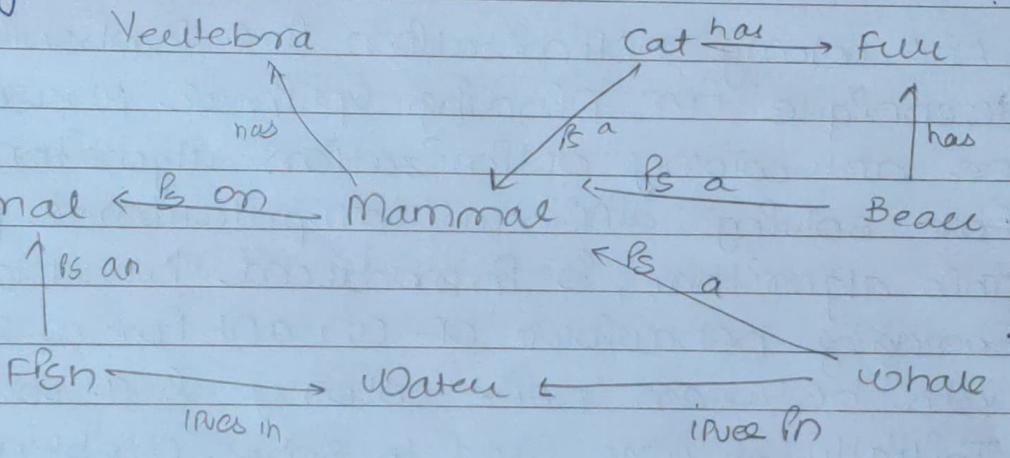
JHARANA
6000121003B

Assignment - 2

Q1. (i) Semantic Networks

- AI agents have to store & organize information in their memory
- One of the ways they do is by using Semantic Networks. They are a way of representing relationship between objects and ideas.
- For eg: a network might tell a computer the relationship between different animals.
- Eg:

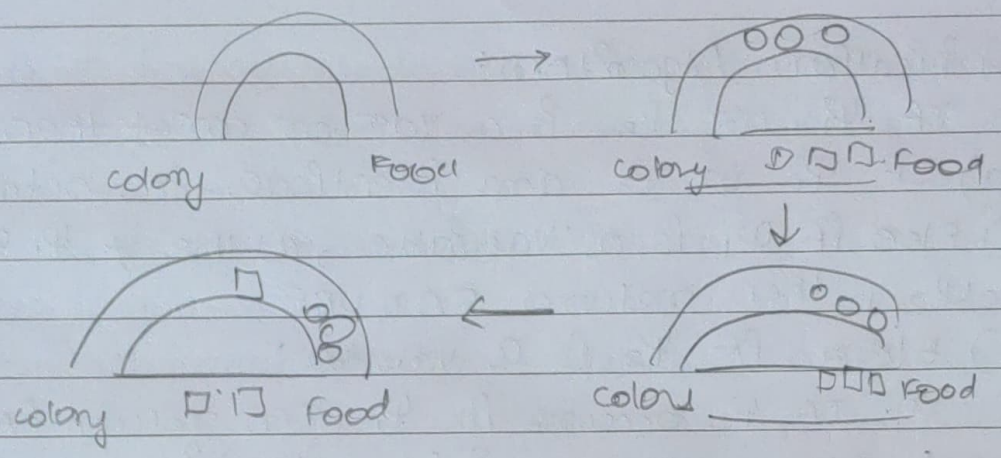


(ii)

RDF	OWL
1. It stands for Resource description Framework	1. It stands for web ontology language
2. RDF is a special framework found online that is tasked with the representation of online exchange data.	2. OWL is a special language used in the description of ontology online.
3. RDF refers to only to structure of data as it is available.	3. OWL refers to different semantic relationships of which bring various ontology

4. RDF is used in legal classes & relationship creation.	4. Excellent for making comparisons.
5. Exportation of content easy on RD	5. OWL is an excellent solution when there is a need to make implicit references

2. • Ant colony optimization is a probabilistic technique for finding optimal paths. In cs, the ant colony optimization algorithm is used for solving different computational problems.
• This algorithm, is introduced based on the foraging behaviour of an ant for a seeking a path between their colony & a source food.
• Initially, it was used to solve problems like TSP
• Ants live in colonies. The behaviour of ants is controlled by goal for searching food.
• while searching ants roaming around their colonies. An ant repeatedly hops from one place to another to find the food.
• It deposits an organic compound called pheromone on the ground.
• when returning it deposits pheromone on the paths based on quantity of the food.



Q3. Unification

- unification is the process of finding a substitute that makes two seperate logical atomic expression identical.
- It accept two literals as input & uses substitution to make them identical.
- Let Ψ_1 & Ψ_2 be 2 atomic sentences and be a unifier such that $\Psi_1 \sigma = \Psi_2 \sigma$ then UNIFY(Ψ_1, Ψ_2) can be written.

conditions for unification:

- Atoms or expressions with various predicate symbols can never be united.
- Both phase must have the same number of arguments.
- If two comparable variables appear in the same expression, unification will fail.

Unification Algorithm:

1. If Ψ_1 or Ψ_2 is a var or const then:
   a) If Ψ_1 or Ψ_2 are identical, the return NIL.
   b) Else if Ψ_1 is a variable, a the y Ψ_1 occurs in Ψ_2, then return FAILURE.
   c) Else if Ψ_2 is a variable:
      a. If Ψ_2 occurs in Ψ_1, then return FAILURE
      b. Else return $\{(\Psi_1 / \Psi_2)\}$
   d) Else return FAILURE.
2. If the initial predicate symbol in Ψ_1 & Ψ_2 are not same, then return Failure.
3. If Ψ_1 & Ψ_2 have a diff no of args, then return Failure.
4. Set substitution set (SUBST) to NIL.
5. For i = 1 to number of elements in Ψ_1
   a. Call unify function with the i^{th} element of Ψ_1 and i^{th} element of Ψ_2, and put the result into S
   b. If S-Failure then returns Failure.
   c. If S ≠ NIL then,
      a. Apply S to the remainder of both L1 & L2
      b. subset = Append (S, subset)
6. Return subset

Example:

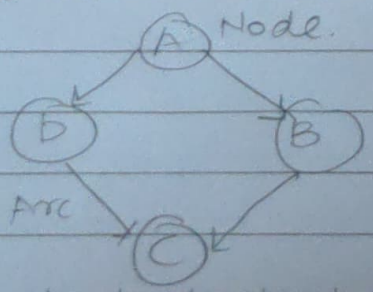
Unify (knows (Richard, x), knows (Richard, John))

Here Ψ_1 = knows (Richard, x),

Ψ_2 = knows (Richard, x)

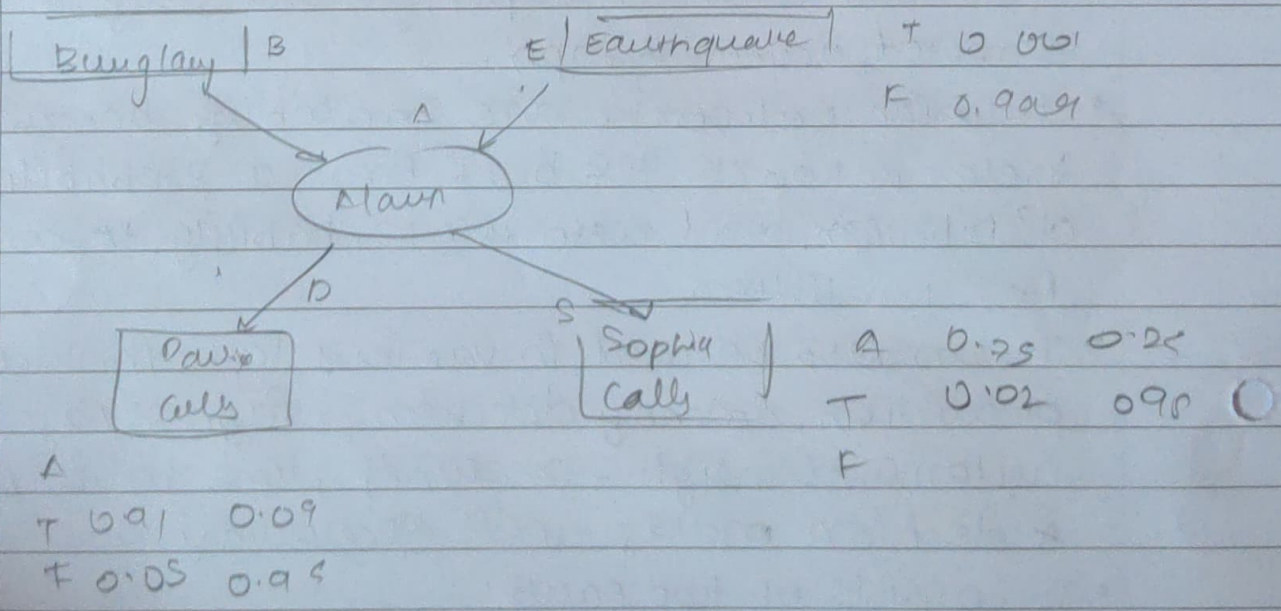
$S_0 \Rightarrow$ { knows (Richard, x), knows (Richard, John) }
$S_1 \Rightarrow$ { knows (Richard, John), knows (Richard, John) }
Succesfully Unified.
Unifier: { John / x }

4. • Bayesian Belief Network is a key computer technology for dealing with probabilistic events and to solve a problem which has uncertainty.
• A bayesian network is a probabilistic graphical model which represents a set of vars and their conditional dependencies using a directed acyclic graph
• Bayesian networks are probability because these networks are built from a probability distribution and also use probability theory for prediction.
• It can also be used in various tasks including prediction, anomaly detection, diagnosis, automated insight, reasoning, time series prediction & decision making under uncertainty
• It consists of two parts:
1. Directed Acyclic Graph.
2. Table of conditional probabilities



- Each node corresponds to the random variables, and a variable can be continuous or discrete.
- Arc or directed arrows represent the casual relationship or conditional probabilities between random variables.

Eg:
Calculate the probability that alarm has sounded, but there is neither a burglary nor an earthquake occurred, and David and Sophia both called the Harry.



Q5.

- Fuzzy set is a set having degrees of membership between 1 and 0. Fuzzy sets represented with ~ character for example, number of cars following traffic signals at a particular out of all cars present will have membership between [0,1]
- Partial membership exists when member of one fuzzy set can also be a part of other fuzzy sets in same universe.
- The degree of membership on truth is not same as probability, fuzzy truth represents membership in vaguely defined sets.
- A fuzzy set $\tilde{A}$ in the universe of discourse.

$$\tilde{A} = \{ (x, \mu_{\tilde{A}}(x)) ; x \in X \}$$

- When the universe of discourse, U, is discrete and finite.

Fuzzy set operations:

1. Union

These operations combine two fuzzy sets into one, taking the max value of each element from two sets.

2. Intersection

This operation takes the minimum value of each element from 2 fuzzy set. Using same sets from above.

3. Complement

This operation inverts the membership values of a fuzzy set, so that elements that were previously members have zero membership and elements that were not members have a membership value of 1.

4. Algebraic Sum

This operation adds the membership values of corresponding elements of two fuzzy sets.

5. Algebraic Product

This operation multiplies the membership values of corresponding elements