Q-3 Explain Ant Colony optimization in Detail.

=> Ant Colony optimization techniqaue was introduced by Marco Dorigo in 1990s

=> Ants communicate with each other using touch, pheromone and sound.

=> We know that pheromones are organic chemical compound which are secreted by ants that trigger responses in peer ant members.

=> We can design an algorithm on this behaviour of ants.

=> For explaining the concept, I am using single ant colony and a single food source.

=> we will imagine the scenario using graphs.

=> Ants will be node.

=> food source will also be node or vertice.

=> The path serves as edges.

=> The amount of pheromone released will be weight of the edge.

⇒ Suppose graph $G = (V, E)$ $V \to$ vertices and $E \to$ edges.

⇒ Here, $V_s \Rightarrow$ source vertice
$V_d \Rightarrow$ destination vertice

⇒ E_1 and E_2 are edges of lengths L_1 and L_2

⇒ Associated pheromone values ⇒ R_1 and R_2

⇒ Now, for each ant, starting probability of selection of path can be: →

$$\boxed{P_i = \frac{R_i}{R_1 + R_2} \quad \text{where, } i = 1, 2}$$

⇒ If $R_1 > R_2$, probability of choosing E_1 is higher

⇒ Now, if returning takes place from E_1; then pheromone value will be updated

⇒ This updation will be made on 2 criterias:-
(1) evaporation rate
(2) Length of path

⇒ Update with consideration of evaporation rate:→

$$R_i \Leftarrow (1 - V) * R_i$$

⇒ $V \Rightarrow$ interval that regulates pheromone evaporation.

=) For path length: →

$$R_i \leftarrow R_i + \frac{k}{L_i}$$

=) $k \rightarrow$ model parameter.

=) At each iteration, all ants are at V_s.

=) Then, ants will move from V_s to V_d.

=) At last, all ants will make return journey.

Q-2 Describe the following Facts to Predicate logic.

~~Ans => (1)~~

(i) Every child loves Santa

Ans -> $\forall x\,(CHILD(x) \rightarrow LOVES(x, SANTA))$

(ii) Everyone who loves Santa loves any reindeer

Ans -> $\forall x\,(LOVES(x, SANTA) \rightarrow \forall y\,(REINDEER(y) \rightarrow LOVES(x, y)))$

(iii) Rudolph is reindeer and Rudolph has red nose.

Ans => ~~REINDEER (RUDO~~
$REINDEER(Rudolph) \wedge REDNOSE(Rudolph)$

(iv) Anything which has red nose is weird or is a clown

Ans => $\forall x\,(REDNOSE(x) \rightarrow WEIRD(x) \vee CLOWN(x))$

(v) No Reindeer is clown.

=> $\neg \exists x\,(REINDEER(x) \wedge CLOWN(x))$

(vi) Scrooge does not love anything which is weird.

=> $\forall x\,(WEIRD(x) \rightarrow \neg LOVES(Scrooge, x))$

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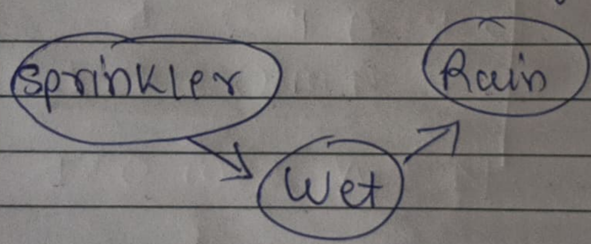
Q-5 Explain Baysein Network.

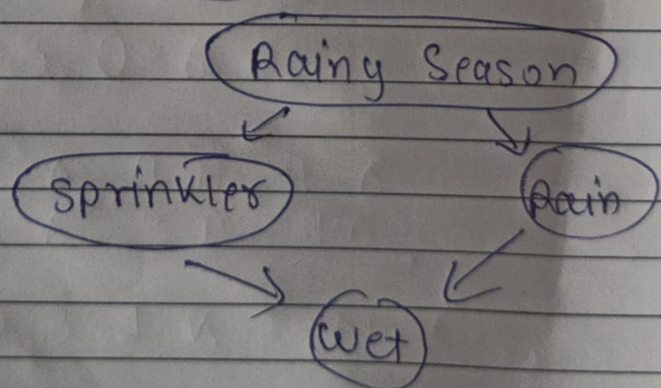
=) The main idea is to describe the real world.

=) Here, we will use a more local representation in which we will describe clusters of events that interact

=) For example:→

S: sprinkler was on last night
W: grass is wet
R: it rained last night.





=) There are 2 different ways that proposition can influence the likelihood:-

(1) Observing a symptom affects the likelihood of all possible causes
(2) The causes influence to the likelihood of symptoms.

=> The main idea behind the Bayesian network is to make a clear distinction between two kinds of influence.

=> The graph shown is Directed Acyclic Graph.

=> But, still we need more information

=> So, we create a probability table for that.

=> When the most genuine reasoning does not seem true, we need an undirected graph in which arcs can be used to transmit probabilities in either direction.

=> We need to make sure that no cycle exists.

=> 3 algorithms are available for such computations: -

(1) Stochastic algorithms
(2) message passing algo.
(3) clinche' triangulation method

Ans (4) POTATO
$=$ + TOMATO
PUMPKIN

$\Rightarrow$ Firstly, applying Rule 5;

$\Rightarrow$ P = 1

$\Rightarrow$ 1 O T A T O
\+ T O M A T O
1 U M 1 K I N

$\Rightarrow$ Here; U = 0; T = 9

$\Rightarrow$ 1 0 9 A 9 0
\+ 9 0 M A 9 0
1 0 M I K I N

$\Rightarrow$ M = 3, O = 6

1 6 9 A 9 6
\+ 9 6 3 A 9 6
1 0 3 1 K I N

I = 7; N = 2

$\Rightarrow$ 1 6 8 A 8 6
\+ 8 6 3 A 8 6
1 0 3 1 K 7 2

$1 + A + A = K$

$1 + 4 + 4 = 9.$

$\Rightarrow K = 9;\ A = 4$

$$
\begin{array}{rcccccc}
\Rightarrow & 1 & 6 & 8 & 4 & 8 & 6 \\
+ & 8 & 6 & 3 & 4 & 8 & 6 \\
\hline
1 & 0 & 3 & 1 & 9 & 7 & 2
\end{array}
$$

$\Rightarrow P = 1 \quad O = 6 \quad T = 8 \quad M = 3$

$A = 4 \quad N = 2 \quad U = 0$

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DNN	CNN
=> It is a kind of neural network with many layers.	=> It is an one kind of Deep neural network
=> Deep neural network is used in the field of supervised ML	=> CNN is used for image classification