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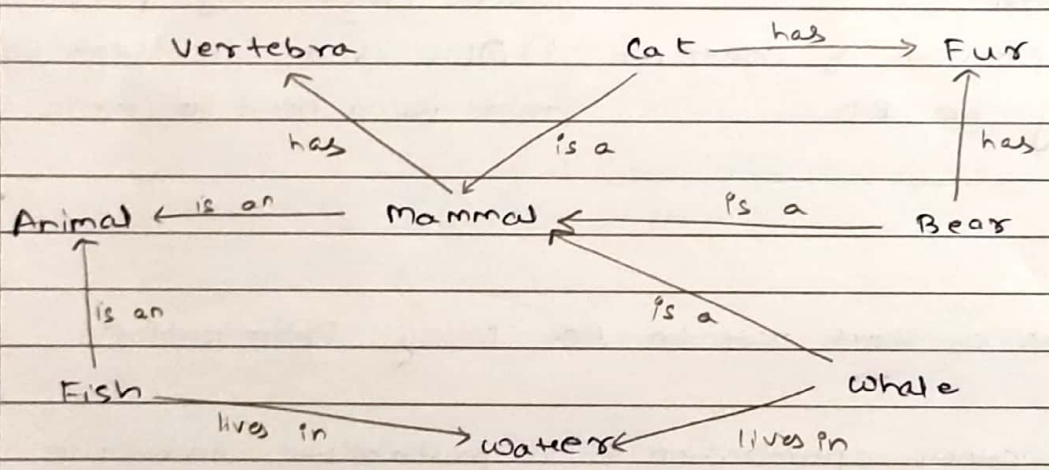
AI- Assignment 2

Q. 1) Write a short note on:

(i) Semantic Networks

→
- AI agents have to store and organize information in their memory.
- One of the ways they do is by using semantic Networks. They are a way of representing relationships between objects and ideas.
- For example, a network might tell a computer the relationship between different animals. (a cat is a mammal, a cat is a whiskers)
- example diagram:



ii) Compare RDF and OWL

→

RDF	OWL
1) It stands for Resource description framework.	1) It stands for Web Ontology language.
2) It is special framework found online that is tasked with the representation of online exchange of data.	2) OWL is a special language used in the description of ontologies online.
3) RDF refers to only the structure of data as it is available.	3) OWL refers to different semantic relationships of which bring in various programming practices.
4) Exploration of content easly on RD	4) OWL is an excellent solution when there is a need to make implicit ref.

Q.2) Write a short note on Ant Colony Optimization.

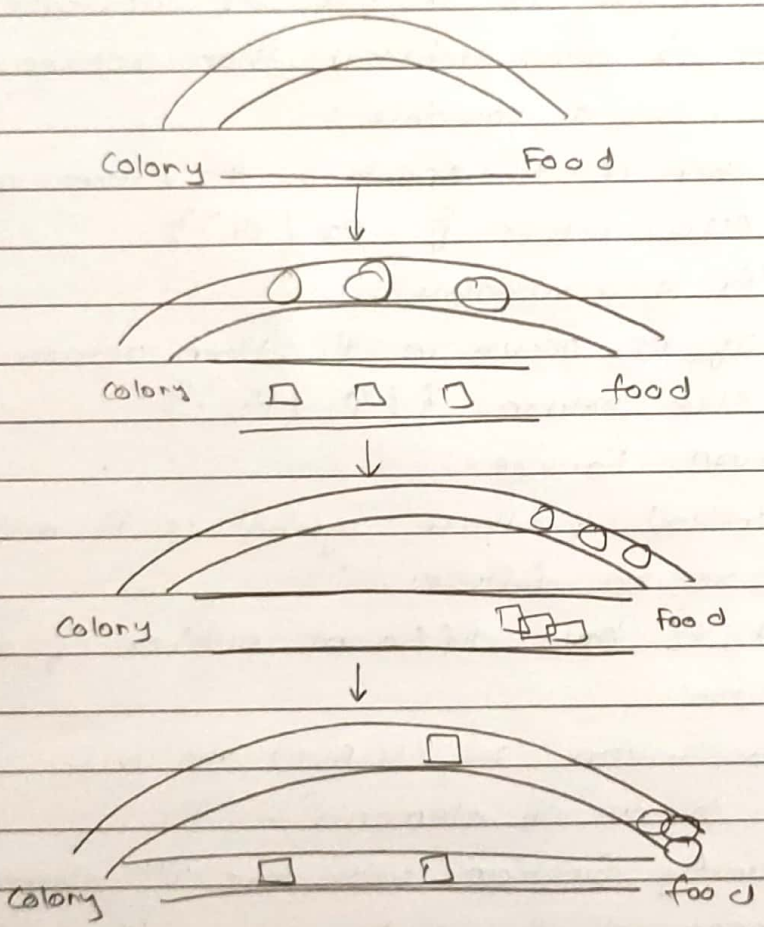
→

1) Ant colony optimization is a probablistic technique for finding optimal paths. In CS, the ant colony optimization algorithm is used for solving different computational problems.
2) This algorithm is introduced based on the behaviour of an ant seeking a path between their colony and a source food.
3) Initially, it was used to solve problems like TSP. It is also used to solve optimization problems.
4) While searching ants roaming around their colonies. An ant

repeatedly hops from one place to another to find the food.

5) While searching, it deposits an organic compound called pheromone on the ground.

6) When returning its deposits pheromone on the paths based on the quantity and quality of the food.



Q. 3) Explain Unification algorithm

→ • Unification is the process of finding a substitute that makes two seperate logical atomic expression identical.

• Unification Algorithm:

(1) If ψ_1 or ψ_2 is a var or constant then:

a) If ψ_1 or ψ_2 are identical, then return NIL

b) Else if ψ is a variable:

(a) then if ψ_1 occurs in ψ_2, then return Failure

(b) Else return $\{(\psi_2 / \psi_1)\}$

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 is ψ_1 and ψ_2 are not same, then return failure.

(3) If ψ_1 and ψ_2 have different number of arguments, then return failure.

(4) Set Substitution set (SUBST) to NIL

(5) For i=1 to no. 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 result in S.

(b) If S = Failure then return failure.

(c) If S ≠ NILL then

(a) Apply S to the remainder of both L_1 and L_2

(b) SUBST = APPEND(S, SUBST)

(6) Return Subset

Example:

UNIFY (knows (Richard, x) ; knows (Richard , John))

Here ψ_1 = knows (Richard, x)

ψ_2 = knows (Richard, John)

So $\Rightarrow$: { knows (Richard, x), knows (Richard, John) }

$S_1 \Rightarrow$ { knows (Richard, John) ; knows (Richard, John) }

Successfully unified.

Unifier : { John / x }

Q.4) Explain 'Bayesian Belief Network'

→ 1) Bayesian belief Network is a key computer technology for dealing with probablistic events and to solve a problem which has uncertainity.

2) A Bayesian Network is a probabilistic graphical model which represents a set of vars and their conditional dependencies using a directed acyclic graph

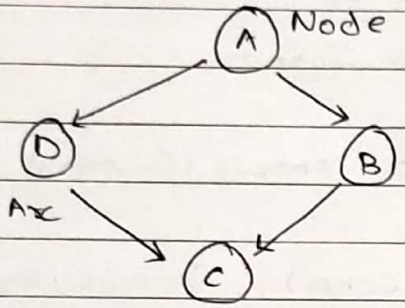
3) Bayesian networks are probabilistic because these networks are busy from probability distributions and also use probability theory for prediction.

4) It can also be used in various tasks including predictions, anomally detection, diagnostics, automated insights, reasoning, time series predictions and decision making under uncertainity.

5) It consist of two parts :

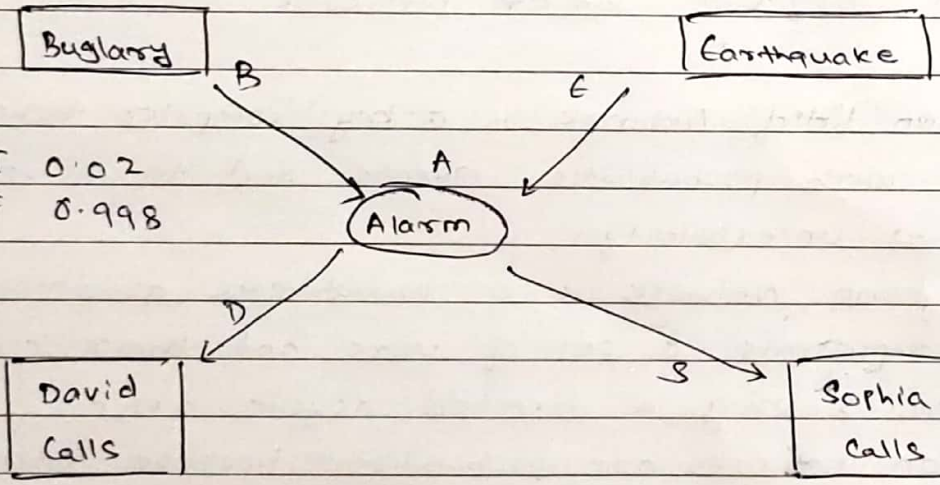
(1) Directed Acyclic graph.

(2) Table of conditional probabilities.



Example :

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



B	E	P(A=T)	P(A=F)
T	T	0.94	0.06
T	F	0.95	0.04
F	T	0.69	0.69
F	F	0.999	0.999

A	P(D=T)	P(D=F)
T	0.91	0.09
F	0.05	0.95

A	P(S=T)	P(S=F)
T	0.75	0.25
F	0.02	0.98

5) Define Fuzzy set. Explain various Fuzzy set operations with suitable example.

→ i) Fuzzy set is a set having degrees of membership between 1 and 0. Fuzzy set are represented with ~ character. For example, Number of cars following traffic signals at a particular out of all cars present will have membership value between [0,1].

2) Partial membership exists when members of one fuzzy set can also be part of other fuzzy set in the same universe.

3) A fuzzy set $\tilde{A}$ in the universe of disclosure, U can be defined as a set of ordered pairs and it is given by

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

When the universe of disclosure, μ is discrete of finite, fuzzy set $A\sim$ is given by:

$$\tilde{A} = \sum_i \frac{\mu_{\tilde{A}}(x_i)}{x_i} \quad , \quad \tilde{A} = \int \frac{\mu_{\tilde{A}}(x)}{x}$$

4) Fuzzy set operations:

a) Union:

This operations combines two fuzzy sets into once, taking the max value of each element from the two sets.

Example, consider 2 fuzzy set.

$A = \{0.3, 0.7, 0.9\}$

$B = \{0.4, 0.6, 0.8\}$

$A \cup B = \{0.4, 0.7, 0.9\}$

(b) Intersection:

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

$A \cap B = \{0.3, 0.6, 0.8\}$

(c) 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 membership have a membership value of 1

Example: $C = \{0.2, 0.5, 0.8\}$

$C' = \{0.8, 0.5, 0.2\}$

(d) Algebraic Sum:

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

Using A and B from before:

$A \oplus B = \{0.7, 1.3, 1.7\}$

(e) Algebraic Product:

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

Using A & B from before:

$A \otimes B = \{0.12, 0.42, 0.72\}$