18CSC305J Artificial Intelligence notes ct-1

Artificial Intelligence (SRM Institute of Science and Technology)

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CT-1

(*) What is agents and types of agents?

→ Artificial intelligence is defined as the study of rational agents. A rational agent could be anything that makes decisions, as a person, firm, machine, or software. It carries out an action with the best outcomes after considering past and current percepts. An AI system is composed of an agent and it's environment. The agents act in their environment. The environment may contain other agents.

Agent = Architecture + Agent Program

(*) Types of Agents :-

Types are total five type:-
(i) Simple Reflex Agents
(ii) Model - Based Reflex Agents
(iii) Goal Based Agents
(iv) Utility - Based Agents
(v) Learning Agents

(i) Simplex reflex agents:-

→ simple reflex agents ignore the rest of the percept history and act only on the basis of the current percept. percept history is the history of all that an agent has perceived to date. The agent function is based on the condition

condition-action rule. A condition-action rule is a rule that maps a state i.e, conditions to an action. If the condition is true, then action is taken, else not. This agent function only succeeds when the environment is fully observervable. For simple reflex agents operating in partially observable, environments, infinite loops ~~if the agent~~ are often unavoidable It may be possible to escape from infinite loops if the agent can ~~random~~ randomize it's action.

DisAD:-

(i) very limited intelligence.

(ii) No knowledge of non-perceptual parts of the state.

(iii) usually too big to generate and store.

(iv) If there occurs any change in the environment, then the collection of rules need to be updated.

② Model-Based Reflex agents:-

It works by finding a rule whose condition matches the current situations. A model-based agent can handle partially observable environments by the use of a model about the world.

The agent has to keep track of the internal state which is adjusted by each percept and that depends on the percept history. The current state is stored inside the agent which maintains some kind of structure describing the part of the world which cannot be seen.

③ Goal-based agents:-

These kinds of agents take decisions based on how far they are currently from their goal. Their every action is intended to reduce it's distance from the goal. This allows the agent a way to choose among multiple possibilities, selecting the one which reaches a goal state. The knowledge that supports it's decisions is represented explicitly and can be modified which makes these agents more flexible. They usually require search and planning. The goal-based agent's behavior can easily be changed.

④ Utility-based agents:-

The agents which are developed having their end uses as building blocks are called utility-based agents.

When there are multiple possible alternatives, then to decide which one is best, utility-based agents are used. They choose actions based on a preference (utility) for each state. Sometimes achieving the desired goal is not enough. We may look for a quicker, safer, cheaper trip to reach a destination. Agent happiness should be taken into consideration. Utility describe how "happy" the agent is. Because of the uncertainty in the world, a utility agent chooses the action that maximizes the expected utility. A utility function maps a state onto a real number which describe the associated degree of happiness.

⑤ Learning Agent :-

A learning agent in AI is the type of agent that can learn from its past experiences or it's has learning capabilites. It starts to act with basic knowledge and then is able to act and adapt automatically through learning.

A learning agent has mainly four conceptual components, which are.

1.) Learning elements:- It is responsible for making improvements by learning from the environments

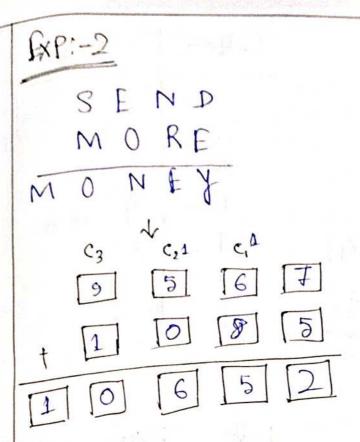2. Critic:- The learning element takes feedback from critics which describes how well the agent is doing with respect to a fixed performance standard.

3. Performance elements:- It is responsible for selecting external actions.

4. Problem Generator:- This components is responsible for suggesting actions that will ~~lead~~ lead to new and informative experiences.

(*) Constraint Satisfaction Problem (CSP):

Crypt-Arithmetic Problem:-

(*) Constraints:-
(i) NO two letters have same value.

(ii) Sum of digits must be as shown in problem.

(iii) There should be only one carry forward.

Note:-

Digits that can be assigned to a word / alphabet $(0-9)$
<u>Range</u>

⊙ Start from the left most digit = 1

Example:-

$$\begin{array}{r} T\ O \\ +\ G\ O \\ \hline O\ U\ T \end{array}$$

Letter		Digit
T	→	2
O	→	1
G	→	8
U	→	0

$$\begin{array}{r} \boxed{2}\ \boxed{1} \\ +\ \boxed{8}\ \boxed{1} \\ \hline \boxed{1}\ \boxed{0}\ \boxed{2} \end{array}$$

(*) video (Easy Engineering classes)

Exp:-2

```
  S E N D
  M O R E
-----------
M O N E Y
```

Letter	Digit
S	9
M	1
E	5
N	6
O	0
R	8
D	7
Y	2

C_3 $C_2 1$ $C_1 1$

```
 9   5   6   7
     1   0   8   5
 +
-----------------
 1   0   6   5   2
```

$7 + 5 = 12$

Example: 3:-

```
   E A T
 T H A T
-----------
A P P L E
```

```
        8     1     9
+   9   2     1     9
-------------------------
 1  0   0     3     8
```

value:-

Letter	Digit
A	1
P	0
L	3
E	8
T	9
H	2

Example - 4 :-

```
    S O M E
    T I M E
  ─────────
    S P E N T
```

Letter	Digit
S →	1
O	
M →	3
E —	4
T →	8
I	
P →	0

```
  [1]  [9]  [3]  [4]
+ [8]  [5]  [3]  [4]
─────────────────────
[1][0][4]  [6]  [8]
```

Ex :- 5

```
  B A  S E
  B A  L L
 ─────────
  G A M E S
```

Letter	Digit
B	
A	
S	
E	
L	
G	
M	

```
→    [7]  [4]  [8]  [3]
+    [7]  [4]  [5]  [5]
  ──────────────────────
  [1]  [4]  [9]  [3]  [8]
```

$E + L = S$ — (a) [no carry]

$E + L = S + 10$ — (b) [carry]

$\quad \hookrightarrow \boxed{E = S - L + 10}$

$S + L = E$

$S + L = E$ $\Rightarrow 2L = 10, L = 5$

again, $E + L = S$

or $S - E = L$

$S - E = 5$

Ex: 6 :→

```
  C R O S S
+ R O A D S
_____
D A N G E R
```

Letter	Digit
D	→ 1

$S + S = R$
$= 2 + 2 = 4$
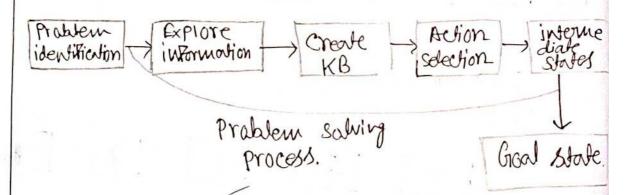
Q.) Explain about Problem Solving Process with neat diagram:-

→ The form problem is used in a situation When, the desired objective is not obvious. The Process of Solving a problem may vary from individual to individual.

Problem solving is a process of generating solutions for a given situation. Problem solving is a process of generation applied to achive goal state. This process consists of sequence of well-defined methods that can handle doubts. or inconsistency issues, uncertainty, ambiguity and help in achieving the desired goal.

| Problem identification | → | Explore information | → | Create KB | → | Action selection | → | interme diate states |

Problem solving process.

Goal state.

1.) Every problem is defired in a context.

2.) Every problem has well-defired objective.

3.) Salution to everyone every problem consists of a set of activites. Each activity changes the set of Problem that is from the present state to the new state.

(8) Describe various AI Model :-

→ Artifical intelligence models are algorithms and mathematical models that enable machines to perform tasks that typically require human intelligence, such as perception, reasoning, learning, and decision making.

Here are some common AI models.

(1) **Rule-Based Systems:-** Rules-based system are AI models that use a set of predefined rules to make decision or draw conclusions. These are rules are typically written by humans and define how the system should react to different inputs.

(2) **Decision Trees:-** Decision trees are a type of machine learning model that uses a tree-like structure to represent decisions and their possible consequence.

(3) **Clustering:-** clustering algorithms are a class of unsupervised machine learning models that group similar data points together based on their similarity.

(4) **Reinforcement Learning:-** Reinforcement learning is a type of machine learning that involves an agent learning to make decision by interacting with an environment. Reinforcent learning is used in a wide range of application.

These are just few examples of AI model.

Q. Diff between the semiotic and statistical.

Semiotic	Statistical
• Deals with qualitative data, such as words images and symbols	• Deals with quantitative data, such as counts Percentage.
• Concernd with the interpretation of meaning and relationships between Signs and their referents	• concerbed with the analysis of patterns and relationships in the data.
• Focuses on the meaning behind the data and how it is communicated	• Focuses on the relationship between variables and the numeri numerical characteristics of the data.
• often used in Fields such communication studies, and cultural studies.	• often used in Fields such as economics, psychology and biology.
• often involves subjective interpretation and is open to multiple meaning	• Generally involves objective analysis and is Focused on Finding definitive patterns and relationships in the data

well-structured	ILL-structured
(i) clearly defined and unambiguous.	(i) vague or unclear
(ii) Systematic and algorithm	(ii) Non-algorithmic.
(iii) Data is readily available	(iii) Data may be scarce, incomplete or ambiguous.
(iv) Objective and based on rules.	(iv) subjective and based on Judgement.
(v) Less expertise is required required	(v) More expertise is required.
(vi) predictable and determin deterministic	(vi) un-predictable and non-deterministic.

Q> what are the Statical models? :

→ Statical models are mathematical framework used to describe and analyze complex relationships between variables in a datasets. They are used in various fields such as, engineering, business, social scineses

(i) Linear Regression:- It is used to analyzed the linear relationship between one or more Predictor variables and a continous response variable.

(ii) Time Series Analysis:- It is a statical technique used to analyzed time-dependent data to understand patterns and trends.

③ **Cluster Analysis:-** It is a multivari Statical technique used to group observation based on similarities in their characteristics.

There are just few examples of statical model.

④ Explain the model building method in AI.

Model building in AI involves creating a mathematical or conceptual computational representation of a system or process. It involves defining the problem, selecting an appropriate algorithm, and training the model using available data. The model is adjusted to make accurate predictions or decisions based on new data.

chart-