

1) What is AI?

Ans: John McCarthy (1956) "Artificial Intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand and human intelligence."

2) What AI does?

Ans: Learning: It learns from the data and experience

- Problem Solving: Analysis and find the solution
- Decision Making: Predict and decide based on the data available.
- Perception: Understanding the environment
- NLP (Natural Language Processing)

3) AI in Use:

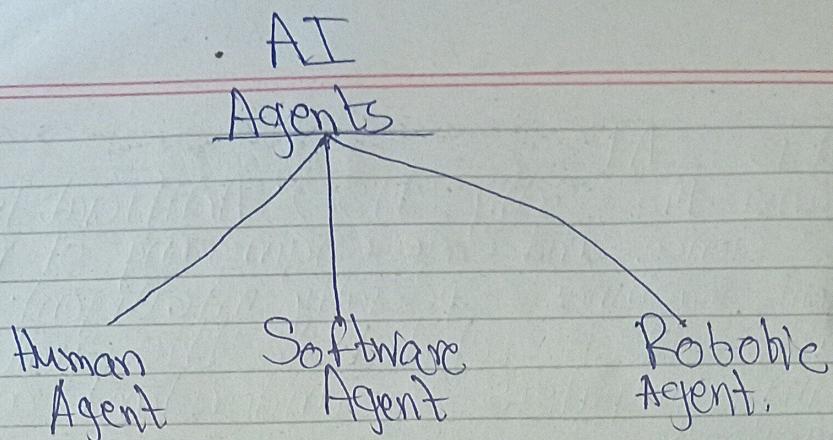
Ans:

- Digital Assistance: Alexa, Google talk, etc,
- Image Email spam filter: ~~It will filter~~ Truecaller.
- Self-Driving Car.
- Smart Home:

4) Types of AI:

- Weak or Narrow AI
- General or Strong AI
- Super Intelligent AI

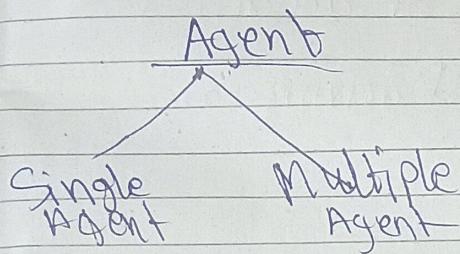
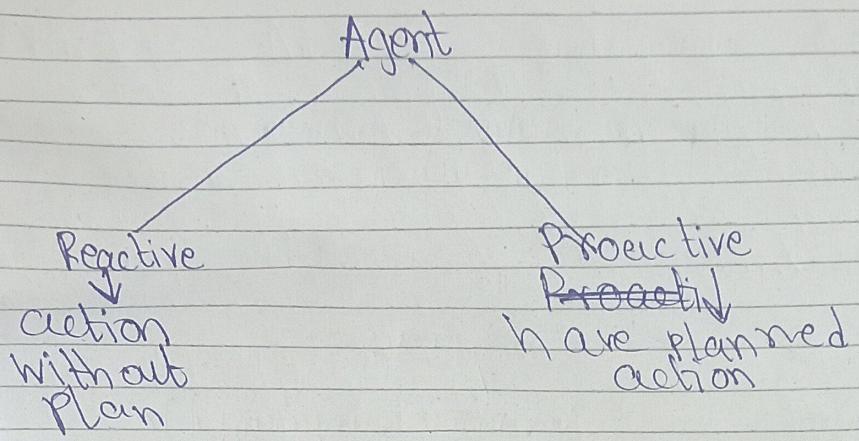
Python is developed in 1991 by Guido Van Rossum.
It is a high level language
It is simple ~~and~~ language, easy to understand, general purpose programming language.
It is platform independence
Free of Cost
Jupyter Notebook, Google Colab



An Agent is anything that perceive its environment through sensor and act on it using its actuator.

Type of Agents

- i) Simple, Reflexive Agent : It make decision on current input without considering past and future.
E.g - Thermometer
- ii) Model Based Agent :- It incorporate internal representation of environment
E.g - Self - Driving Car
- iii) Goal Based Agent : It has pre-defined objective and goal. It uses search and planning method for decision making
E.g - Delivery Robot, Roboboat
- iv) Utility Based Agent : Go Beyond basic goal agent with quality of outcome.
- v) Learning Agent : Improve performance over time through experience
- vi) Rational Agent : Always do the right thing produce optimal solution



Types of Environment

- i) Fixed and Dynamic: Has stable rules and conditions.
- ii) Environment changes constantly
- iii) Full Observable and Partially Observable

Sense and access complete state of agent and each point in time

E.g. Chess

- iii) Deterministic & Stochastic

Predictable agent can anticipate in next state based on the current state

action

E.g. playing chess calculator

We cannot completely access the environment

Same actions leads to different state

E.g. Football

IV) Episodic & Sequential:

Separate &
independent
~~episodes~~
episod

Current State is influenced
by previous actions

V) Discrete & Continuous

Limited number
of states or
action

E.g.: Chess 4 Tic tac
Toe

Infinite & uncountable
number of action

Eg: Self driving car.

BFS

Problem Solving in AI

(i.) 3 Types of Problem

(i.) Ignorable problem

(ii.) Recoverable problem

(iii.) Irrecoverable problem

How to solve the problem AI
need some techniques

Several techniques in AI to solve problem

→ Algorithm

→ Types of Algorithm that help in problem

Solving

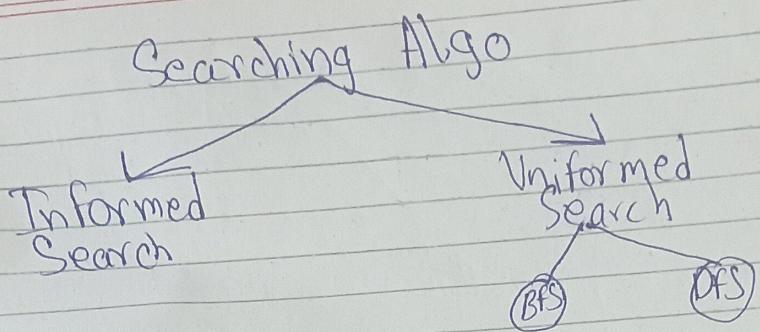
(i.) Searching Algo

(ii.) Optimized Algo

(iii.) NLP

(iv.) ML

Method e-1



- Breadth First Search
- Uninformed Searching Tech
 - Level Order traversal
 - Level by Level Search
 - we use queue to solve BFS prob
 - Queue - FIFO

What is State Space Search?

Ans - State Space Search is a problem-solving technique in Artificial Intelligence that models a problem as a collection of all possible states and transitions.

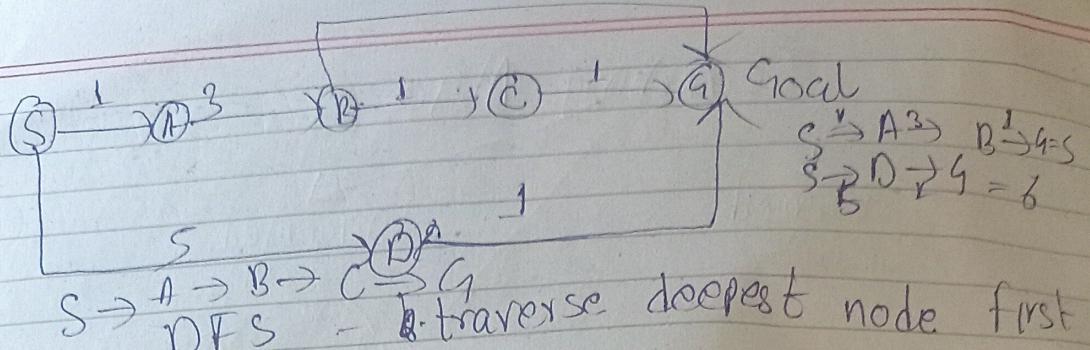
Key Features of State Space Search

- Exhaustive Exploration: It explores possible states systematically until the goal is found or the states are exhausted.
- Completeness
- Optimality
- State Representation
- Memory and Time Complexity

Uninformed Vs Informed Search

Uninformed (Blind)

Informed Search (Heuristic)



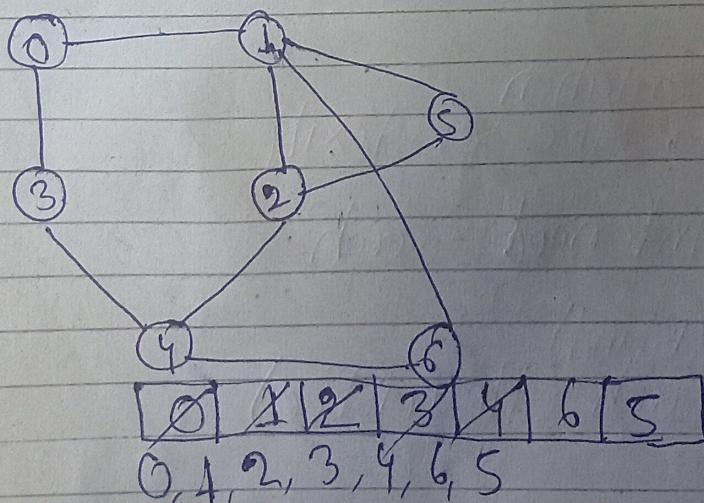
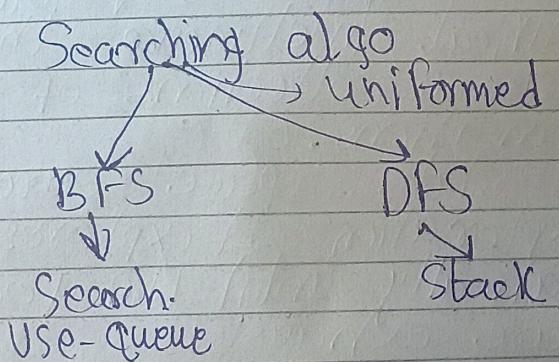
Short nbs always complete

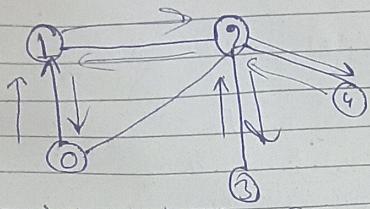
Uniform Cost Search: It is search algorithm for finding least cost path. When all edges of graph have different weight.

Goals of Uniform Cost Search:

- ① To find the minimum total cost
- ② It guaranteed find the optimal path.

③





1) Which type of agent operate using if then rule without utilising any internal state.

Ans: ~~a~~ Simple Reflex agent. b) Goal based agent

2) Identify the type of agent that uses performance feedback to improve its action.

Ans: Learning agent

3) Recall which of the following is not a property to describe environment.

Ans: Sequential and parallel.

4) Selective term of all possible sequence of action and resulting State in a problem

Ans: State-space

5) Identify type of agent that evaluates its success using utility function

Ans: Utility based agent

6) Choose the correct pair that describe a complex real world environment

Ans: Partially observable, dynamic

7) Define goal in context of problem solving

Ans: Target State

8) Select the agent that uses internal model to maintain world knowledge.

Ans: Model based agent

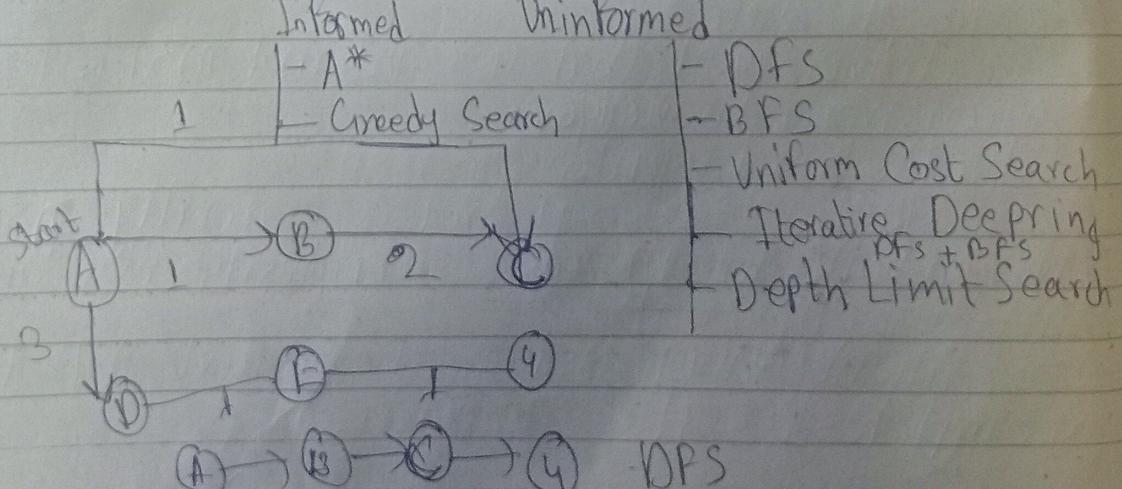
9) Interpret the reason why a partially observable environment ~~causes~~ increases complexity for an intelligent agent

Ans: Agent must reduce the actual state from incomplete percept

- 10) Define AI? And its type? Give two examples?
- 11) Branches of AI?
- Ans - ML, NLP, Robotics, Expert System
- 12) Application of AI in daily life.
- Ans: Virtual Assistant, Email Spam Filter, Navigation App, Recommendation System, Voice-to-Text, Text-to-Speech System
- 13) Define AI Agent.
- Example - Vacuum Cleaning Robot.
- 14) Different types of AI Agent.
- 15) Label the Structure of Intelligent Agent, with its Core Components.
- Ans: Sensor - Perceive Environment
 Actuator - Take action
 Agent Program - Decision making
- 16) Who is the Father of AI?
- 17) Difference between Autonomous and Non-Autonomous Agents?
- 18) How AI different from traditional Software System

Searching Technique

(A) → (B) → (C)



Depth Limit Search:

DLS is the variation of DFS that limit the depth of exploration to prevent infinite loop in large search space

Useful when goal depth known

Iterative Deepening Search

It combines both BFS and DFS by running DFS with increasing depth limit until solution is found

M-2

Knowledge Representation Schema & Reasoning

Concept

refers to encoding info about world into format that AI system can utilise to solve complex task

(i) Energy of knowledge & Intelligence

(ii) Knowledge as foundation = It provide facts, rules & data without it intelligence lacks to your mathematical act.

(iii) Intelligent as application = Apply knowledge to solve problem

(iv) Interdependence = Intelligent without knowledge cannot learn or read

(v) Synergy = Effective AF system merge robust knowledge base with reasoning algo.

Application of Fuzzy Logic

- i) Control System
- ii) NLP
- iii) AI
- iv) Image Processing.
- v) Medical Diagnosis

$A = \text{Good std}$

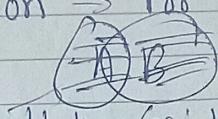
$B = \text{bad std}$

$\cup \rightarrow \text{Membership Fun.}$

$A = (x_1, 0.2) (x_2, 0.5) (x_3, 0.9)$

$B = (x_1, 0.9) (x_2, 0.3) (x_3, 0.4)$

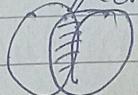
Union \rightarrow For all std \vee



Football Cricket

Intersection

Common



Find complement of

$A (1 - u)$

$(x_1, 0.9), (x_2, 0.2)$

$(x_3, 0.4)$

Complement

$\bar{0} \rightarrow 1$

$\bar{1} \rightarrow 0$

$A = \{ (x_1, 0.1) (x_2, 0.3) (x_3, 0.6) \} \quad \text{Find}$

Complement of $A \quad 1 - \vee (x_1, 0.9) (x_2, 0.7) (x_3, 0.4)$

$A = \{ (x_1, 0.2) (x_2, 0.7) (x_3, 0.5) (x_4, 1) \}$

$B = \{ (x_1, 0.6) (x_2, 0.4) (x_3, 0.8) (x_4, 0.3) \}$

Union (A and B) $\rightarrow \max \mu$

Union $\rightarrow (x_1, 0.6) (x_2, 0.7)$

Intersection ($A \cap B$) $\rightarrow \min \mu$

$(x_1, 0.2), (x_2, 0.4) (x_3, 0.5) (x_4, 0.3)$

Algebraic Sum

$$\mu_{A+B}(x) = [\mu_A(x) + \mu_B(x)] - [\mu_A(x) \cdot \mu_B(x)]$$

$A = \{ (x_1, 0.1) \}$

$$A = \{0.1^2, 0.3, 0.4\}, \quad N = \{0.1 + 0.3 + 0.4\}$$

Algebraic Sum
 $\mu_{A+B}(x) = [\mu_A(x) + \mu_B(x)] - [\mu_A(x) \cdot \mu_B(x)]$

$$A = [0.1 + 0.3 + 0.4 + 0.5]$$

$$B = [0.1 + 0.2 + 0.2 + 0.1]$$

$$\Phi_1 \{ \frac{0.3}{1} + \frac{0.5}{2} + \frac{0.6}{3} + \frac{1.5}{4} \} - \{ 0.02 + 0.06 + 0.08 + 0.09 \}$$

$$= \{ 0.1 + 0.2 + 0.4 + 0.3 + 0.1 \}$$

Algebraic Product

$$\mu_{A \otimes B}(x) = \mu_A(x) \cdot \mu_B(x)$$

$$A = \{0.1^2 + 0.3 + 0.4 + 0.5\}$$

4)

$$B = \{0.1 + 0.2 + 0.2 + 0.1\}$$

$$= \{ 0.01 + 0.06 + 0.08 + 0.05 \}$$

- 1) Define Fuzzy Logic
Ans: fuzzy logic is a form of logic where truth value are expressed in degree between zero and one.
- 2) What is Classical Logic?
Ans: Classical logic ~~works with binary value~~ is strictly true and false work with binary value

Example 0.2, 0.5, 0.4, 0.5

- 3) Explain membership function?

Ans: A function that maps each elements to a membership value between 0 and 1 is called membership function.

- 4) Advantage of Fuzzy Logic

Ans: It is closer to human reasoning and natural language.

- i) It can handle vague & imprecise info

ii) Provide flexibility in decision making.

iii) Usefully control system like AC, Self - driving car.

- 5) Limitations of Fuzzy Logic

Ans: i) It requires expert knowledge to design good membership function

ii) It can be less accurate than mathematical

iii) Statistical Model

iv) It lacks universal standard methodology

v) Cross Over point ones point

Find the cross ones point

$$A = \{ \frac{0.2}{1}, \frac{0.7}{2}, \frac{0.5}{3}, \frac{0.5}{4}, \frac{0.8}{5} \}$$

- 1) Game Playing is an important domain of AI
Game doesn't require much knowledge the only knowledge we need is game rules, legal moves & condition of winning or losing the game.
- 2) AI algorithm can be used to develop more effective decision making system for real world application
- 3) What is Game Playing in AI?
Ans: Game playing refers to development of algorithm and models that enables machine to play and excel in game that require decision making, strategy of problem solving.
- 4) Types of games in AI?

- Single Player game.

o Example: Puzzle Solitaire
Here the AI completes against itself

- Multi Player game

Example: Chess, Ludo

Here AI play against Human or another AI

o Deterministic game

Example: Chess
Where outcome are determined by players decision

Stochastic games

Example: Card or dice game

It involves randomness or uncertainty.

o Perfect V/S Imperfect information game.

Min Max Algo.

Min Max Algorithm is a decision making algorithm used in AI particularly game theory and computer games. It is designed to minimize the possible losses in worst-case scenario and maximize the potential game.

Working of Min Max in AI:

i) Min Max algorithm involve two player, maximizer and minimizer.

Difference between Min Max

Max

- i) Max aims to maximise the score or utility value
- ii) Choose the move that needs highest possible utility value

~~iii) Steps~~

Q:

Steps involving Min Max Algo :

Step 1: Generate the game tree

Step 2: Evaluate terminal State

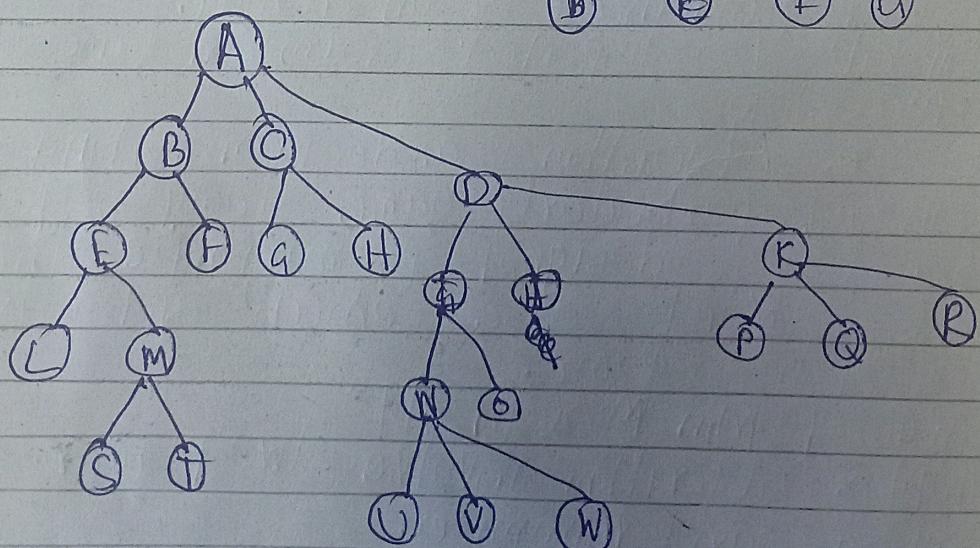
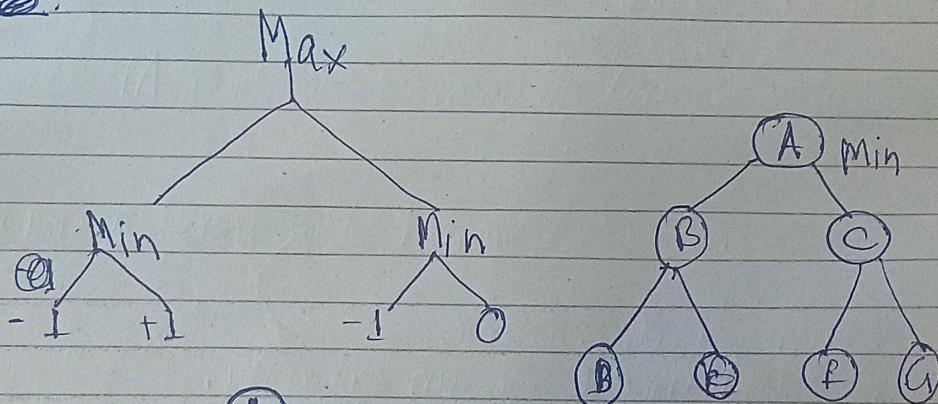
Step 3: Propagate utility value upward

Step 4: Select the optimal move

~~Step 5:~~

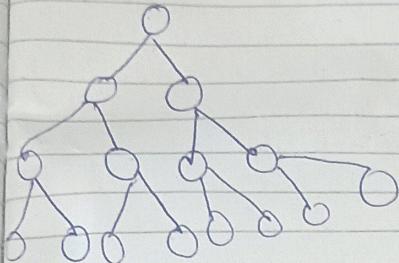
Min

- i) Min aims to minimise the maximizers score
- ii) Select the move that results in lowest possible utility value for the maximizer



Module-3 Game Playing in AI

- i) Search Algo used in Game
- ii) Minmax search algo.
- iii) Alpha beta pruning algo.

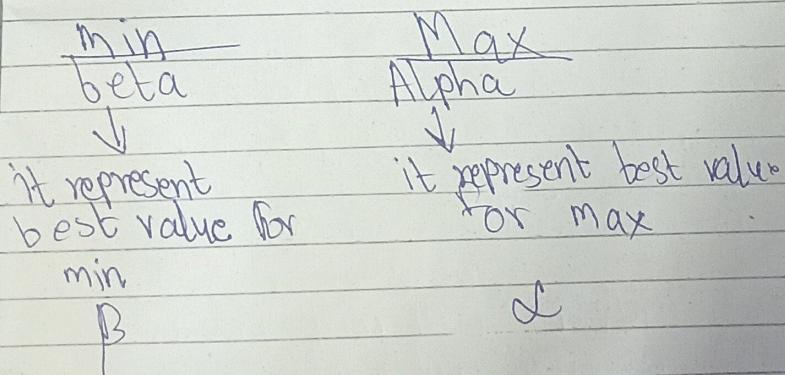


1.) Alpha beta pruning algorithm is a technique used to improve the number of nodes in a evaluated game tree. It is used in two player game turn based game

Alpha beta pruning

↓
2. players game

Alpha beta pruning algo it works by eliminating the branches that are guaranteed to not influence the outcomes
0 Alpha represent best methods



1) What is Expert System
Ans:- Expert System is a crucial subset of AI that stimulates the decision making availability of human expert.

2) Ans: Expert System use knowledge based filled with domain specific information and

Module - 4 NLP

Natural Language Process Branch of AI deal with Language (audio)

1) What is NLP?

Ans: NLP is a technology used by machine to understand analyse and manipulate human language. It help the developers to organize knowledge for performing task such as translation, summarization, speech recognition, and relationship extraction.

2) Application of NLP

- i) Spam detection
 - ii) Sentiment Analysis
 - iii) Spelling correction
 - iv) Machine Translation
- 3) Phases of NLP
- i) Lexical Analysis
 - ii) Syntactic Analysis
 - iii) Semantic Analysis
 - iv) Discourse Integration
 - v) Pragmatic Analysis

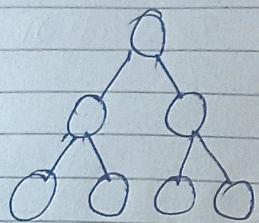
- Lexical Analysis: It scan the source code and convert it into meaningful lexemes
- Syntactic Analysis: Used to check the grammar and relationship between the words
- Semantic Analysis: It concerns with the literal meaning of a sentence

Game Playing

For 2 player game

Min-Max

P_1 P_2
 Mini Max



Alpha-Beta Pruning

P_1 P_2
 Alpha Beta
 ↓ ↓
min value maximum value
 ↓
 min

Given nodes [4, 7, 6, 5]
Root node = 7

Find the number of nodes in iterative with branching Factor

29-10-25

TBC

2nd Highest Salary :-

ID	Name	Address	Salary

Select Salary from Name order by Salary

AI (LAB)

- 1) Find a number of nodes in full binary tree of that tree using min-max algorithm.
- 2) Time Complexity of min-max algorithm.
- 3.) State the best case scenario for alpha-beta ~~pruning~~ ^{pruning}.
→ Best to worst
- 4.) Find the number of leaf node in a ternary gain tree of depth tree
→ Number of leaf node is g^n .
- 5.) Compare number of node ~~explored~~ ^{Explore} by min-max vs Alpha beta pruning for for depth=4 in a binary tree.
⇒ Alpha beta explore fewer nodes
- 6.) Find the number of nodes pruned when alpha-beta pruning is applied on binary tree of depth-4.
- 7.) What is NLP?
→ Structured ^{and} Grammatical rules of Sentence
- 8.) Phase of NLP deal with the contextual meaning of the sentence.
⇒ Fragmentic processing.

Q.) Data Structure commonly used in Syntax.

⇒ tree

10.) Library For NLP:-

⇒ NLTK .

11.) Primary purpose of Semantic Analysis.

⇒ Determine the meaning of sentence .

12.)