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AI CTS Merged - note

Artificial Intelligence (SRM Institute of Science and Technology)

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CT-1

AI - Unit-1

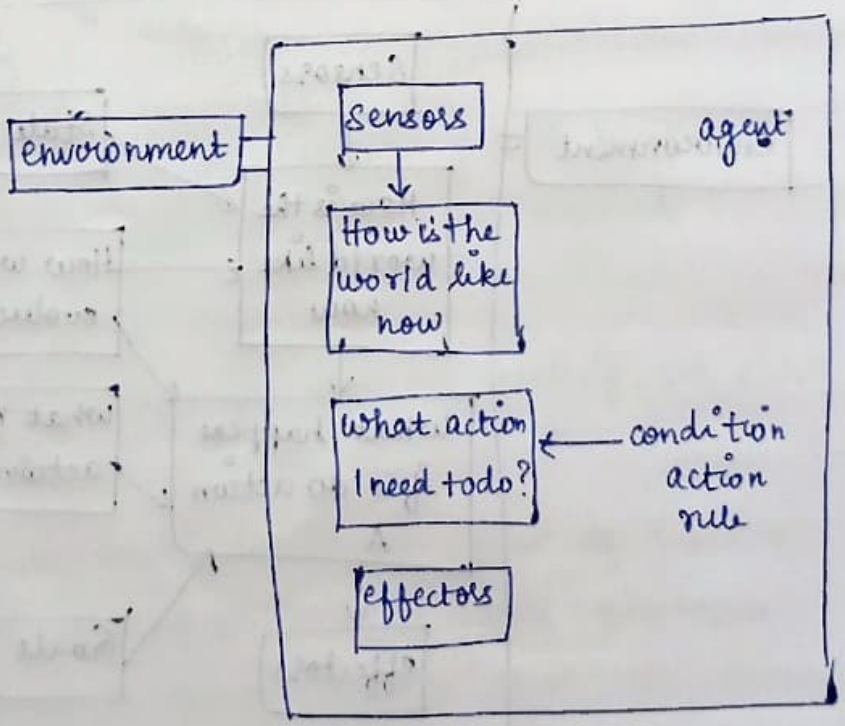
Part-C

(2) with suitable diagrams explain about types of agents.

Agent: Agent is an entity that can preceive the information and act on that information to acheive the desired outcome

Types:
- ⊙ simple reflex agent
- ⊙ Model based reflex agent
- ⊙ Goal based
- ⊙ Utility based

Simple reflex: based on condition - action rule.
If condition is true the action take place, else not.



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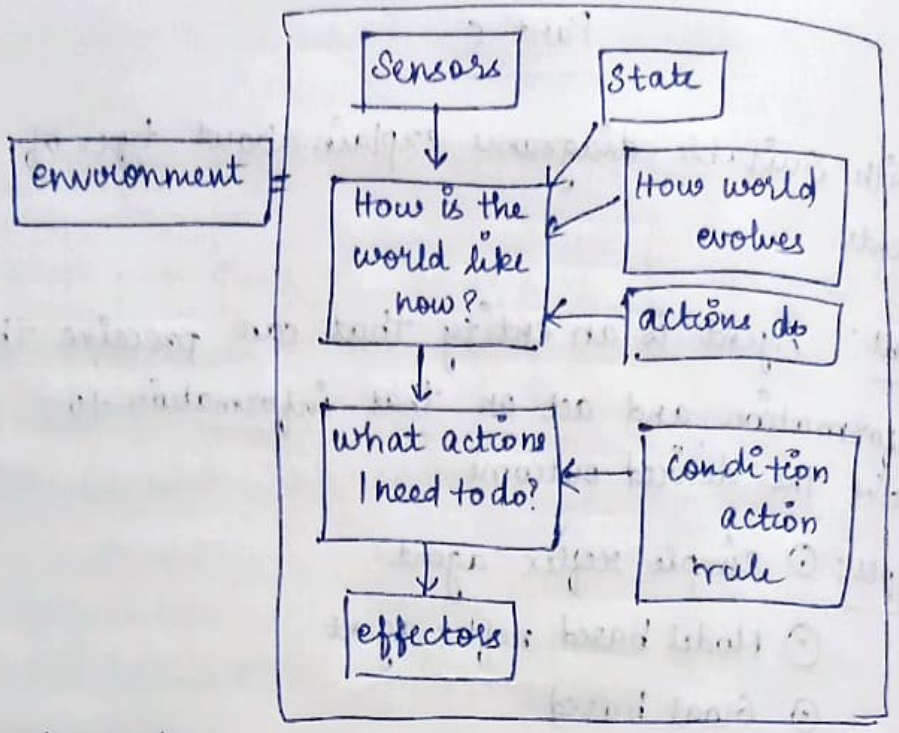
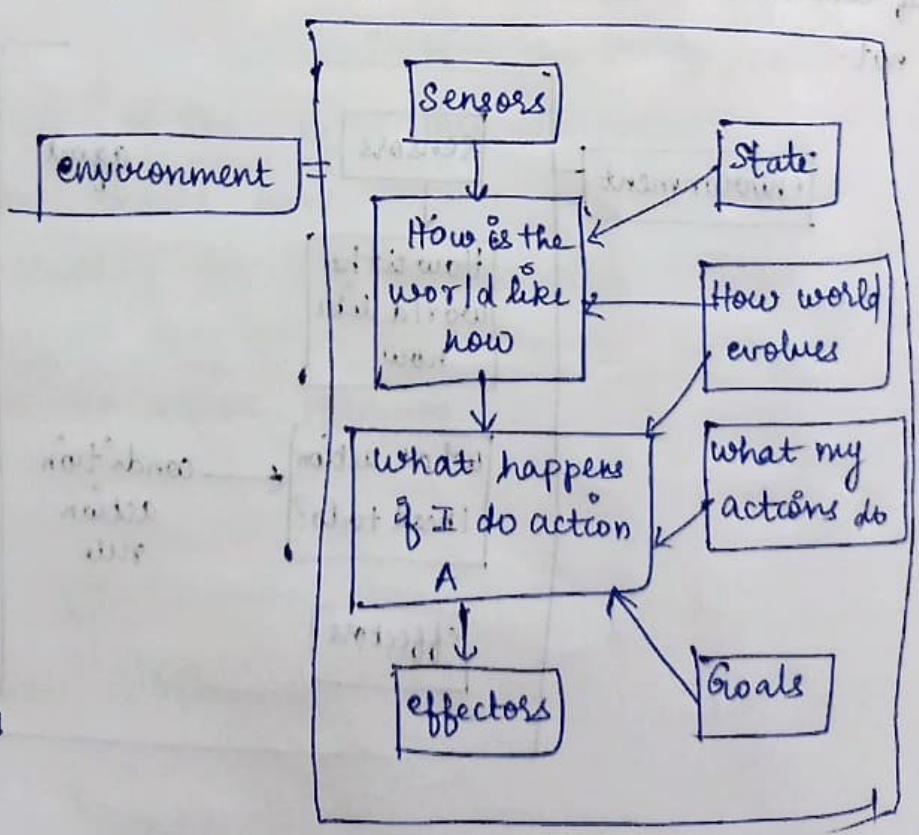
Model based reflex: works by finding a rule whose condition matches the current situation



Goal based agents:

Takes decision based on how far they are currently from their goal.



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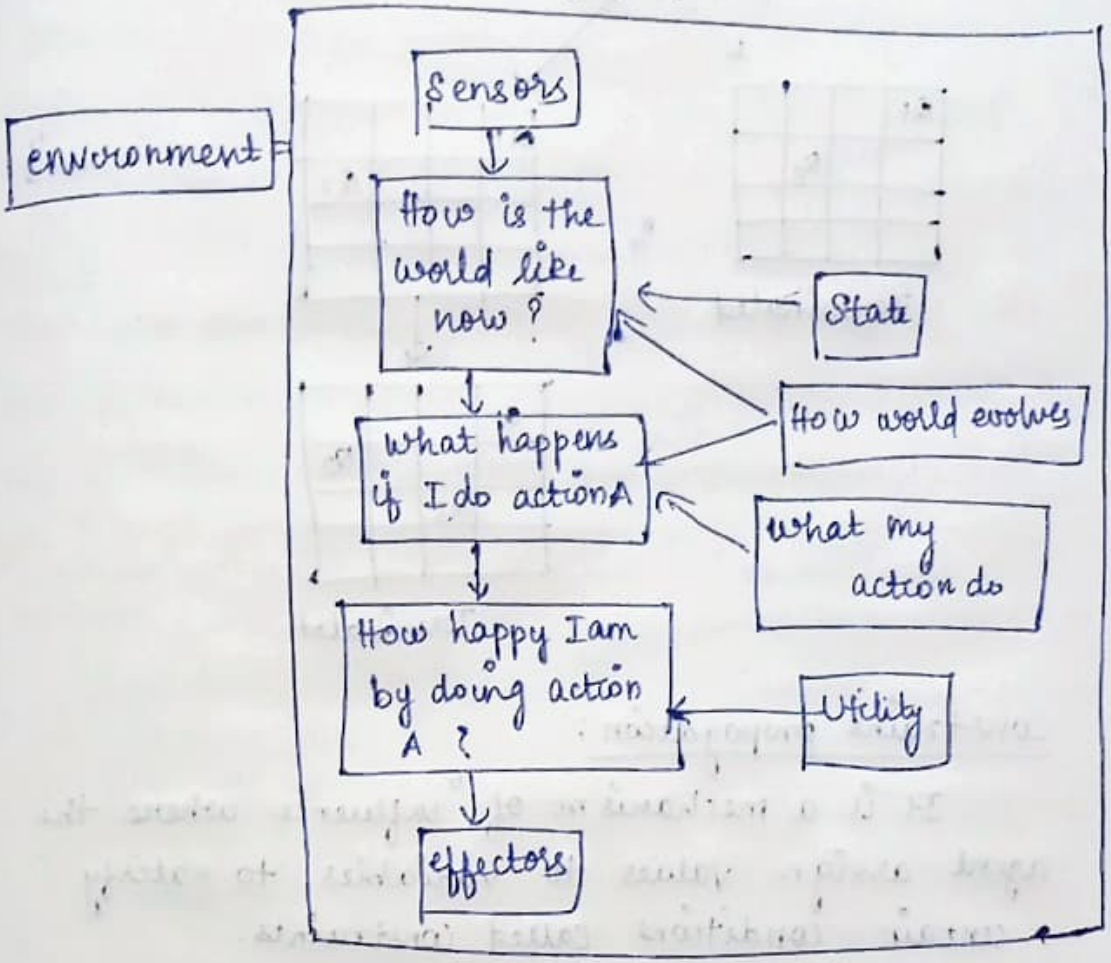
Utility based agents:

The agents which are developed having their end users as building blocks.



(3) Discuss the forward checking and constraint propogation technique with an example

Forward checking:

→ To understand the forward checking, we shall see 4 queens problem.

→ If an arrangement on the board of queen X, hampers the position of queen X+1, then this forward check ensures that the queen X should not be placed at the selected position and a new position is to be looked upon

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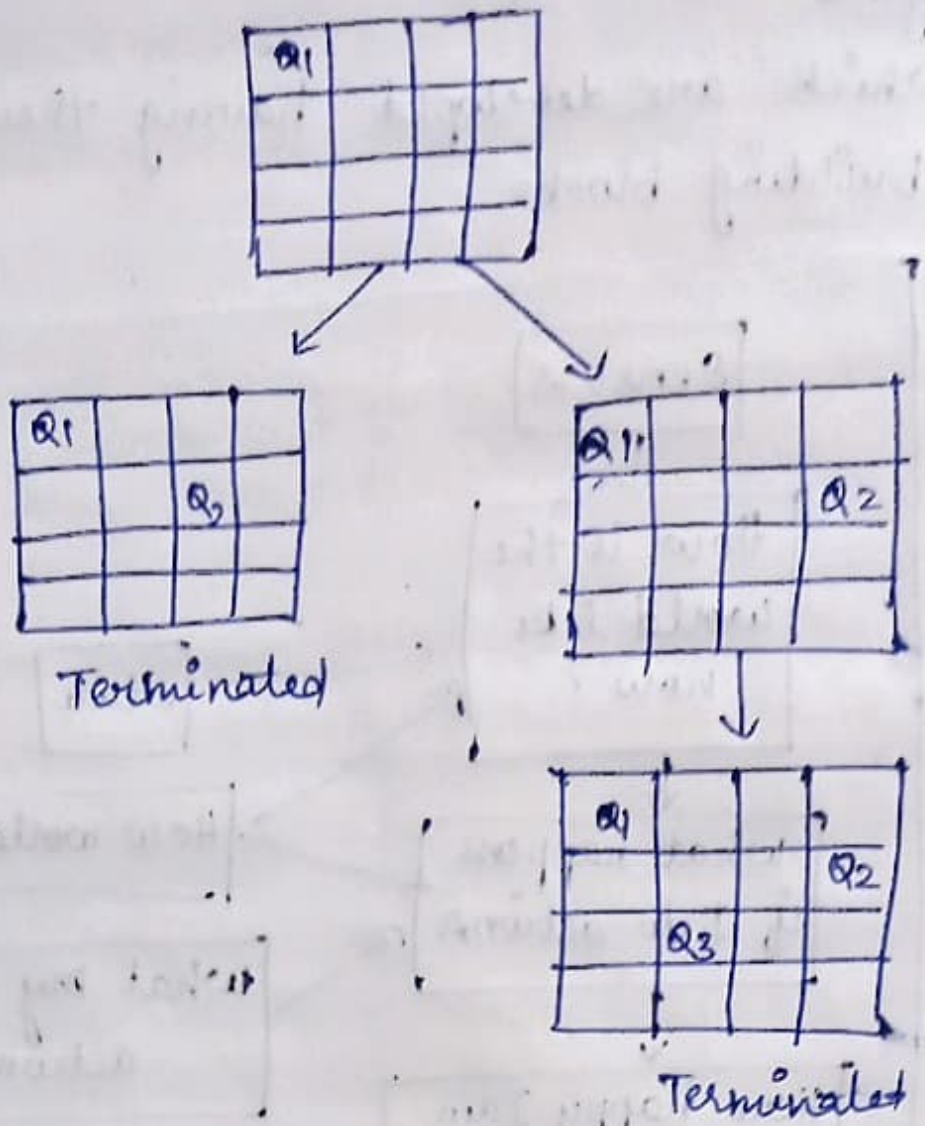

constraint propogation:

It is a mechanism of influence where the agent assign values to variables to satisfy certain conditions called constraints.

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⑤ Describe the problem formulation step with example

First step:

Identification of problem in problem solving process. (A problem statement can have description of data, method, procedure & algorithm that are used to solve it).

Step 2:

The next step is analysis & representation of the task knowledge.

This is done using state space diagram.

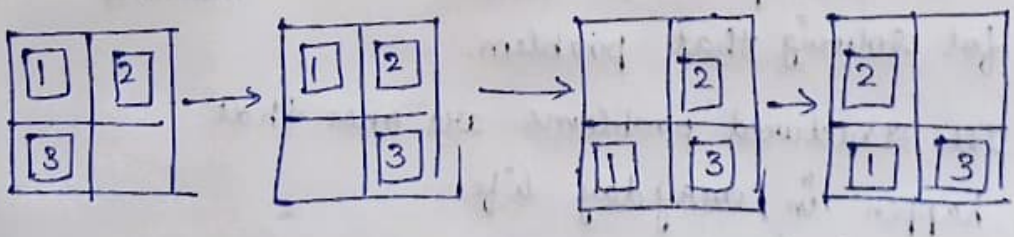
This approach is also called state space method.

↓ what is to be solved

Problem identification & definition → Problem space → Task Knowledge → State Space

→ what conditions → what is the specification of achievable objective?

Eg: State space puzzle



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Part-B

(1) Describe various AI models:

Supervised, unsupervised, semi supervised, reinforcement.

(labelled), (unlabelled), (partially) (ranking based)

(2) List milestones in AI evolution

→ Machine learning

→ NLP (Natural Language problem)
(giving computers the ability to understand text & spoken words in much the same way as humans)

→ Automation & Robotics

→ Machine vision

(3) What are the statistical models?

→ Statistical model is nothing but applying mathematical approaches in dataset.

→ Here Training and Testing only done.

→ They include graphs, curves, shapes.

→ Most efficient way.

(4) Give example of one ill structured problem with description & elaborate the method for solving that problem.

Ill structured problems are ones that happen in everyday life.

They do not yield a particular answer.

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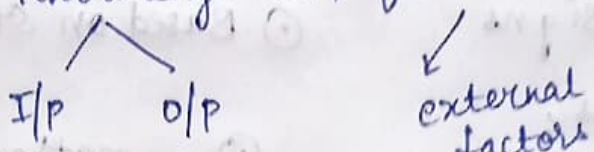
Eg: predicting how to dispose wet waste safely (explain)

(5) Explain the model building concept in AI

Basically AI models have two main elements : Knowledge and feed back.



Knowledge based:

-) inductive: based on general rules from datasets of i/p, o/p pairs.
-) deductive: based on series of rules & infers new rules that are more efficient in the context of AI.

Feedback based: Supervised, unsupervised, semisupervised, reinforcement.

(6) List various Equipments in day to day life where AI is used.

→ voice assistants
→ smart watches/gadgets
→ Autonomous vehicles
→ ~~Imagine~~ Image recognisation
→ Fraud detection

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(7) Diff between semiotic model and statistical model.

Semiotic	Statistical
⊙ Based on sign process & communication	⊙ Based on relationship & statistical techniques
⊙ classify signs	⊙ Based on statistics.
⊙ Uses codes, Sounds individual letter	⊙ mathematical data
⊙ Logical approach	⊙ decision making

(8) can forward checking & backjumping go together for a same problem?

→ conflict set is maintained using forward checking & maintained

→ considering the 4 queens problem, conflict needs to be detected by the user of conflit set so that a backtrack can occur

→ Backtracking with respect to the conflict set is called as conflict - directed backjumping

→ Back jumping approach can't actually restrict the earlier committed mistakes in some other branches.

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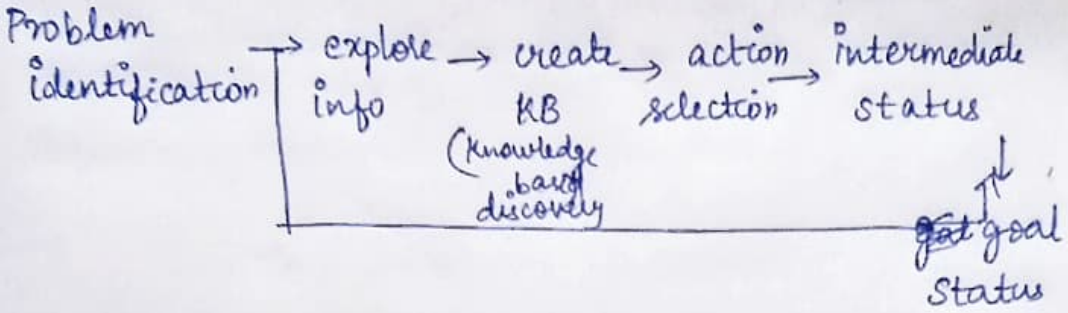
(9) Explain about problem solving process with neat diagram.



(10) Discuss the local search in CSP with examples

→ Initial state :

- {} - all variables are unassigned

→ Successor fn:

a value is assigned to one of the unassigned variables with no conflict

→ Goal test:

a complete assignment

→ path cost:

a constant cost for each step

→ solution appears at depth n if there are n variables.

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AI

★ Unit-2 12 marks

1) Explain Uniform cost search algo.

→ search is the universal tech in AI

→ 3 parts
- state space : set of all possible states
- start : where search begins
- goal : fn that looks at current state & returns if it not goal.

Uniform cost search

→ Used for traversing a weighted tree / graph.

→ algo comes into play when different cost is available for each edge.

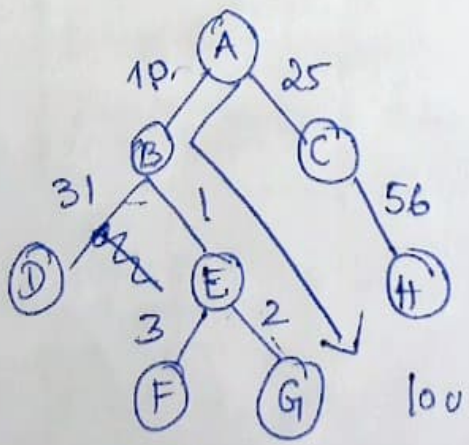
→ primary goal - lowest cost

→ Can solve any graph.

→ Implemented by priority queue.
max priority to lowest cumulative cost

→ UCS is equivalent to BFS algo if path cost of all edges is same.

Eg:



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Advantages:

optimal at every state

Disad:

Doesn't care about no of steps

some times it may stuck in ∞ loop.

Searching

Uninformed

- Breadth FS (from root to leaf) FIFO)
- Depth FS (from root but backtracks) (STACK)
- Uniform cost sear.
- Bidirectional search → (simultaneous forward & backward sears) * stops when graph intersects
- Iterative deepening (combi BFS & DFS) increases limit
- Depth limited search (same as DFS but with predetermined limit) → 2 failures Standard: no soln Cutoff: no soln for given limit

(solves ∞ path problem)

Uninformed

- Does not contain any domain knowledge
- Just brute force
- blink search

Informed search

- Use domain knowledge
- most efficient soll.
- AKa Heuristic search
- complex problem

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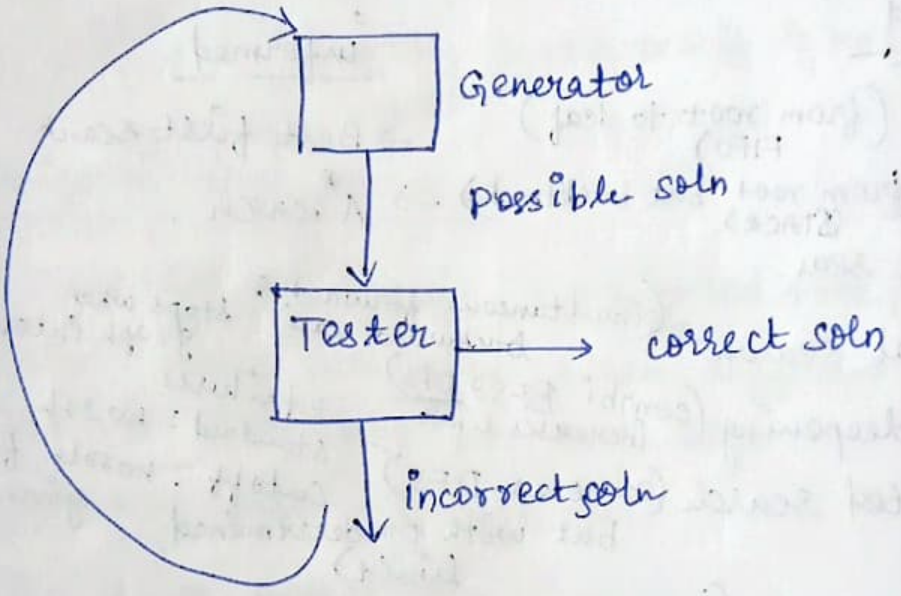
Generate and test algorithm

→ comes under informed search.
→ simple algorithm that guarantees to find the solution
→ DFS procedure.
→ It can be implemented on a search graph rather than a tree



Best First search:

→ Traversal technique that decides which node is to be visited next by checking the most promising node.
→ A node is selected for expansion based on evaluation function $f(n)$

$$f(n) = h(n)$$

→ implemented by priority queue.

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A* search :

→ It searches for shortest path between initial & final states.

→ Advance BFS

Uses open and close list.

→ Same expansion fn

$$f(n) = g(n) + h(n)$$

open → searches → lowest value → best node → if this is goal state exit → else make successors of best node

→ presented by Hart

$$f(n) = g(n) + h(n)$$

- $f(n)$: cheapest soln
- $g(n)$: cost to reach start to n
- $h(n)$: cost to reach n to goal.

→ For consistent $h(n) \leq h^*(n)$

AO* search :

~~Both~~ Unlike using open & close list like A* AO* maintains the entire graph.

start
h(start) > threshold → searches for children.

→ select promising node that is not expanded

→ Add to graph.

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* Local Search algo and Hill climbing

Local Search algo → hard optimization problem.

Hill climbing :-

→ is a LS algo where it continuously moves in the direction of increasing ~~evelva~~ elevation to find peak / best solution.

→ Terminates when it reaches the peak & no neighbour has higher value.

→ optimizing the mathematical problems

→ widely used is, Traveling-Saleman problem.

Features:

→ Uses Generate and Test method

→ Greedy approach (optimisation)

→ no backtrack

Types of Hill climbing:

→ **Simple HC:**

Examines neighbouring node one by one & selects the first node which optimizes the current cost

→ **Steepest - Ascent HC:**

Examines all the neig. nodes & from that it selects the best.

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Stochastic Hill climbing:

→ Does not examine all.

→ just selects a node at random.

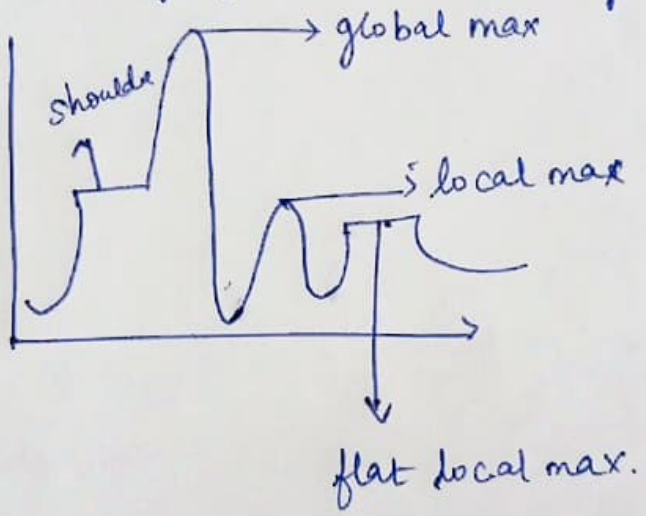
First choice hill climbing

One of the variant of stochastic Hill climbing

Successor is generated randomly.

large no of successor ⇒ better option.

State-Space diag for Hill. climbing:



Problems:	Overcome
local max :	backtrack
Plateau :	Big jump.

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Unit-3 12 m

① Wumpus world:

→ Knowledge based agent game.

→ PEAS

Performance measure	Environment	Actuators	Sensors
↓	• Cave is 4×4 • Rooms not diagnoly • Wumpus • pit • Breeze • Glitter room. • Agent position • Loc of wumpus gold	move fwd	Breeze
		right	Stench
		left	Glitter
		Shoot	Scream (when wumpus gets killed)
		grab	
		release	

Agent gold = +1000 pts
Agent dies : -1000 pts
Each move : -1 pt
Agent uses arrow = -10 pts

Fully observable - NO

Deterministic : yes

static : yes

Discrete : yes

Single-agent - yes

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(2) ~~Min max algorithm~~ (U-2)

~~Demps~~

(2) Dempster Shafer theory:

→ Dempster Shafer theory is given because of the following reasons.

·) Bayesian theorem only concerned about single evidences.

So DST combines all possible outcomes.

Uncertainty in this model is given by:-

→ consider all possible outcomes

→ Belief will lead to believe in some possibility in bringing some evidence.

→ plausibility will make evidence with possible outcomes.

a, ~~b~~, c, d ⇒ lift scene

a,	ac	acd	none.
c,	cd		
d.	ad		

$2^3 = 8$ possibility

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Mass function m_K : proportion of all relevant & available evidence.

Belief in K: Sum of mas function.

$$m(a) + m(b) + m(c) + m(a,c) + m(b,c) + m(a,b,c)$$

Plausibility :

Some of masses that intersects with K.

Characteristics :

→ probability = 1
→ Reduced ignorance
→ combination rule is used to combine various types of possibilities

} adv.

Disadv:

→ computation effort is high, as we have to deal with 2^n of sets.

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③ Probabilistic Reasoning:

→ Representation of knowledge where the concept of probability is applied to indicate the uncertainity.

Why we use probabilistic reasoning:

→ unsure of predicates

→ possibilites becomes large.

→ error can occur.

Notations

→ Statement S: March will be cold.

→ Probability P.

→ Chances $P(S) = 30\% = 0.3$.

→ Probability always takes values from 0 to 1.

$P(\neg S) = 0.7$

$P(S) + P(\neg S) = 1$

$P(S \text{ AND } T) = P(S \wedge T)$

or $P(S \vee T)$

$P(S \vee T) = P(S) + P(S) - P(S \wedge T)$

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Conditional probability:

$$P(B/A) = \frac{P(B \cap A)}{P(A)}$$

$P(B/A)$ → given

Bayes theorem:

$$P(B/A) = \frac{P(A/B) \times P(B)}{P(A)}$$

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Unit-4

① Explain about STRIPS.

→ STRIPS is one of the languages for Planning problems.

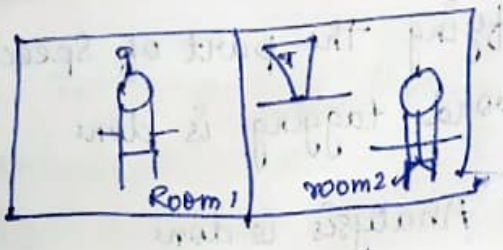
→ STRIPS stands for STandford Research Institute Problem Solver.

→ It is Historically important.

→ It makes use of first order Predicate

→ Strips allows function-free literals.

Example robot



This example involves a robot, a cup tea, guest and two rooms. We want robot to get the tea and give it to the guest.

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→ A strip planning problem specifies

- Initial state
- Goal
- Set of strips action.

The strips representation for an action consists of

→ The precondition, which is a set of assignments of values to features that must be true for action to occur and

→ The effect which is a set of resulting assignments of values to those primitive features that change as the result of action.

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(7) List out planning terminologies, and components of planning.

The task of coming up with a sequence of actions that will achieve a goal is called planning.

* Planning environment

1) classic planning environment,

- Fully observable, deterministic, finite, static and discrete

2) Non- classical planning

Partially observable, stochastic with diff algorithms.

* Planning Problem:

The planning problem is actually the question how to go to next state or goal state from current state.

The planning problem is defined with

→ Domain model
→ Initial state
→ Goal state

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→ The domain models tells the actions along with objects. It is necessary to specify the operators too.

→ Initial state is where any action is yet to take place.

→ Final state aka goal state which the plan is intended to achieve

+

Explain about strips (planning language)

+

Eg:
Block world

→ There are 'N' no of blocks resting on table with specified sequence.

→ Goal: arrange in desired sequence.

→ Available moves: → put block on table

→ Put a block on another block top.

→ State is represented using sequence of blocks in current pos.

Start:

Goal:

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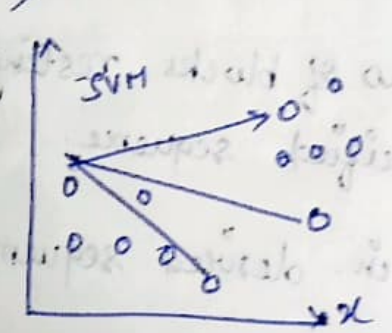
⑧ SVM

→ SVM → new class of successful learning methods.

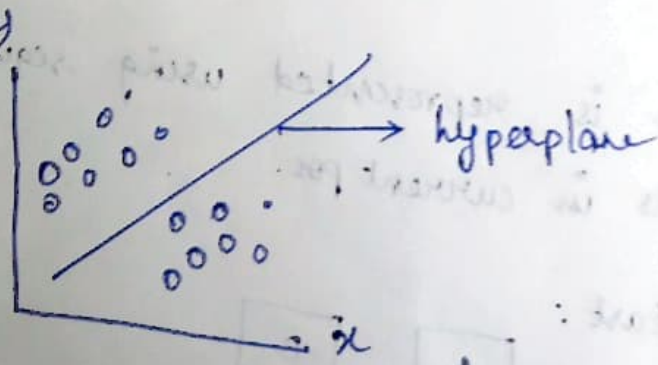
→ It comes under supervised learning methods.

→ They can rep. non-linear functions & have efficient training algorithm.

→ Goal of SVM is to train a model that assigns new unseen objects into a particular category.



Hyperplane: line that segregates the dimensional space.



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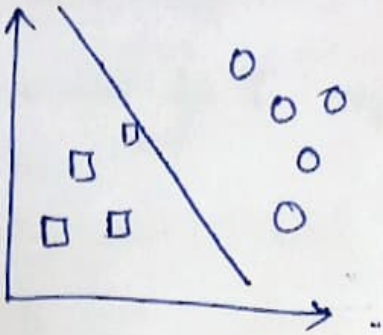
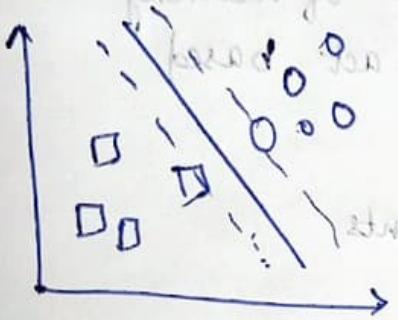
When hyperplane is not clear we use a technique called Kernelling.

Example of bad decision boundaries



Eg of good decision boundaries



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④ Types of Learning:

Types of learning

→ Learning from agents

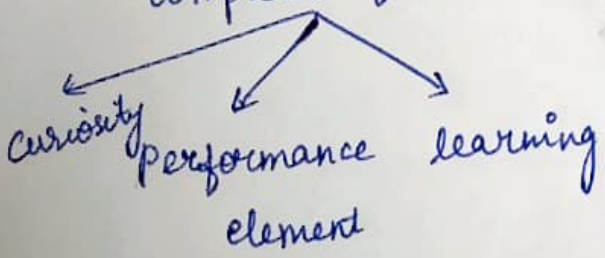
→ Inductive learning

→ Decision tree learning.

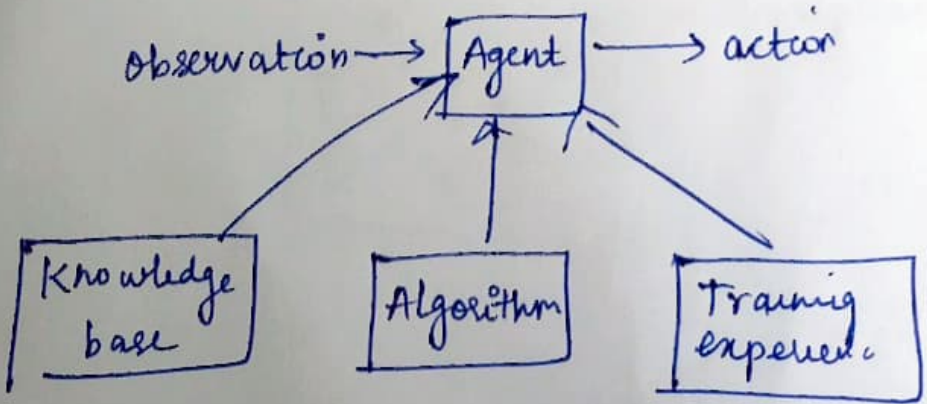
Learning from agent:

→ An agent is defined the computational entity which is capable of receiving the environment and can act based on the situation

composed of 3 elements



Based on the coordinator outcome is measured



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Inductive learning :

→ learning generalised rules

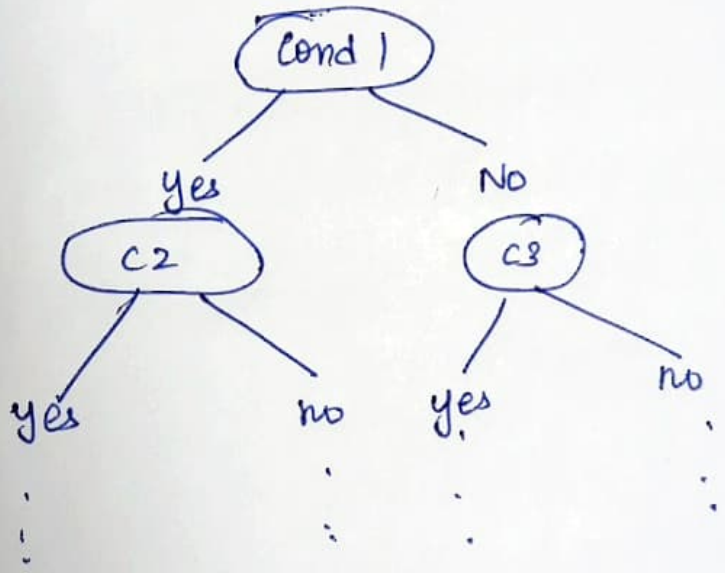
→ Eg: classify as +ve / -ve.

Decision trees

→ learned fn is represented by a decision tree

→ In programming it is represented as if then rules.

→ Based on observation



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AI

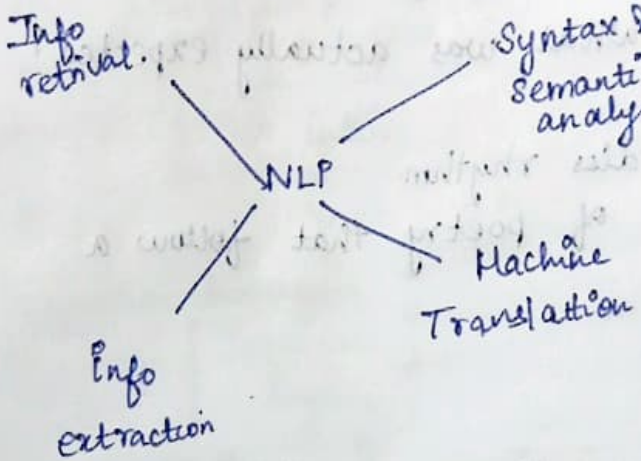
Unit-5

(4) Different Levels of NLP:

→ Natural Lang. are lang that living creatures use for communication

→ The capability to understand, interpret & communicate through natural language is very important

NLP Tasks



Levels of NLP (7)

M S S. D P P P

~~H S D S P P~~

H S S D P P P

Morphology :-

→ Analysis of morphemes (smallest grammatical unit)

→ words ending with ed, ing change meaning.

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Syntax:

→ Rules

Semantic:

Meaning checking for sentence.

Discourse integration

meaning of current sentence is dependent on prior sentence.

Pragmatics:

What we try to tell ⇒ correct interpret & convey & handle it.

convey what was actually expected?

Prosody: Handles rhythm.

In case of poetry that follow a rhythm.

Phonology:

Analysis of different kind of sounds that are combined.

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(2) With a neat sketch, explain the architecture, characteristic features and roles of expert system:

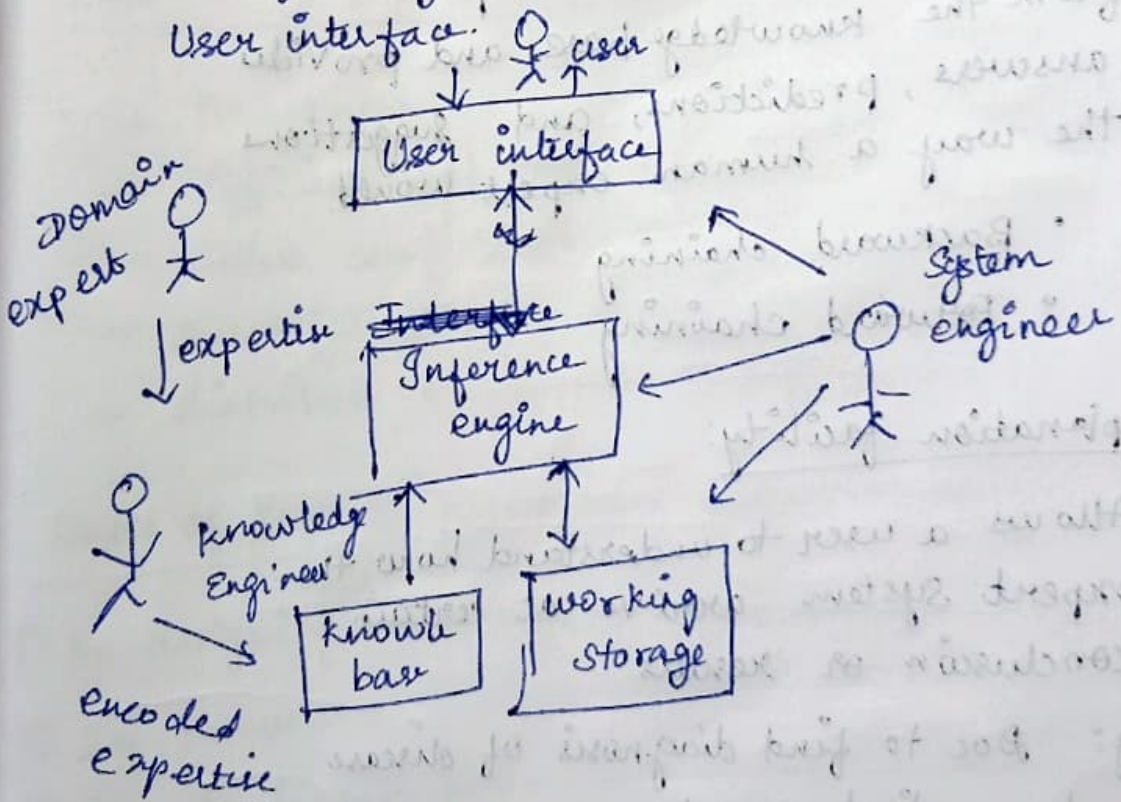
Expert System:

An expert sys is a computer system that takes decision like that of humans.

Architecture of Expert System:

components :-

Knowledge base
Interface Engine
User interface



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Knowledge base

Stores all relevant info, data, rules, cases & relationship used by the expert system.

It uses
- Rules
- If then statements
- Fuzzy logic

Inference engine:

→ Seeks info and relationships from the knowledge base and provides answers, predictions, and suggestions the way a human expert would.

- Backward chaining
- Forward chaining

Explanation facility:

Allows a user to understand how the expert system arrive at certain conclusion or results.

Eg: Doc to find diagnosis of disease by medical expert.

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Knowledge acquisition faculty

efficient means of capturing and storing all the components of the knowledge base.

Acts as an interface between expert and the knowledge base.

User interface :

UI specially for designing, creating, updating and using expert system.

Characteristics of expert system

- → Permanent
- → efficient solution
- → Solve complex problem.
- → Successful form of AI
- → distribute the expertise of human

Roles of Expert system

1) In designing & manufacturing domain
2) In knowledge domain
3) In the finance domain
4) In the diagnosis and troubleshooting of devices
5) Planning and scheduling.

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③ Explain about Information Extraction and Machine Translation.

→ In IE, template matching is carried out.

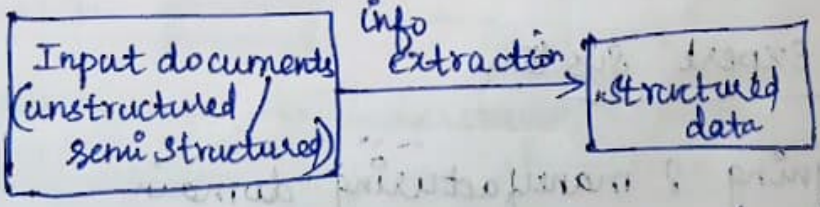
→ IE modules could make entries in database

→ Already there is pre-defined fixed format where text entries are carried out

→ Basically IE unstructured data to structured data.

→ In IE info are extracted from templates.

→ Info retrieval gets info as documents whereas IE gets info from the documents.



Modules of IE:

(Machine translation)

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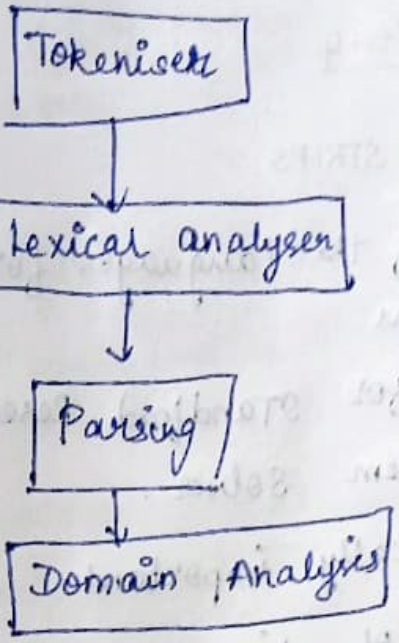

Tokeniser: Does word seperation.

Lexical analyser: Speech tagging is done.
Identifying the part of speech and word tagging is done.

Parsing: Syntax Analysis is done.

Domain analysis: Merging the partial results.

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