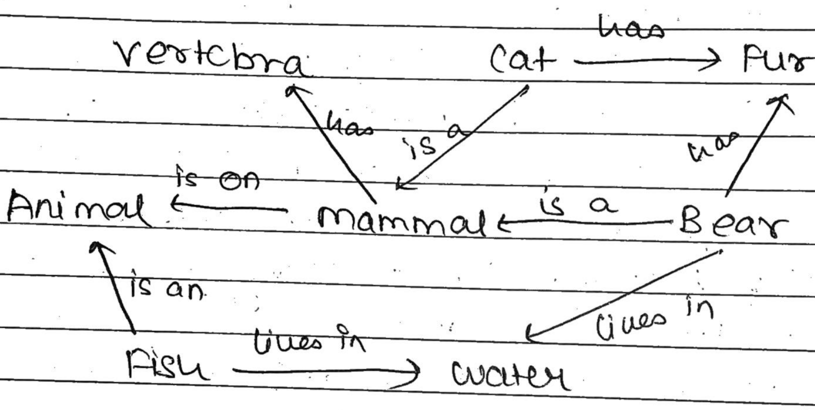
Deshna Gandhi
60004210047

AI Assignment

Q1)

(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 HAS whiskers)
- Example diagram:



(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 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	3) OWL refers to different semantic relationships of

it is available.	which bring in various programming practices.
4) RDF is used to legal classes of relationship creation	4) OWL is 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.

Q2. Write short note on Ant Colony Optimization.

Ans: i) 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.

ii) This algorithm is introduced based on the foraging behaviour of an ant a seeking a path between their colony and source food.

iii) Initially, it was used to solve problems like TSP. It is also used to solve optimization problems.

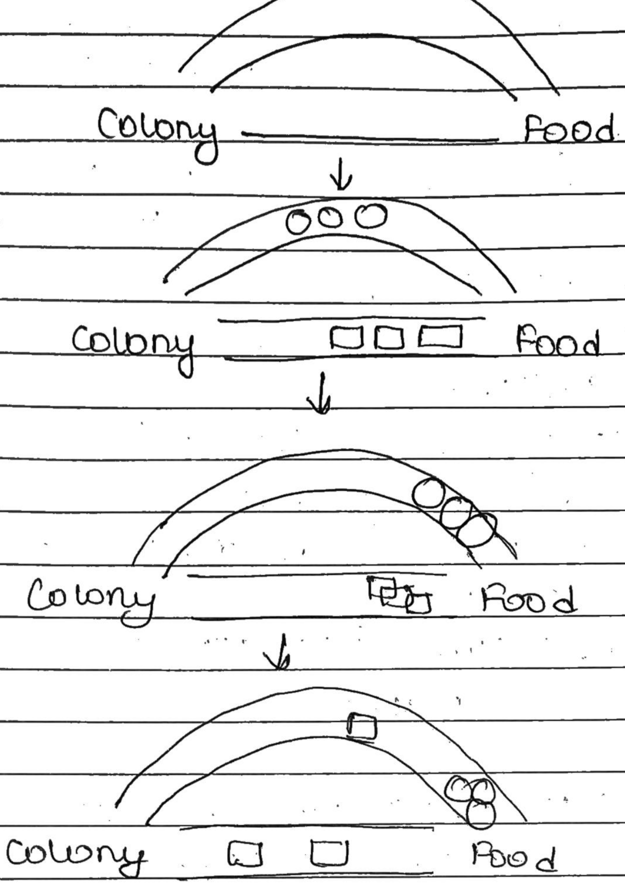
iv) Ants live in colonies. The behaviour of ants is controlled by goal for searching food.

(v) While searching ants roaming around their colonies. An ant repeatedly hops from one place to another to find the food.

(vi) It deposits an organic compound called pheromone on the ground.

(vii) When returning it deposits pheromone on the paths based on the quantity and quality of the food.

MRP ₹ 120/-



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

Conditions for Unification,
- Atoms or expressions with various predicate symbols can never be united
- Both phases 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 constant then:

   a) If Ψ_1 or Ψ_2 are identical then return NIL.

   b) Else if Ψ_1 is a variable

      a) then if Ψ_1 occours 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 occours 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 (SUBSET) to NIL.

5. For i=1 to number of elements in Ψ_1

   a) call unify function with the ith element of Ψ_1 and ith 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.

~~Exption~~

Exampu:

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

Here, Ψ_1 = knows (Richard, x), &

Ψ_2 = knows (Richard, X).

S_0 => {knows (Richard, x), knows (Richard, John)}

S_1 => {knows (Richard, John), knows (Richard, John)}

Successfully Unified.

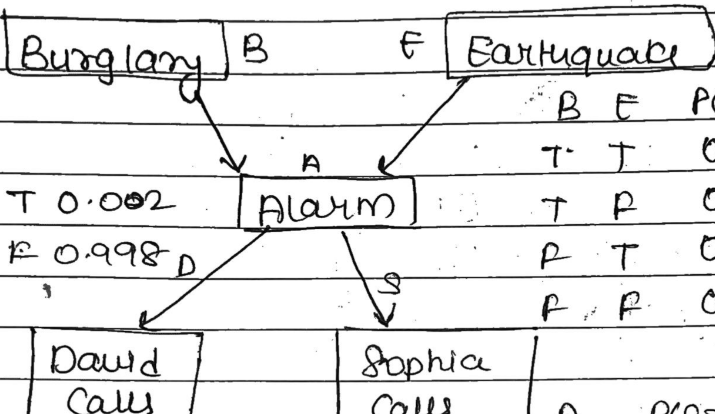
Unifier: {John/x}

Q4. Bayesian Belief Network is a key computer technology for dealing with probabilistic events and to solve a problem which has uncertainity.

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

- Bayesian n/w are probabilistic becoz these n/ws 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, diagnostic automated insight, reasoning time series prediction and decision making under uncertainity.
- It consists of 2 parts
  1. Directed Acyclic graphs
  2. Table of conditional probabilities.

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



T 0.002
F 0.998

B	E	P(A=T)	P(A=F)
T	T	0.94	0.06
T	F	0.95	0.04
F	T	0.69	0.89
F	F	0.99	0.99

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

Q5. i) Fuzzy set is a set having degrees of membership between 1 and 0. Fuzzy sets 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]

ii) Partial membership exists when member of one fuzzy set can also be a part of other fuzzy sets in the same universe.

iii) The degree of membership or truth is not same as probability, fuzzy truth represents membership in vaguely defined sets.

iv) A fuzzy set A~ in the universe of disclosure U can be defined ~~as~~ 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, U is discrete & ~~finite~~ finite, fuzzy set $\tilde{A}$ is given by

$$\tilde{A} = \sum_{i}^{n} \frac{\mu_{\tilde{A}}(x_i)}{x_i}, \quad \tilde{A} = \int \frac{\mu_{\tilde{A}}(x)}{x}$$

Fuzzy set operations:

1. Union:
This operation combines two fuzzy sets into one, taking the max value of each element from the two sets
Ex, consider 2 fuzzy sets
$A = \{0.3, 0.7, 0.9\}$
$B = \{0.4, 0.6, 0.8\}$
$A \cup B = \{0.4, 0.7, 0.9\}$

2. Intersection,
This operation takes min value of each element from 2 fuzzy set,
using same sets from above,
$A \cap B = \{0.3, 0.6, 0.8\}$

3. Complement.
This operation inverts the membership values of a fuzzy set, so that elements that not members have a membership value of 1
Ex. $C = \{0.2, 0.5, 0.8\}$
$C' = \{0.8, 0.5, 0.2\}$

4. Algebraic Sum
This operation adds the membership values of corresponding elements two fuzzy sets using A & B from before:
$A \oplus B = \{0.7, 1.3, 1.7\}$

5. Algebraic Product
This operation multiplies the membership values of corresponding elements in 2 fuzzy sets using A & B from before
$A \otimes B = \{0.12, 0.42, 0.72\}$