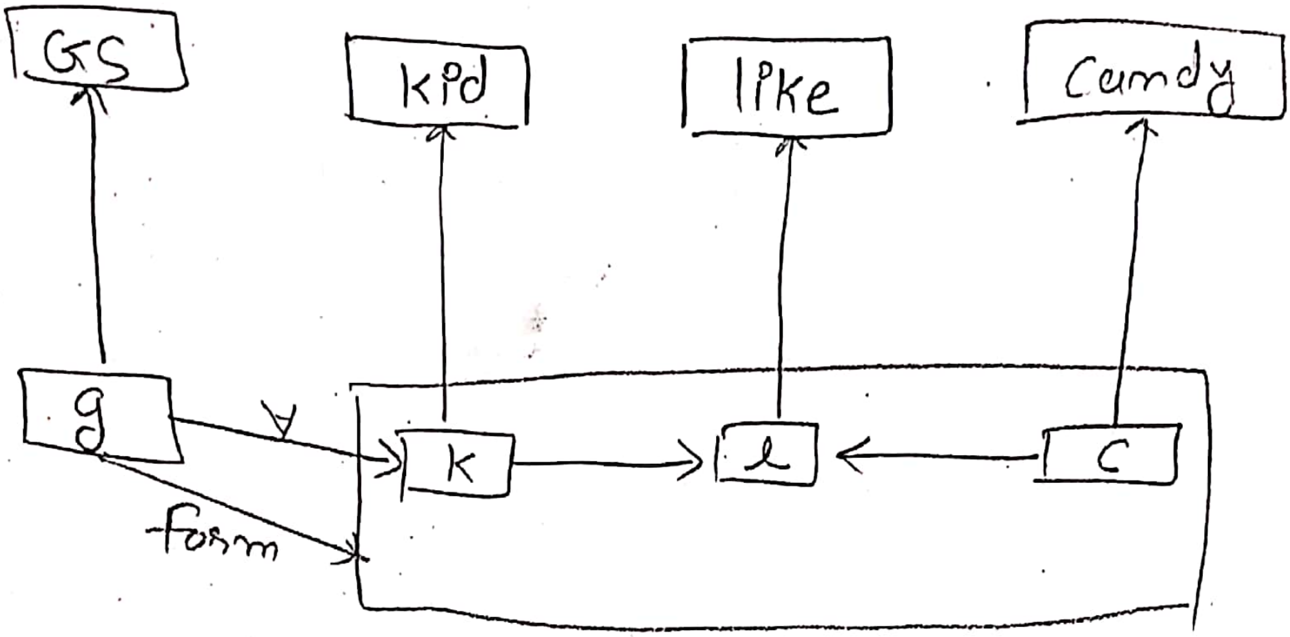
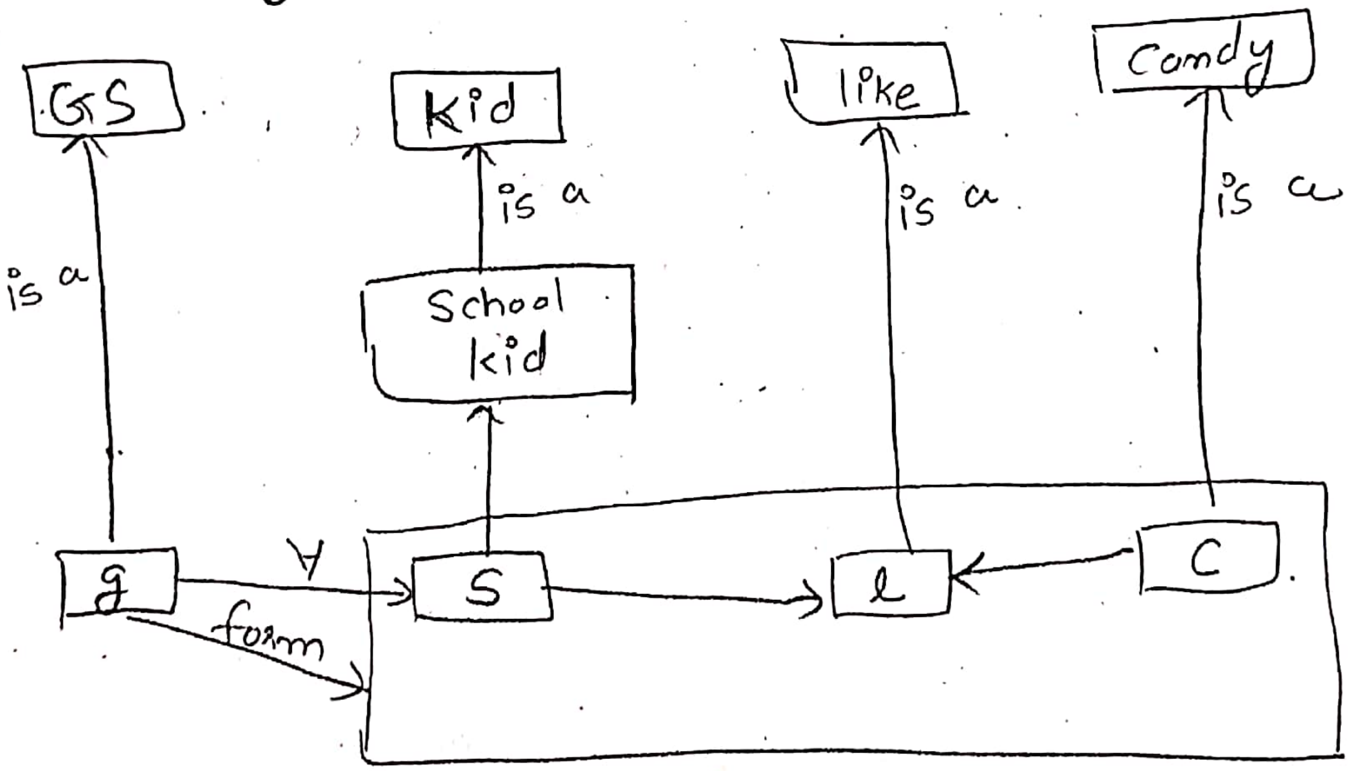
3) Every kid likes candy



(4) Every School going kid likes candy



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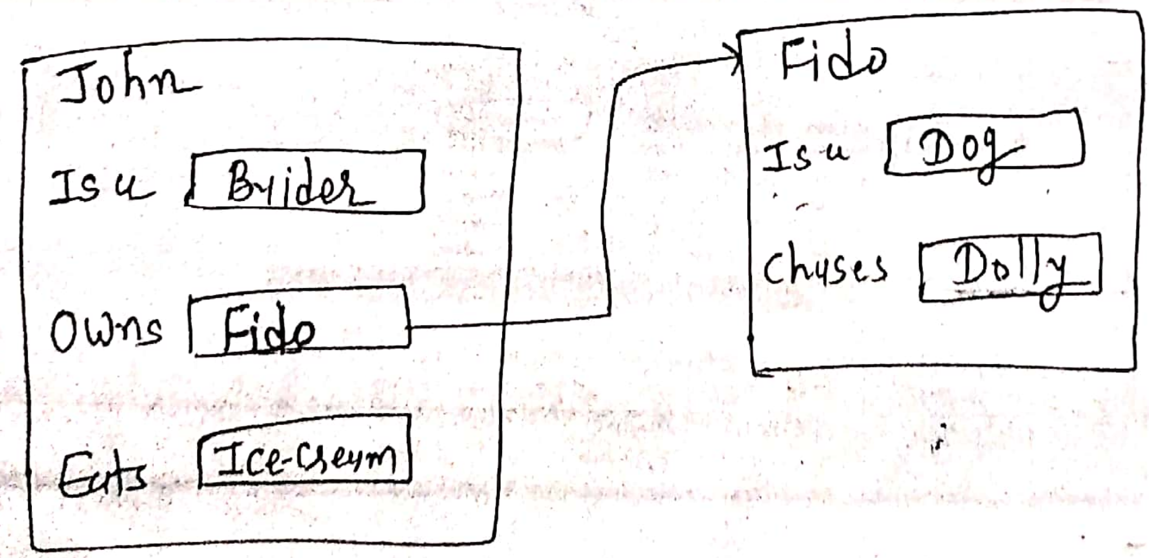
frames

→ frame Consist of number of frames which are Connected by links/edges like Semantic net.

→ for example Consider the following statements:

- John is builder
- John owns fido
- John eats Ice-cream
- Fido is a dog.
- fido chases Dolly.

↳ We Can represent such knowledge using frame Structure, in which John is a name of frame, is a name of slot (Attribute) and builder Value of slot. It is described in below fig



[fig: Frames]

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