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BE-B 20

Date: 15/09/2020

* Assignment 3

** Question 1

- Rules of Inference / procedure in Propositional Logic.

Logical reasoning is the process of drawing conclusions from premises using rules of inference. The basic rule of is modus ponens. It states that if both $P \rightarrow Q$ & P hold, then Q can be concluded, and it is written as

$$\frac{P \qquad P \rightarrow Q}{Q}$$

Here the lines above the dotted line are premises and the line below it is the conclusion drawn from the premises.

Rules of inference provide the templates or guidelines for constructing valid arguments from the statements that we already have.

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① Addition

If P is a premise, we can use Addition rule to derive $P \vee Q$.

$$\frac{P}{\therefore P \vee Q}$$

Eg. Let P be the proposition, "He studies very hard is true".

Therefore — "Either he studies very hard or he is a very bad student".

② Conjunction:

P & Q are two premises.

P → He studies hard

Q → He is the best boy

$$\frac{P \quad Q}{\therefore P \wedge Q}$$

Therefore, He studies very hard & he is the best boy in the class.

③ Simplification

If $P \wedge Q$ is a premise, we can use simplification rule to derive P.

$$\frac{P \wedge Q}{\therefore P}$$

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④ Modus Ponens

If P & $P \rightarrow Q$ are two premises, we can use Modus Ponens to derive Q.

$$\begin{array}{l} P \rightarrow Q \\ \underline{P} \\ \therefore Q \end{array}$$

⑤ Modus Tollens

If $P \rightarrow Q$ & $\neg Q$ are two premises, we can use Modus Tollens to derive $\neg P$.

$$\begin{array}{l} P \rightarrow Q \\ \underline{\neg Q} \\ \therefore \neg P \end{array}$$

⑥ Disjunctive Syllogism

$$\begin{array}{l} \neg P \\ \underline{P \vee Q} \\ \therefore Q \end{array}$$

⑦ Hypothetical Syllogism

$$\begin{array}{l} P \rightarrow Q \\ \underline{Q \rightarrow R} \\ \therefore P \rightarrow Q \end{array}$$

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⑧ Constructive Dilema

$$\frac{(P \rightarrow Q) \wedge (R \rightarrow S) \quad P \vee R}{\therefore Q \vee S}$$

⑨ Destructive Dilema

$$\frac{(P \rightarrow Q) \wedge (R \rightarrow S) \quad \neg Q \vee \neg S}{\therefore \neg P \vee \neg R}$$

** Question 2

* Resolution in Propositional Logic

① Convert all the propositions of F to clause form.

② Negate S & convert the result to clause form. Add it to the set of clauses obtained in step 1.

③ Repeat ~~unit~~ until either a contradition is found or no progress can be made.

ⓐ Select 2 clauses. Call these the parent clauses.

ⓑ Resolve them together. The resulting clause called the resolvent will be the disjunction of all of the literals of both the parent clauses with the following exception: If there are any pairs of literals L & $\neg$L such that one of the

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parent clauses contain L & other contains ¬L, then eliminate both L & ¬L from the resolvent.

(c) If the resolvent is the empty clause, then a contradiction has been found. If it is not, then add it to the set of clauses available to the procedure.

* Resolution in First Order Logic

(1) Convert all the statements of F to clause form.

(2) Negate S & convert the result to clause form. Add it to the set of clauses obtained in 1.

(3) Repeat until either a contradiction is found, no progress can be made or a predetermined amount of effort has been expended:

(a) Select 2 clauses. Call these the parent clauses.

(b) Resolve them together. The resolvent will be the disjunction of all of the literals of both of the parent clauses with appropriate substitutions performed.

(c) If the resolvent is the empty clause, then a contradiction has been found. If not, add it to the set of clauses available to the procedure.

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**Question 3

* Backward chaining

- It is reverse of forward chaining.
- Rules start with the goal.
- The rules whose right side matches with the root are considered.
- The process of selection is from right to left.
- Once a rule is applied, its left side is then looked upon upon searched in the right side again. This is continued till the initial state is reached.
- It is depth-first search algorithm.

Example:

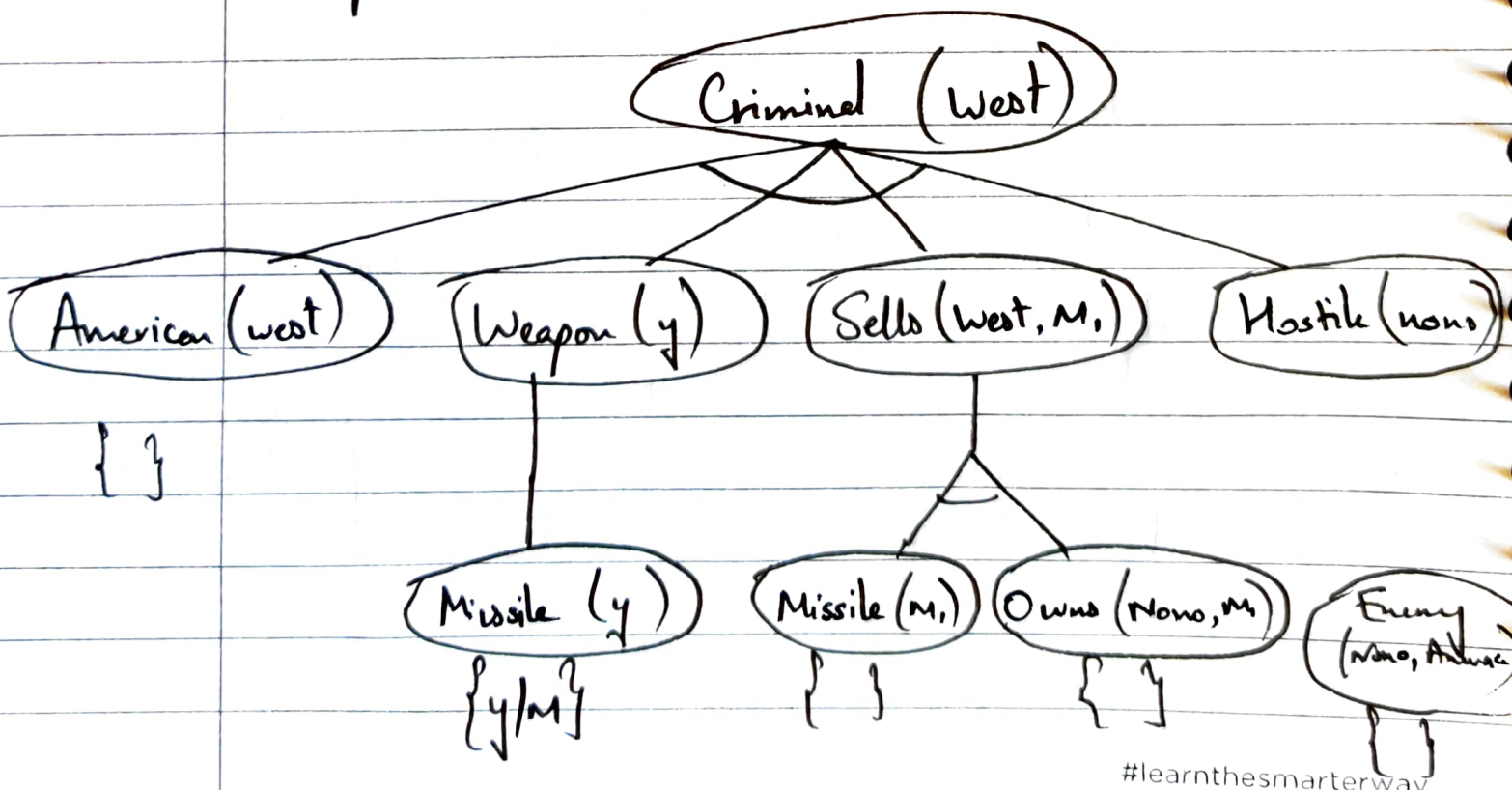

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Fig. Proof tree constructed by backward chaining to prove that West is a criminal. The tree should be read depth first left to right. To prove criminal (west), we have to prove the four conjuncts below it. Some of these are in the knowledge base, and others require further backward chaining.

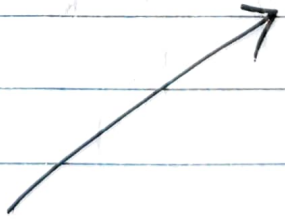
**Question 4

- Semantic net allow you to define relations between objects, including class & relations (X is a Y).
- Only restricted Inference supported by methods - that based on inheritance.
- Eg. Fido is a dog. dog have 4 legs
  so Fido has 4 legs.

P : Dog (Fido)

P → Q If Dog (Fido) Then has 4 legs (Fido)

$$\frac{P \qquad P \rightarrow Q}{Q}$$



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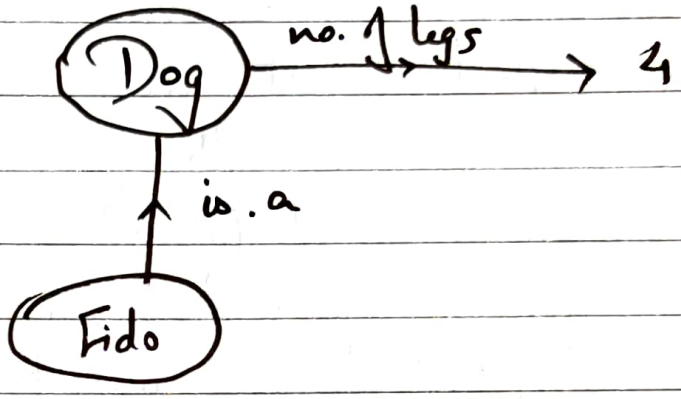

✳✳Question 5

- A frame is a prototype of a concept
  - Denoting the attributes of the concept.
  - The class of objects or concepts to which the concept in question belongs.
  - And some more things.
- An instance of a frame is a representation of a specific object.
- Instantiation of a frame.
- A slot in a frame specify the characteristics of the entity which the frame represents.
- A slot in a frame contains info as attribute-value pairs, default values etc.

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Eg.

① Employee details

Tim Smith (
(Profession (value, Manager))
(EmpID (value 100213))
(Address (value Pune))
)

② "Tweety is a blue bird having wings to fly".

Tweety (
(Species (value bird))
(Color (value yellow))
(Activity (value fly))
)