

- Artificial :- Not genuine or natural but made by people.
- Intelligence:- Smart thinking ability to understand, learn, think or act like a human.

* Artificial Intelligence :-

Artificial Intelligence (AI) is the simulation of human intelligence by machines.

1. The ability to solve problems.

2. The ability to act rationally.

3. The ability to act like humans.

Foundations of AI

i. Mathematics

ii. Psychology \Rightarrow Study of human minds and its function

iii. Study of Physics

iv. Philosophy \Rightarrow logical thinking.

Purpose of AI

1. Reduce the human work.
2. Reduce the human mistakes.

Application of AI

1. Agricultural :- AI Sensors can detect weeds and then decide which herbicides to apply within the right buffer zone.
2. Education Field :- AI helps find out what a student does or does not know, building a personalized study schedule for each learner, considering the knowledge gaps.
3. Healthcare for assisting doctor.
4. Autonomous Vehicles for advance feature.
5. Social Media for serving personalized experience.
6. Travel Industry for predicting Pricing pattern.
7. Air traffic Control.

Good Write

History of AI:

1950 - Proved This at 1950 Through
Turing Test (Voice msg)

1955 - • John McCarthy coined term Artificial
Intelligence.
• He is also known as Father of AI.

1974 - Computers became faster and
affordable.

1980 - The Year of Artificial Intelligence.

2000 - Landmark of AI establishment
achieved.

Robotics And AI

- A Robot is a mechanical or virtual artificial agent, usually an electro-mechanical machine that is guided by a computer program or electronic circuitry.
- Robots can be autonomous or semi-autonomous.
- A robot may convey a sense of intelligence or thoughts of its own.

Humanoid Robot and HI

- Sophia is a social humanoid robot developed by Hong Kong based company Hanson Robotics.
- Sophia was activated on April 19, 2015.
- She made her first public appearance at South by Southwest festival in mid-March 2016 in United States.
- In October 2017 Sophia became a Saudi Arabian citizen the first robot to receive citizenship in any country.

Artificial Intelligence

Advantage

- More powerful and more useful Computer.
- New and improved interface.
- Solving new problems.
- Relieves information overloads.
- Conversion of information into knowledge.

Disadvantage

- Increase costs.
- Difficulty with software development - slow and expensive.
- Few experienced programmers.
- Few practical products have reached the market as yet.

* The Explosive Growth of AI.

- Since AI is applicable in almost all fields, they become the needs of our life. It is the reason behind the explosive growth of AI.
- The growth can be divided into two parts
 - Growth in positive sense. (useful to society)
 - Growth in negative sense. (harmful to society)

Good Write

Difference b/w Data Science and Business Intelligence.

Business Intelligence

Data Science

- | | |
|--|---|
| <ul style="list-style-type: none">• Deals with data analysis on the business platform.• BI analyzes Past data.• Handling static and structured data.• MS Excel, SAS BI, Sisense, micro strategy.• BI helps Companies to solve questions. | <ul style="list-style-type: none">• Consist of several data operations in various domains.• Past data is analyzed for future predictions.• Both structured and unstructured data that is also dynamic.• Python, R, Hadoop/Spark.• Questions are both curated and solved by data scientists. |
|--|---|

JANUARY 2019						
M	T	W	T	F	S	S
1	2	3	4	5	6	
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

TUESDAY

WEEK 49

DAY 338-027

DATE 04.12.2018

04

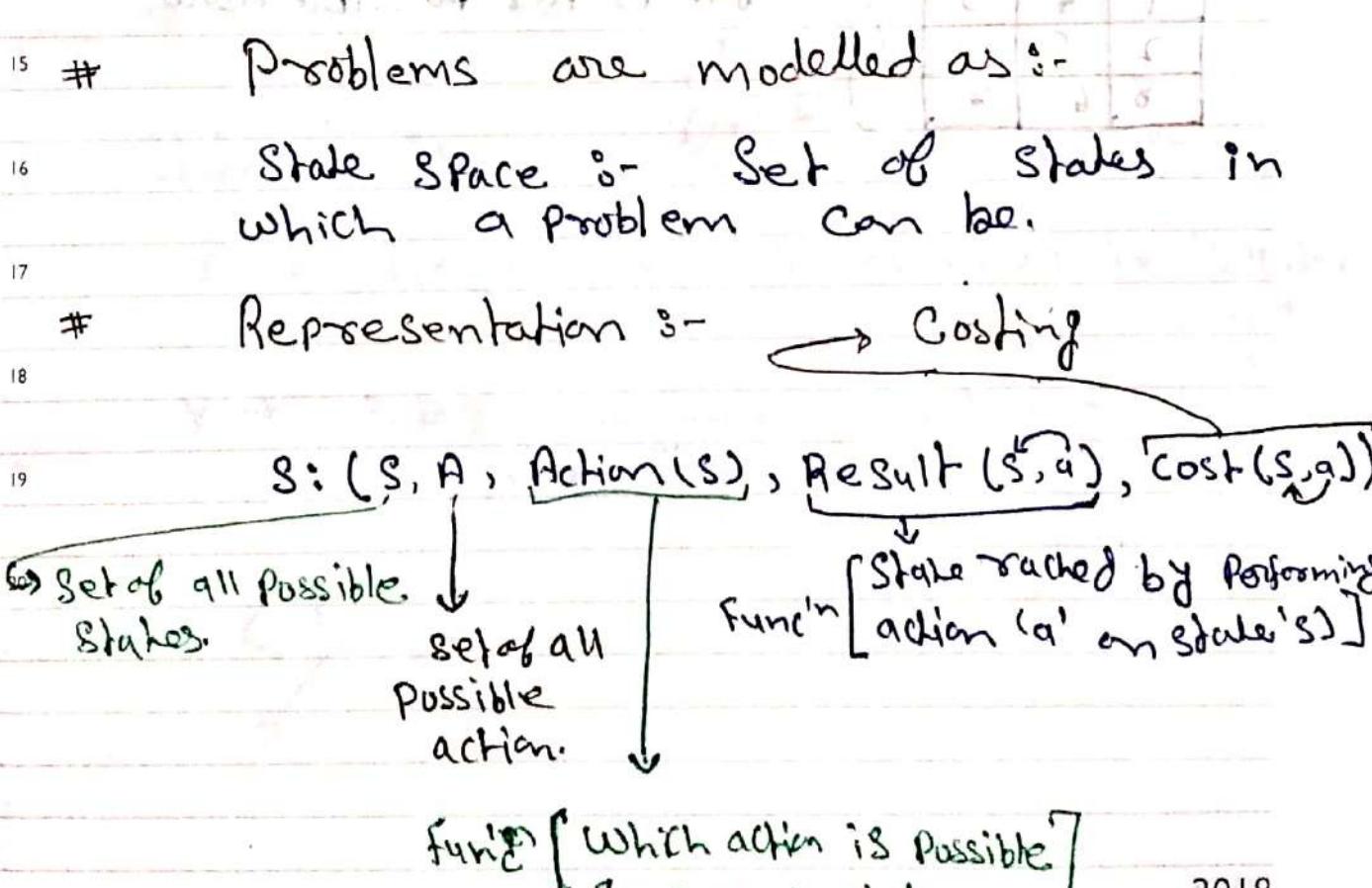
DECEMBER

08 * State Space Search :-

- 09 • It is used in Problem Solving.
- 10 • It is a process used in AI in which successive configurations or states of an environment instances are considered with intentions of finding a goal state with desired property.

15 # Problems are modelled as :-

16 State Space :- Set of states in which a problem can be.

17 # Representation :- 

19 $S: (S, A, \text{Action}(S), \text{Result}(S, a), \text{Cost}(S, a))$

→ Set of all possible states.

↓
set of all possible actions.

↓
Func'n [State reached by performing action 'a' on state 's']

↓
func'n [Which action is possible for current state]

2018

②

05

DECEMBER

WEDNESDAY

WEEK 49

DAY 339-026

DATE 05.12.2018

DECEMBER 20					
M	T	W	T	F	S
31					1
3	4	5	6	7	8
10	11	12	13	14	15
17	18	19	20	21	22
24	25	26	27	28	29

Example

Eight Puzzle Problem

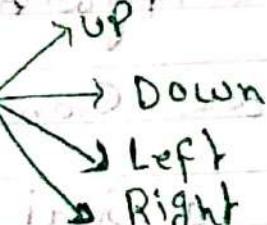
Start(s) \rightarrow initial state in 3x3 Grid (G).

10	1	4	3
11	2	8	5
12	6	7	

1	2	3
8		4
7	6	5

Action Possible

Right



Legal Moves
For a state.

14	1	4	3
15	2	5	8
16	6	7	

Right is not Possible now.

Up
Down
Left

Whole do is -> 8082 2603
and need reading is 42082

17

18

(0,2,0), (0,3) + (1,2,0), (0,1,0), (1,1,2)

[0,1,0], [0,2,0] \rightarrow next

↓ 0,1,0, 0,2,0
0,1,0, 0,2,0
0,1,0, 0,2,0
0,1,0, 0,2,0

2018

JANUARY 2019						
M	T	W	T	F	S	S
1	2	3	4	5	6	
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14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

THURSDAY

WEEK 49

DAY 340-025

DATE 06.12.2018

06

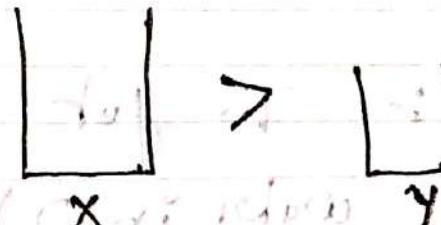
DECEMBER

WATER Jug Problems and its State representation.

- Two Jugs of different Capacities are given.

i. X-Litre

ii. Y-Litre



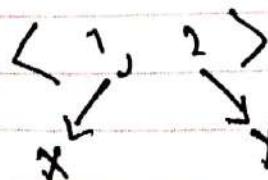
- No marking is there on any Jug.

- Goal is to fill exactly 'L' litres of water into 'Y'-litre Jug.

State is represented as $\langle x, y \rangle$

$x \rightarrow$ integer amount of water in 'X' litre Jug

$y \rightarrow$ integer amount of water in 'Y' litre Jug



2018

DECEMBER 2018						
M	T	W	T	F	S	S
31					1	2
3	4	5	6	7	8	9
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07

DECEMBER

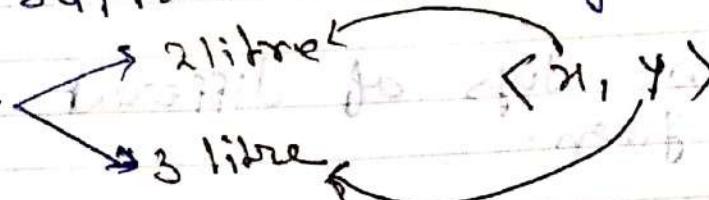
FRIDAY

WEEK 49

DAY 341-024

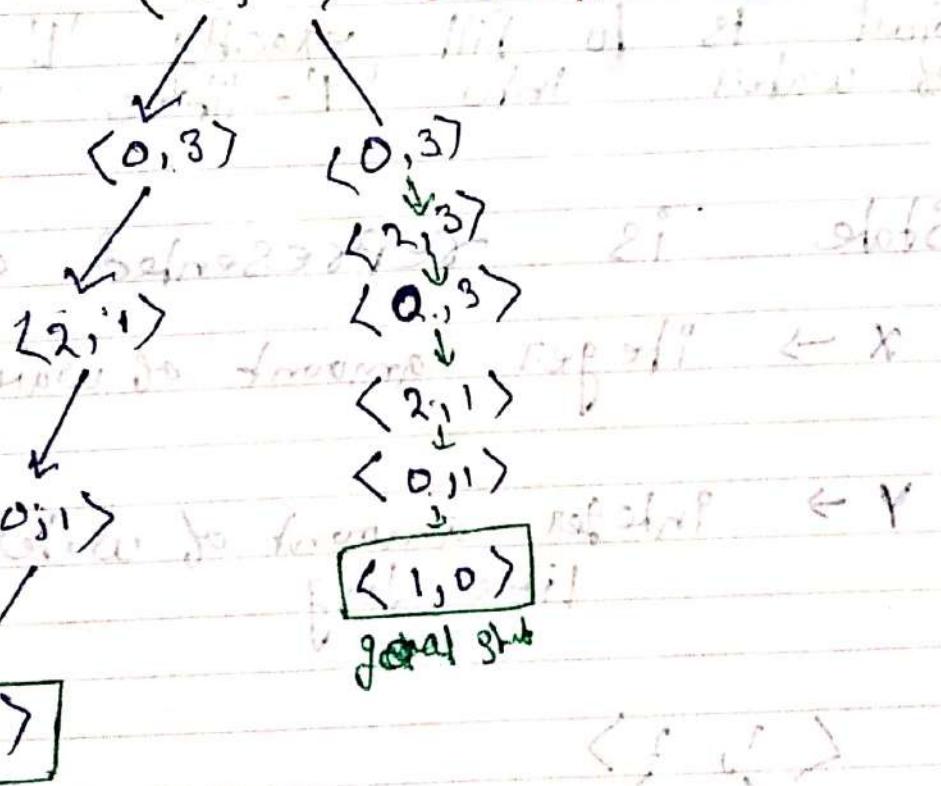
DATE 07.12.2018

Ex ample :- Suppose capacity of two jugs :-



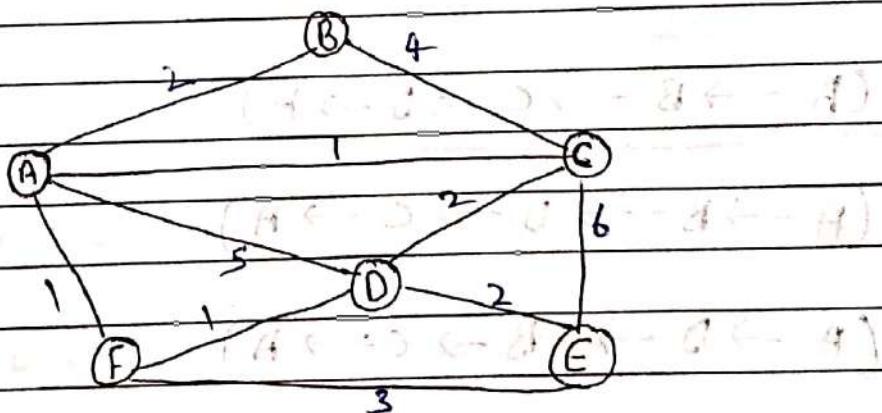
Goal :- To get exactly '1' liter of water in 2 liter jug.

<0, 0> { initial state.



★ Travelling Salesman Problem:

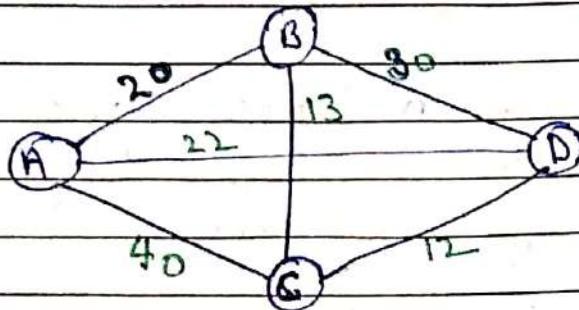
- If there are "n" cities and Cost of traveling from any city to any other city is given.
- Then we have to obtain the Cheapest round-trip such that each city is visited exactly once returning to starting city, completes the tour.
- Typically Travelling Salesman problem is represented by weighted graph.



- In list, here are direct roads b/w each pair of city cities.

- To find Route, salesman should follow shortest possible round trip.

States is represented as pair of any two cities and distance b/w them.

Example:-

State Space : Initial state (states A)

$$\hookrightarrow \{ (A \xrightarrow{20} B), (A \xrightarrow{40} C), (A \xrightarrow{22} D) \}$$

States

Possible Routes :-

$$(A \rightarrow B \rightarrow C \rightarrow D \rightarrow A) = 67$$

$$(A \rightarrow B \rightarrow D \rightarrow C \rightarrow A) = 102$$

$$(A \rightarrow D \rightarrow B \rightarrow C \rightarrow A) = 105$$

$$(A \rightarrow D \rightarrow C \rightarrow B \rightarrow A) = 67$$

$$(A \rightarrow C \rightarrow D \rightarrow B \rightarrow A) = 102$$

$$(A \rightarrow C \rightarrow B \rightarrow D \rightarrow A) = 105$$

Good Write

* Difference b/w uniformed and informed search:-

Informed Search

i. Search without any information.

ii. No Prior knowledge.

iii. Time Consuming

iv. More Complexity

v. DFS, BFS etc.

Informed Search

ii. Search with Information.

iii. Use knowledge to find out the solution.

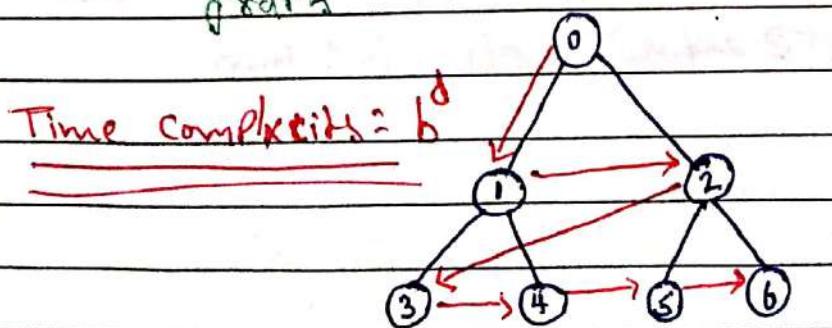
iv. Quick Solution.

v. A*, Heuristic Search technique.

* (BFS):- It stands for Breadth First Search.

- BFS uses Queue data structure for finding the shortest path.

- BFS can be used to find single source shortest path in an ~~weighted~~ unweighted graph



Search → 0, 1, 2, 3, 4, 5,

Good Write

Algorithm

Step1 - Set STATUS = 1 (ready state)

for each node.

Step2 - Enqueue the starting node A
and set its STATUS = 2 (waiting state)

Step3 - Repeat Step 4 and 5 until Queue
is empty.

Step4 - Dequeue a node N. Process
it and set its STATUS = 3
(processing state).

Step5 - Enqueue all the neighbours of
N that are in the ready state
(whose STATUS = 1) and set
their STATUS = 2 (waiting state)

[End of loop]

Step 6 - Exit.

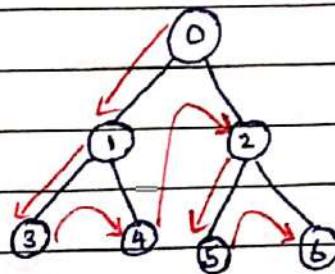
Good Write

Q2. ★ DFS :- It Stand for Depth First Search.

• DFS uses Stack data structure.

• DFS is More suitable when there are solution away from source.

• DFS is more suitable for game or puzzle problems.



Algorithm

Step 1 → SET STATUS = 1 (ready state) for each node in G

Step 2 → push the starting node A on the stack and set its STATUS = 2 (waiting state)

Step 3 → Repeat step 4 and 5 until STACK is empty.

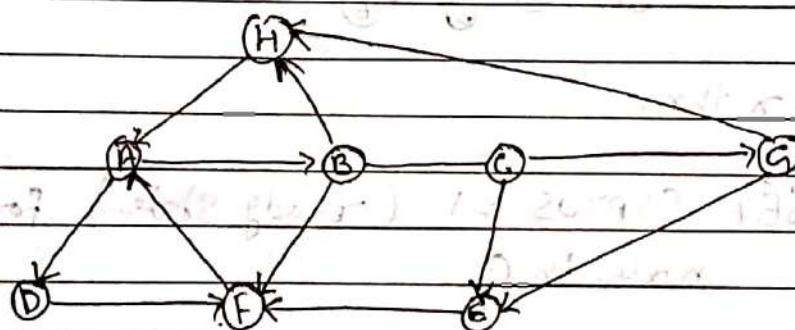
Step 4 → Pop the Top node N. Process it and set its STATUS = 3 (Processed state)

Step 5 → Push on the stack all the neighbours of N that are in the ready state (whose STATUS = 1) and set their STATUS = 2 (waiting state)

[End of Loop]

Step 6 → Exit.

Example:-



Now after 6 steps following path H → A → D → F → B

$$H \rightarrow A \rightarrow D \rightarrow F \rightarrow B$$

At STATUS line 3 now & node E is left

$$E \leftarrow G \leftarrow C$$

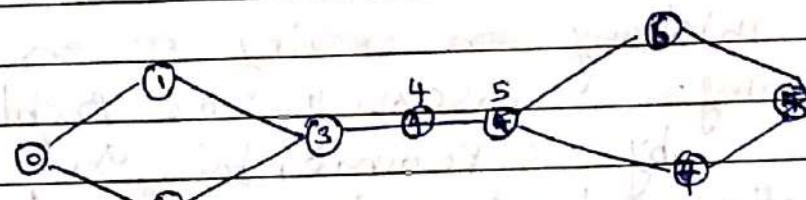
All work is about out after step 9 of H → A → D → F → B

Good Write

★ Bidirectional Search:-

Bidirectional search is a graph search algorithm that finds a shortest path from an initial vertex to a goal vertex in a directed graph.

It runs two simultaneous searches: one forward from the initial vertex to a goal, stopping when the two meet.



Time Complexity :-

$$\frac{d_1}{2} + b$$

Algorithm:-

Step 1 → Say, "0" is the initial node and "8" is the goal node, and "4" is the intersection node.

Step 2 → we will start searching simultaneously from start to goal node and backward from goal to start node.

Step 3 → whenever the forward search and backward search intersect at one node, then the searching stop.

Good Write

* Heuristic Search:-

- It is an iterative algorithm that starts with arbitrary solution.
- It helps to find better sol'n by incrementing a single element.
- This technique is very useful in Robotics.
- It is involving or serving as an aid to learning, discovery, or problem solving by experimental and especially trial-and-error method.

Heuristic Search is categorized into two ~~to~~ Part.

a. Direct Heuristic Search :-

Other names for these are Blind Search, uninformed search, and Blind

These are not always possible. Since they demand much time or memory.

They search the entire state space for a solution.

For example: BFS, DFS

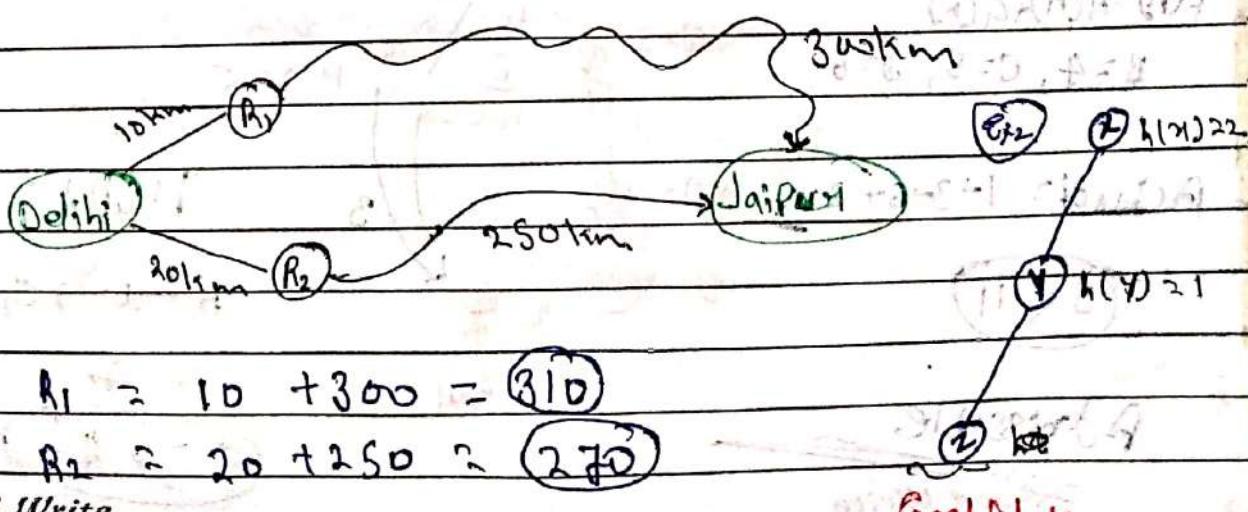
Good Write

9.1 Heuristic Search :- Tries to solve problems in minimum steps/cost by using heuristic function.

- Heuristic Search is used in informed search.
 - This technique is very useful in Robotics.
 - It is iterative algorithms that start with arbitrary solution.
 - It solves the problem by error-and-trial method.

Heuristic Function :- It is a function $H(n)$ that gives an estimation on the cost and getting from node 'n' to ~~goal~~ goal state.

- Helps in selecting optimal node for expansion.

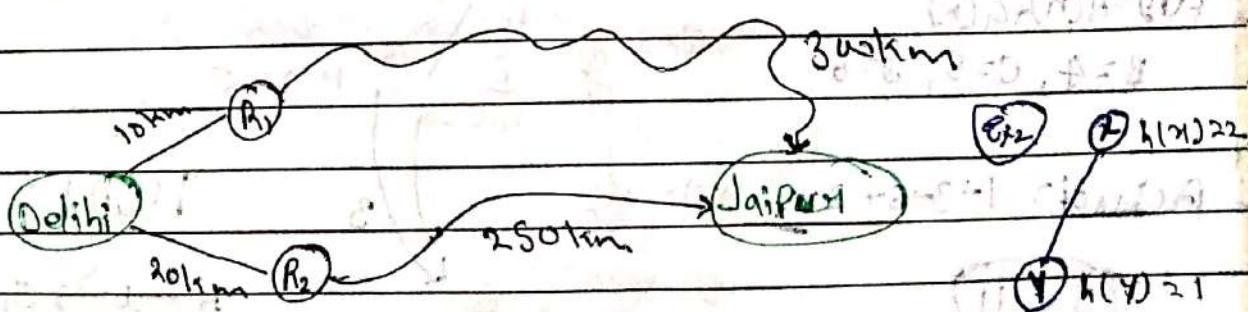


Q.1 Heuristic Search :- • Tries to solve problem in minimum steps/cost by using heuristic function.

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- This technique is very useful in Robotics.
- It is iterative algorithms that start with arbitrary solution.
- It solves the problem by error-and-trial method.

Heuristic Function :- • It is a function $H(n)$ that gives an estimation on the cost and getting from node 'n' to goal state.

- Helps in selecting optimal node for expansion.



$$H_1 = 10 + 300 = 310$$

$$H_2 = 20 + 250 = 270$$

Good Write

Goal Node

Type of Heuristic :-

i) Admissible :- In this Heuristic function, never overestimates the cost of reaching the goal.

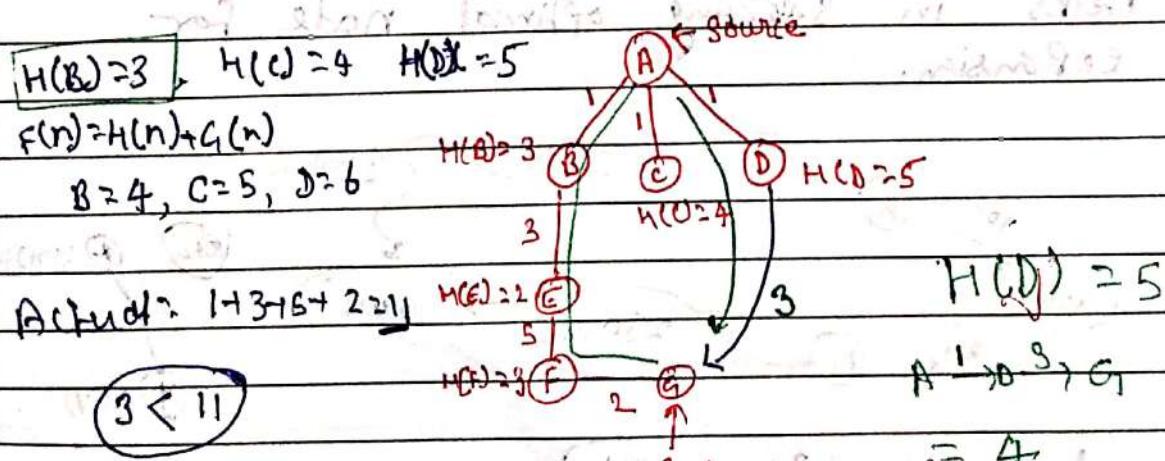
$$\text{equation :- } h(n) \leq h'(n) \{ \text{goal} \}$$

$h(n)$ is always less than or equal to actual cost of lowest-cost path from node ' n ' to goal.

ii) Non-Admissible :- In this Heuristic function overestimate the cost of reaching the goal.

$$\text{equation :- } h(n) > h'(n) \{ \text{goal} \}$$

$h(n)$ is always greater than the actual cost from node (n) to goal.



~~Admissible~~

~~Good Write~~

Non-admissible.

Heuristic Search Method:

Weak Methods:-

a. Generate and Test Method:-

- In this technique all the solution are generated and tested for best solution.
- It ensures that the best sol'n is checked from all possible generated solutions.
- Heuristic , DFS with backtracking
- If the sol'n is found quit.

Properties of good Generators:-

i. Complete

ii. Non-Redundant

iii. Informed

iv. Costly but always do feasible

v. Informed + Informed solution

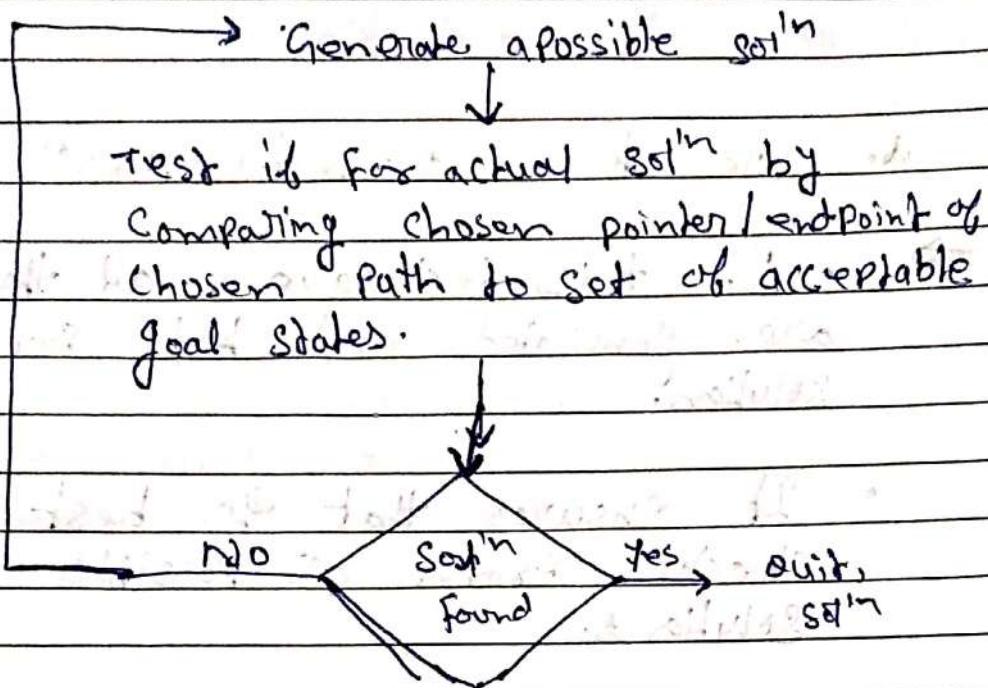
vi. Costly, but always good at best of

vii. Good at first few nodes

viii. Offers a lot of choices

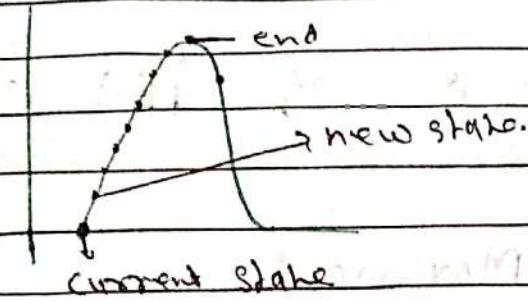
Good Write

Flow Diagram



b. Hill Climbing :-

- Hill Climbing is local search algo.
- It use Greedy Search Approach
- There is NO Backtracking Possible.
- Variant of generate and test method in which feedback from test procedure is used to help generator decide which dir'in to move in search Space.
- It always moves in a Single dir'in.

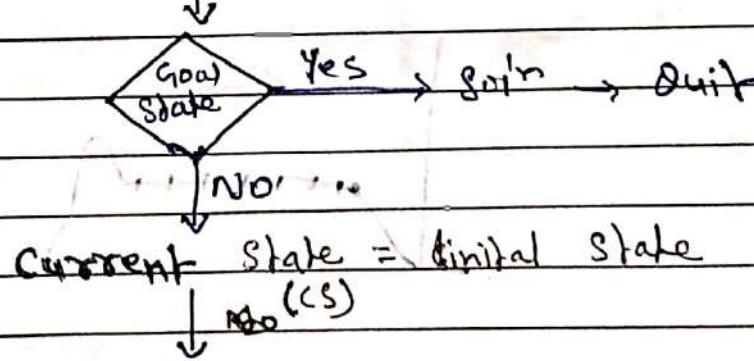


If new state is better than current state.

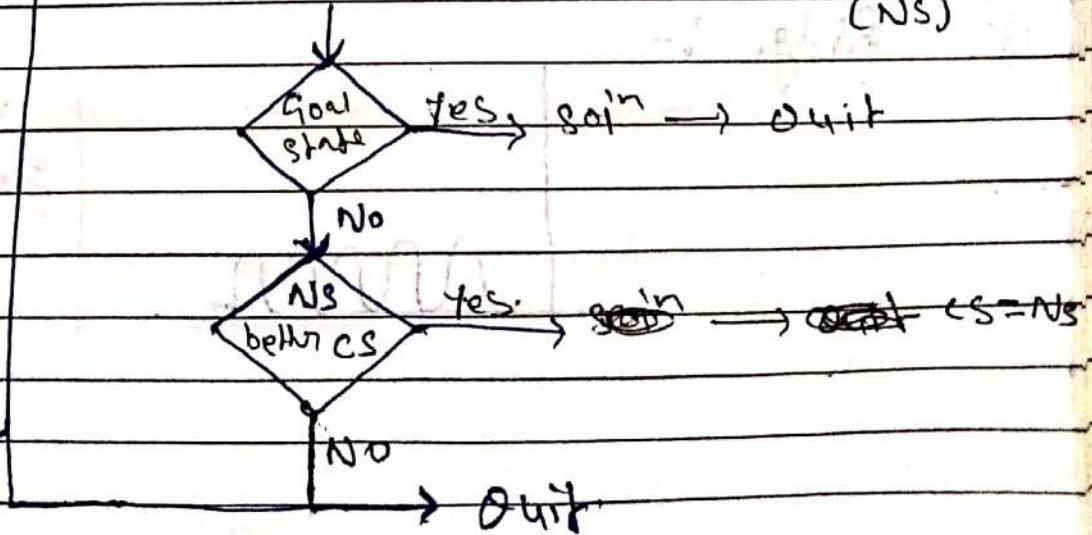
\downarrow
new state = current state.

Flow chart →

Evaluate initial state



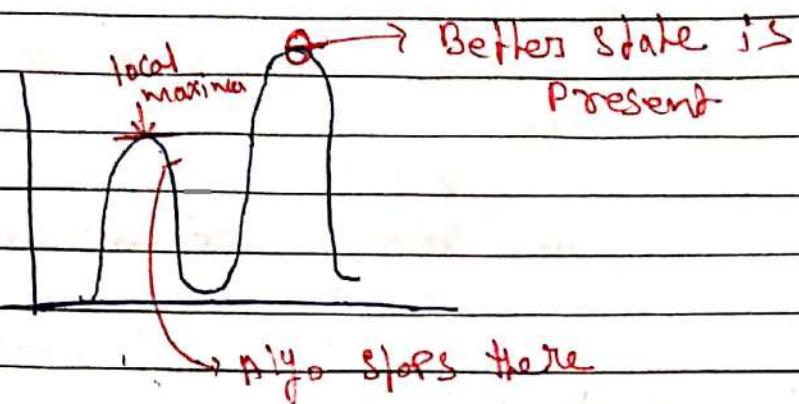
→ Apply operator 'o' and get new state (NS)



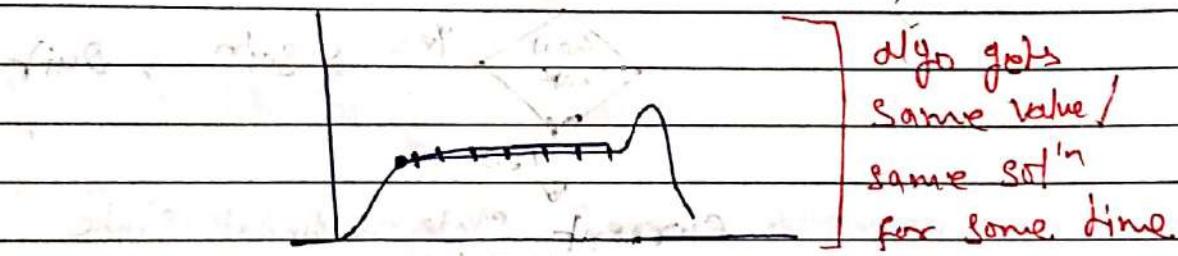
Good Write

Limitations of Hill climbing :-

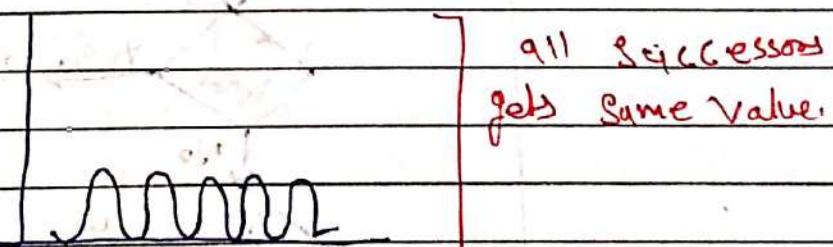
① Local Maxima :-



② Plateau :-



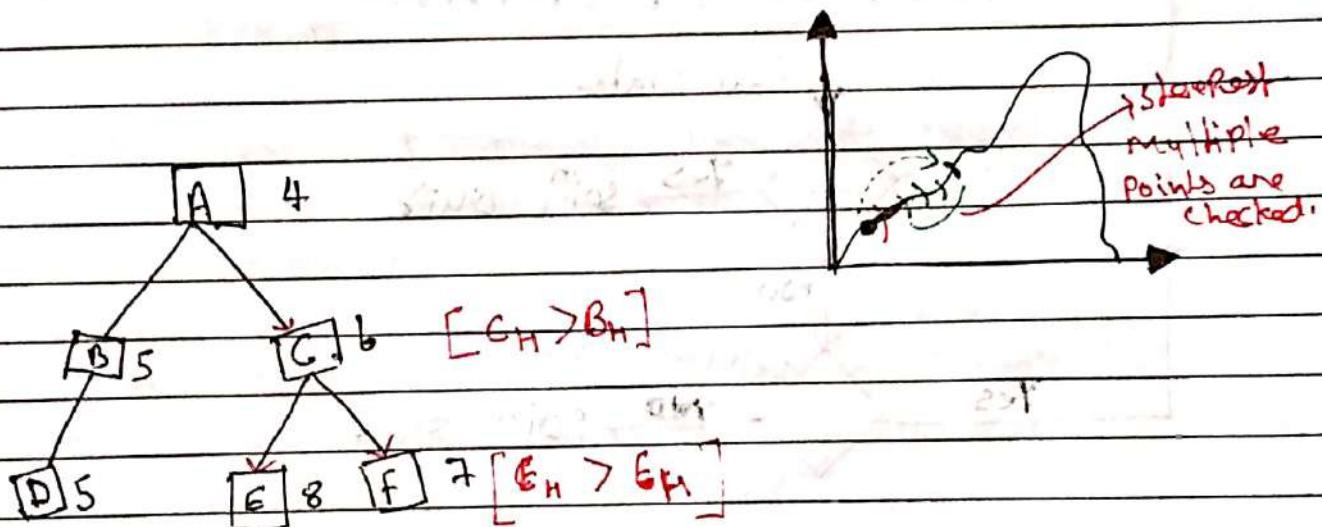
③ Ridge :-



Good Write

* Steepest Hill Climbing :-

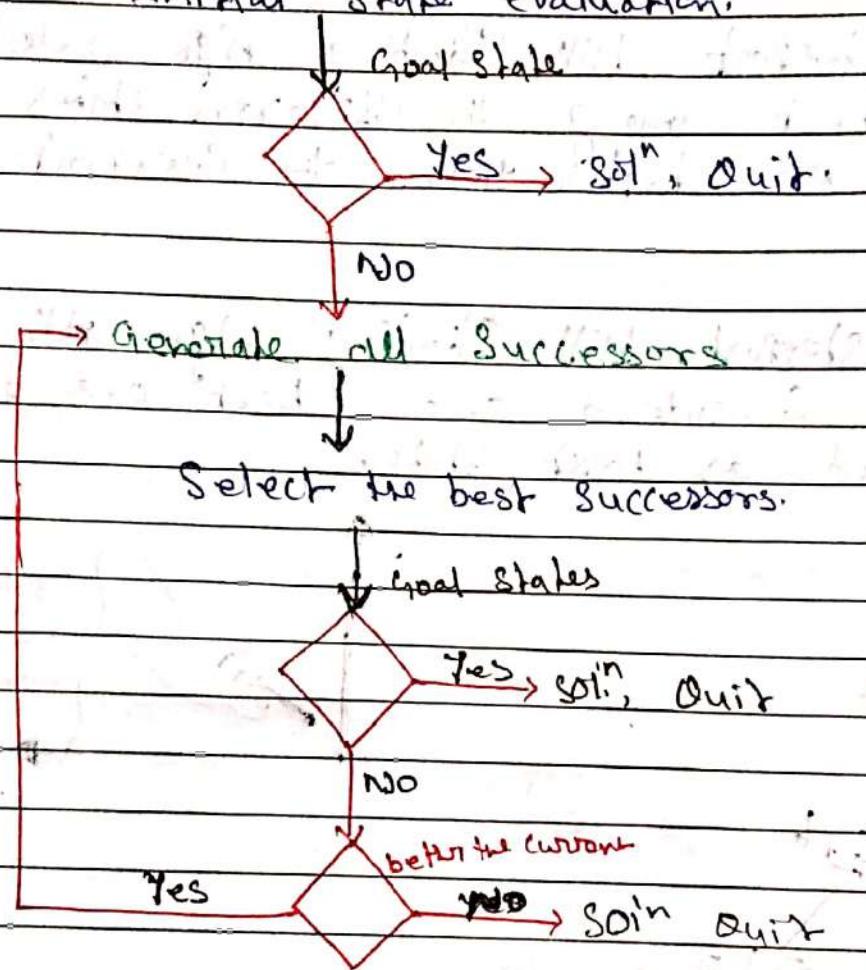
- In Steepest Hill Climbing multiple points are checked.
- In Steepest Hill Climbing Algo. Select the best among the Children states that are better than the current state.
- In Steepest Hill Climbing Algo All moves are Considered and best one is selected as next state.



- Slower than simple Hill Climbing.

Flow Diagram:-

Initial State evaluation.



Good Write

* Simulated Annealing :- (35 min)

- Simulated Annealing (SA) allows downward steps.
- Annealing is a process in metallurgy where metals are slowly cooled to make them reach a state of low energy where they are very strong.
- The term objective function is used in place of heuristic function.
- we attempt to minimize the objective function.
- The probability that the metal will jump to a higher energy level is given by $P = e^{-\Delta E/kT}$
- ΔE = is the difference in the energy level
- T = is the temperature
- k = is Boltzmann's Constant
- Moves to worse states may be accepted.

Good Write

Algorithm:-

Step1:- Evaluate the initial state. If it is also a goal state then return and quit. otherwise Continue with the initial state as a current state.

Step2:- Initialize ~~best-so-far~~ BEST-SO-FAR to the current state.

Step3:- Initialize T according to the Annealing schedule.

Step4:- Loop until a solution is found or until there are no new operators left to be applied in the current state:

a. Select an operator that has not yet been applied to the current state and apply it to produce a new state

b. Evaluate the new state. Compute

$$\Delta E = (\text{value of current}) - (\text{value of new state})$$

i. if the new state is goal state then return it and quit

ii. If it is not a goal state but is better than the current state then make

if the current state is also set BEST-SO-FAR to the new state.

m. If it is not better than the current state, then make it the current state with probability ' p' .

n. This step is usually implemented by invoking a random number generator to produce a number in the range $[0,1]$. If that number is less than Probability (p) then the move is accepted otherwise do nothing.

c. Revise T as necessary according to the annealing schedule.

Step 5: Return BEST-SO-FAR as the answer.

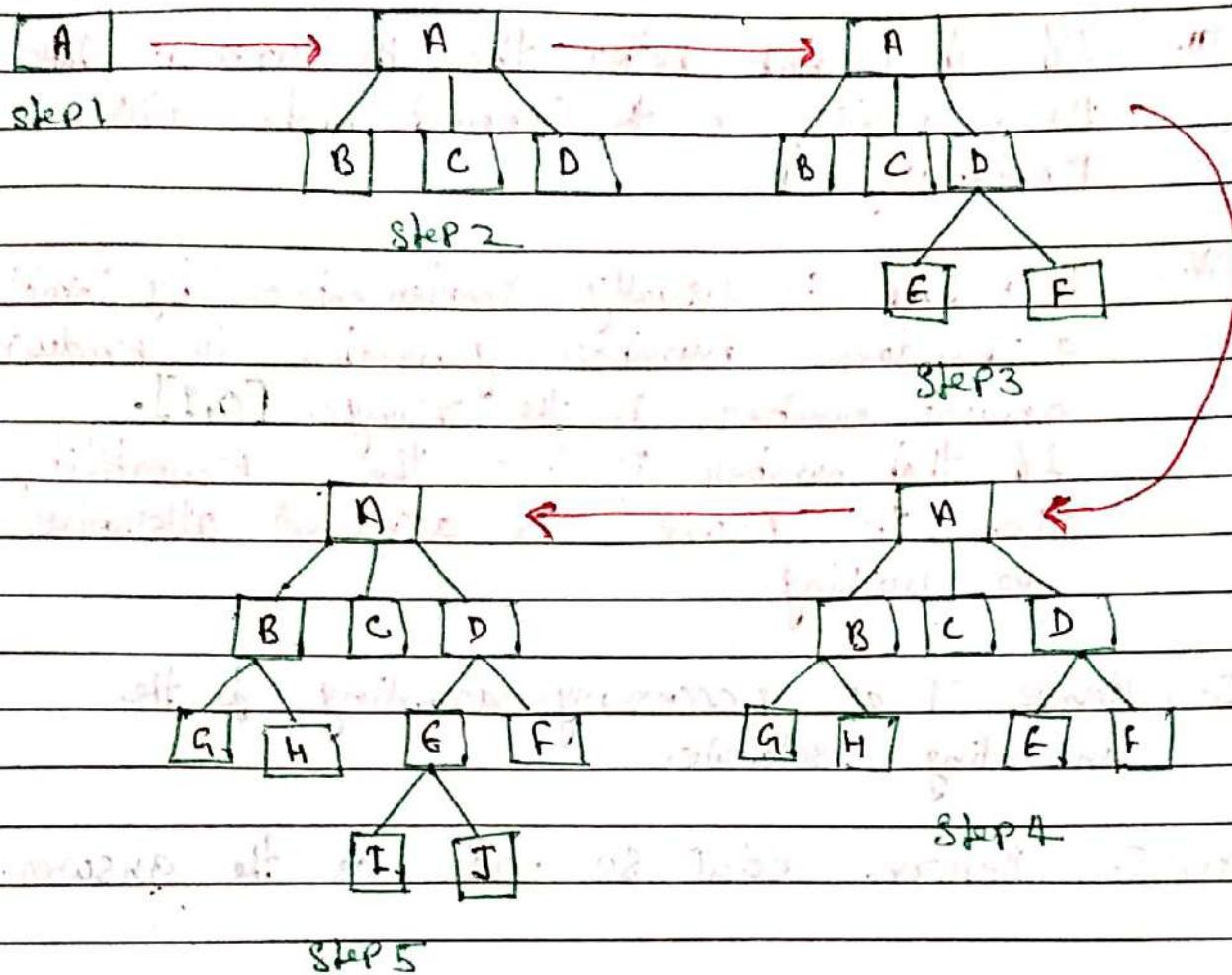
force will result in local minima
but still no global minimum
because step size is small

a single spin flip of $T=0$
has 50% chance of not updating
at all (mixed random walk without)

for forward 17 moves back 27%
and vice versa - no much no progress

Good Write

★ Best First Search :-



- Best First Search algorithm is a way of combining advantage of both DFS and BFS into a single method.
- DFS is good because it allows a solution to be found without all completing branches having to be expended.
- BFS is good because it does not get trapped on dead-end paths.

Good Write

- One way of combining the two algorithm is to follow a single path at a time but switch path whenever some completing path looks more promising than the current one does.
- At each step of the best first search process we select the most promising of the nodes we have generated so far. This is done by applying an appropriate heuristic function to each of them.
- We then expand the chosen node by using the rule to generate its successor.
- If one of them is a solution, then we can quit, else repeat the process until we search goal.

To implement such a graph procedure, we will need to use lists of nodes:

I. OPEN :- Nodes that have been generated and have had the heuristic function applied to them which have not yet been examined. (that is their successors generated)

II. CLOSE :- Nodes that have already been examined, we need to keep these nodes in memory if we want to search a graph rather than a tree.

Good Write

estimated time.

* A* Algorithm:-

A* no of solution

$$F' = g + h'$$

Final value

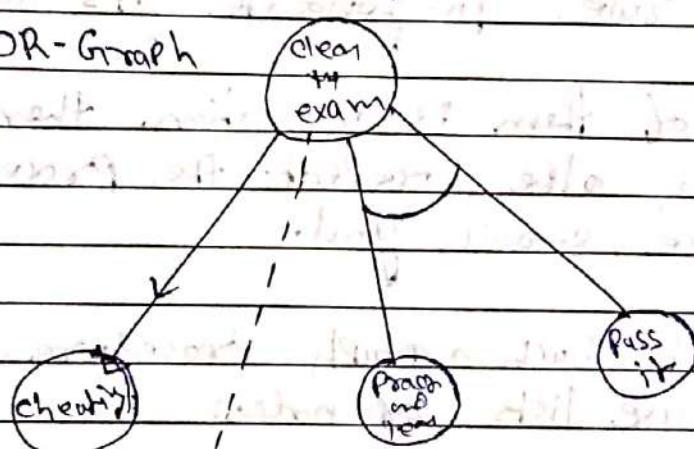
fixed inter.

Previous node \rightarrow Successor node.Example \rightarrow Tower of Hanoi

* AD*

AD* 1st option solution.

And - OR - Graph



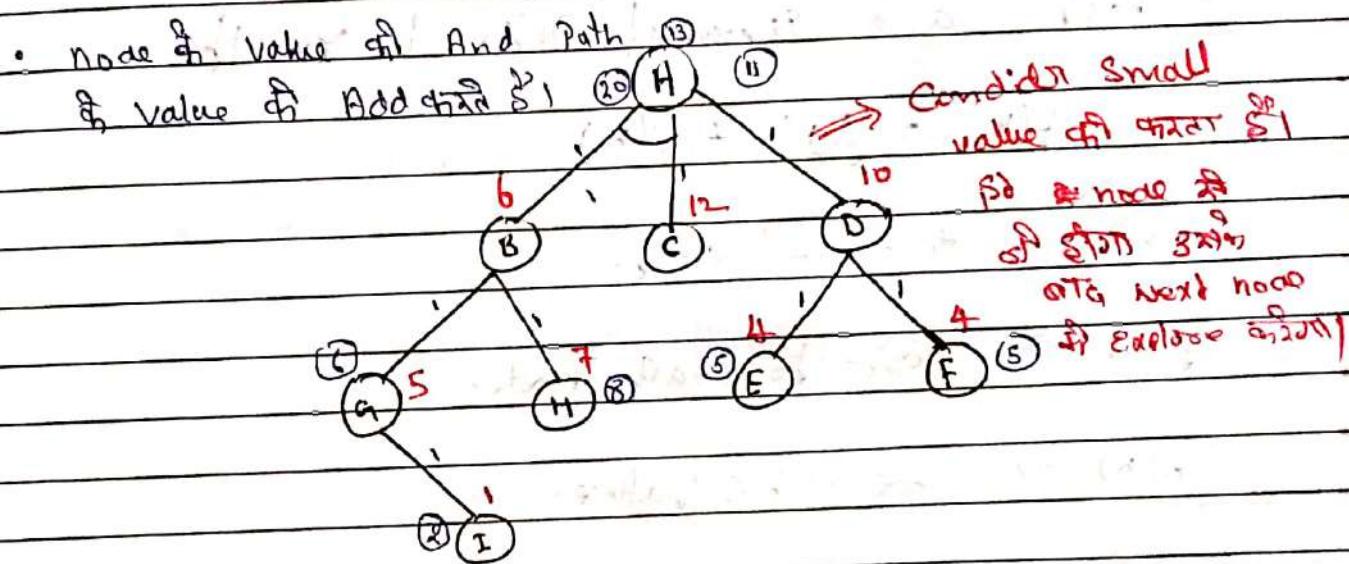
• Based on AND - OR - GRAPH

- This algorithm is Based on problem decomposition technique which means a bigger problem can be resolved using decomposition of the problem into the lower problems

Good Write

- Difference b/w A* and AO* is that A* algorithm gives optimal solution but the AO* does not explore all the solution available or choose the path once it got a solution. There is no guarantee to find the optimal solution.

Both of these algorithm are based on (best first search) algorithm.



and value of And Path
& value of Add node \$1

and value of And Path
& value of Add node \$1

and value of And Path
& value of Add node \$1

Good Write

~~HAPPY~~

* A* Algorithm

- Uses heuristic function $h(n)$ and cost to reach the node 'n' from start state $g(n)$.
- finds shortest path through search space.
- fast and optimal result.

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

$f(n) \rightarrow$ estimated cost.

$g(n) \rightarrow$ Cost to reach node.

$h(n) \rightarrow$ heuristic value.

A* algorithm :-

- i. Enter Starting node in OPEN List.
- ii. If OPEN List is Empty return FAIL
- iii. Select node from OPEN List which has smallest value. ($g+h$)
 ↳ If node = Goal, return Success.
- iv. Expand node 'n' and generate all successor
 ↳ Compute ($g+h$) for each Successor
 Good Write node.

v. If node 'n' is already in OPEN
(CLOSED, attach to backpointer).

vi. go to (ii)

From left to right all elements of
Superset added to open set
OPEN and then move to next row

From left to right all elements of
Superset added to open set
OPEN and then move to next row

From left to right all elements of
Superset added to open set
OPEN and then move to next row

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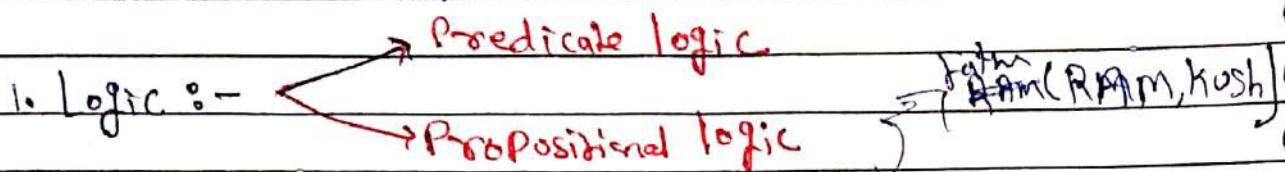
From left to right all elements of
Superset added to open set
OPEN and then move to next row

From left to right all elements of
Superset added to open set
OPEN and then move to next row

Unit 2

Knowledge representation :-

- (1) logic] do it yourself:-
- (2) Graphs



This is sunny day \rightarrow Sunny(Proposition), Ram is father of kush.

2. Semantic network:-

To represent the knowledge in different ways we have different knowledge representation technique such as,

- i. logic.
- ii. Semantic networks
- iii. frames
- iv. conceptual graph.
- v. Conceptual dependency.
- vi. Script.

1. Logic :- A logic is a formal language precisely defined Phrases, symbols and ~~and~~ Semantics

~~Mainly~~ Mainly two type of logic.

i. predicate logic.

ii. propositional logic.

1. **Predicate logic:** — A predicate logic is used to represent the knowledge this will be also used in knowledge representation, scene reasoning method.

The Predicate is a truth assignment for a statement which can be either true or false.

→ Therefore, symbols can be used in predicates logic

A → For All

E → There Exist

→ Implies

7 → Not

∨ → OR

Λ → AND

ii) Propositional Logic:- The real world facts as logical proposition can be represented by propositional logic.

Example :-

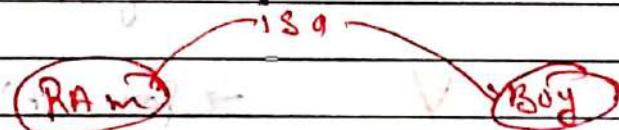
This sunny day (sunny)

It is raining then it is not sunny

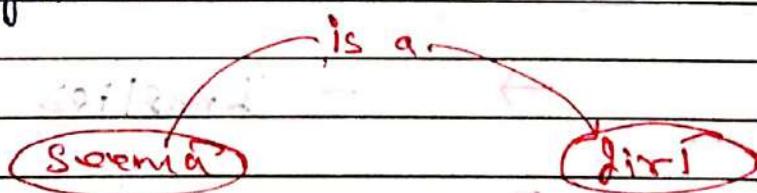
Raining \rightarrow \neg sunny.

3. Semantic Network :-

i) Ram is a BOY



ii) Seema is a girl



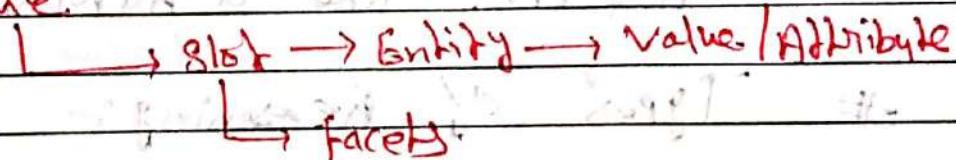
3. Frame :- A frame is a collection of attribute and associated value that describe some entity in the real world.

frames are general record like structure which consist of a collection of slot and slot value, the slot may be of any size and type.

Sets typically have ^{names} names and values or subfield called facets.

facets may also have any number of values and name.

frame



Syntax of a frame

`<Frame, name>`

<slot 1> <facet name> <value>

<slot 2> <facet name="" value2>

$\langle \text{slot} \rangle \langle \text{fact name} \ldots \text{value} \rangle$

* Reasoning in AI :-

The reasoning is the mental process of deriving logical conclusion and making prediction from a variable knowledge, facts and belief we.

Can say that reasoning is way to infer (develop) facts from existing data.

It is the general process of thinking logically to find valid valid conclusion.

In artificial intelligent the reasoning is essential so that the machine can also think logically as a human brain, and can perform like a human.

Types of Reasoning :-

in AI Reasoning can be divided into the following categories

- i. Deductive
- ii. Inductive
- iii. Abductive
- iv. Common-sense
- v. monotonic
- vi. non-monotonic

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↳ Deductive Reasoning :- In this reasoning include deduce new information from logically related known information. It is a form of valid reasoning which means the argument conclusion must be true when the ~~but~~ premises are true.

Deductive reasoning is a type of propositional logic in AI and it requires various rules and facts. It is sometime preferred to as "reasoning". This reasoning mostly starts from the general premises to the specific conclusion which can be explained as below.

Premise 1 :- All human eats veggies.

Premise 2 :- Swish is a human.

Conclusion :- Swish eats veggies.

The general process of deductive reasoning is



Q. What do you mean by learning? Briefly define all the learning techniques available in AI.

→ Learning the process that improves the knowledge of AI program by making observation about its environment. Most of the Artificial Intelligence (AI) basic literature identifies two main group of learning models: Supervised And Unsupervised.

There are ~~big~~ type of learning technique.

- Learning Problems
 - i. Supervised learning
 - ii. Unsupervised learning
 - iii. Reinforcement learning.
- Hybrid learning Problems
 - iv. Semi-supervised learning
 - v. Self-supervised learning
 - vi. Multi-instance learning

I. **Supervised Learning** :- Describe a class of problem that involves using a model to learn a mapping between input example and the target variable.

II. **Unsupervised Learning** :- Describe a class of problem that involves using a model to describe or extract relationships in data.

III. **Reinforcement Learning** :- Describe a class of problems where an agent operates in an environment and must learn to operate using feedback.

IV. **Semi-Supervised Learning** :- It is supervised learning where the training data contains very few labeled examples and a large number of unlabeled examples.

V. **Self-Supervised Learning** :- This learning refers to an unsupervised learning problem that is framed as a supervised learning problem in order to apply supervised learning algorithms to solve it.

Q2. What do you understand by knowledge representation? what type of various knowledge representation technique can be used in AI:-

- Knowledge representation used to capture the knowledge about real world.
- Knowledge representation is the study of ways of how knowledge is actually represented or picturized.

To represent the knowledge we have different representation technique such as:-

1. Logic :- Logical representation means drawing a Conclusion based on Various Conditions.
- Logical representation is a language with some concrete rules which deals with propositional and has no ambiguity in representation.

Mainly two type of logic.

Q.

v. Multi-Instance learning :- It is a supervised learning problem where individual example are unlabeled. instead, bags or group of samples are labeled.

In Multi-Instance learning, an entire collection of example is labeled as containing or not containing an example of a class, but individual member are Collection are not labeled.

Q2 What do you mean by an expert system.

Define its Component and Characteristics of expert System.

⇒

In artificial intelligence, an expert System is a Computer System emulating the decision-making ability of a human expert. Expert Systems are designed to solve complex problems by reasoning through bodies of knowledge, represented mainly as if - then rules rather than through conventional procedural code.

Good Write

Component of expert system:-

An expert system is typically composed of at least three primary components.

These are the

1. Inference engine.
2. Knowledge base
3. User interface.

i. Inference Engine :- The inference engine is the main processing element of the expert system. The inference engine chooses rules from the agenda to fire. If there are no rule on the agenda, the inference engine must obtain information from the user in order to add more rule to the agenda.

ii Knowledge base :- The knowledge base is a collection of rules or other information structures derived from the human expert. Rules are typically structured as if / then ~~then~~ statement of the form :-

IF <antecedent> THEN

<consequent>

III. User Interface :- A user interface is the method by which the expert system interacts with a user. These can be through dialog boxes, Command prompts, forms, or other input method.

~~Chap~~

Characteristics of expert System:-

- Human experts are perishable but an expert system is permanent.
- It helps to distribute the expertise of a human.
- They use a knowledge base and interface engine.
- Expert System were among the first truly successful forms of artificial intelligence (AI) software.
- Low accessibility, cost.
- Fast Response.