25/7/24

Artificial Intelligence

1. Understanding the human behaviour & Intelligence

AI:

* The art of creating machine that can perform functions that require intelligence when performed by people.

* The study of how to make computers do things at which at the moment the people are better.

* The study of the computation that make it possible to ~~pursue~~ perceive, reason and act.

* ~~The~~ To develop a system that act like human.

* To develop the system to think like human.

Components of AI system:

1. Agent:
2. Sensor
3. ~~Activators~~ Actuators
4.

Uses of AI :

1. Health care — Medical diagonis
2. Finance — Stock market
3. Retail → Product management
4. Manufacturing → Product management
5. Transportation → route finding, ang
6. customer service → Chatbot
7. Security. →
8. Marketing — CRM. E-billing
9. Education — online Tutorial system.

Approaches of AI :

There are different types of approaches

i) Acting humanly
ii) Thinking humanly
iii) Thinking rationally
iv) Acting rationally
v) Machine learning approach — To learn from the previous data.
vi) Neural network approch
vii) Fuzzy logic approach
viii) Hybrid approach
→ Image recognition
Speech recognition
Voice recognition

Neural network :

Drawbacks of AI:

It is very difficult

* Lack of transparency & accountability
* Security and privacy.
* Ethical concern
  ↳ Decision making
* Complin & analyzing is difficult.
* With Basic knowledge, it is able to build an AI system.

Technologies based on AI:

1. Machine learning
2. Natural Language Processing
3. Computer vision → GUI → To make & understand visual info.
4. Robotics
5. Neural networks → Learning algorithm based on the functions of the brain.
6. Expert System
7. Chatbot.

AI Problems:

There are basically three types of problems:

i) Ignorable — Solutions steps is ignored
ii) Recoverable —
iii) Irrecoverable —

Steps:

→ Problem Definition - Detailed specification of inputs

→ Problem analysis - Analyse the problem thoroughly

→ Knowledge Representation - collect the detailed information.

→ Problem solving - selecting the best techniques.

Components to formulate the associated problem:

→ Initial state - Initial state of the problem.

→ Action - / control / conditions.
Problem formulation works.

→ Transition -

→ Goal test -

→ Path costing -
Time complexity

Eg: n-queens problem.

AI techniques:

1. Machine Learning:

→ ML is one of most wide technique

→ To predict the data from the initial data to the next data based on predictive analysis.

There are different algorithms

↳ Unsupervised learning

↳ Supervised learning

↳ Reinforcement learning

↳ Deep learning.

→ Artificial neural networks are the foundation of the subfield of ML that is Deep learning based on predictive analysis

2. Machine vision

→ Machines are capable of collecting and analyzing visual data.

→ In this cameras are utilized to record sensory information → then processed using digital signal processing

→ It is converted to analog to digital.

→ medical diagnosis

→ Natural Language Processing:

→ The way in which computers were trained to comprehend natural languages is via their connections with human language.

→ It is the method of extracting meaning from human languages.

→ The machine in NLP records the speech of a person speaking.

Applications:

* IVR Interactive voice Response systems used in contact centres.
* Language translations like Google translations
* Word Processors → correctness of the syntax
* Microsoft word – spell checker.

→ Automation and Robotics:

→ The goal of automation is to enable machines to perform boring, repetitive jobs, increasing productivity and delivering more effective efficient and affordable results.

→ To automate process, business employs ML through,

→ artificial neural
→ graphs

→ CAPTCHA technique. → this automation can avoid fraud problems during online payments.

→ Robotic process automation is to carry high volume, reptitive jobs & being capable of adapting to situations.

Defining a problem as a state space search.

State space search algorithm:

Tiles program.

1. state
2. Initial state
3. Goal
4. pathcost

3	8	1
6	2	5
	4	7

→

3	8	1
6	2	5
4	-	7

→ Third state

→

3	8	1
6	2	5
4	7	-

→ Transformed to second state

→

3	8	1
6	2	-
4	7	5

3 8 1
- 6 2
4 7 5

→

3 8 1
4 6 2
- 7 5

→

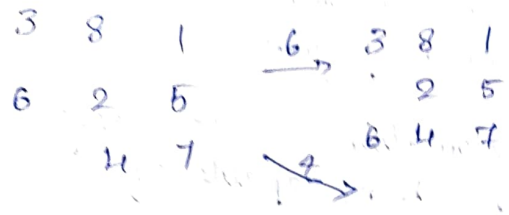
3 8 1
4 6 2
7 - 5

→

3 8 1
4 2 -
7 6 5

~~3 8 1~~
~~6 2 5~~
~~4 7~~

3 8 1
6 2 -
4 7 5



State :

Specify the location of each of the states

Initial state :

Any state can be taken as a initial state

Goal :

~~Any~~ Many combinations of the state to achieve the goal.

ditions :

A blank state can be moved from

* UP
* Down
* left
* right

Path cost :

To estimate the p. cost of the path

Problem characteristics:

* It is the problem decomposed into smaller sub problems which are easy to solve.

* The solution steps can be ignored (or) undone.

* If the problem can be predictable.

* The solution of the problem is absolute or relative.

* Define the role of knowledge in problem solving.

whether it requires a human interaction to solve the problem.

Search algorithm in AI:

A search problem consists of

1) state space
2) start space
3) Goal state
4) Solution
5) Plan.

Types:

i) Uninformed
   - DFS Depth First Search
   - BFS Breadth First search
   - Uniformed cost search

ii) Informed → A* algorithm

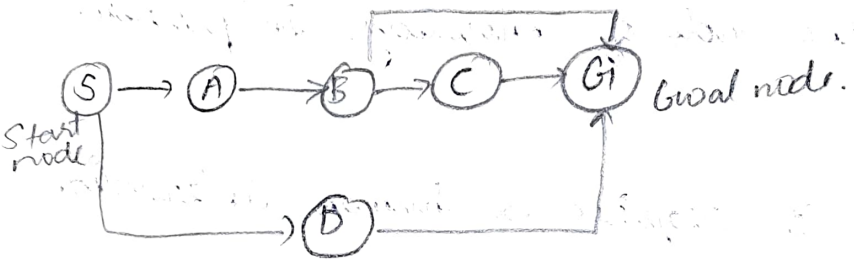
DFS:

* DFS is an algorithm for traversing or searching a tree (or) graph data structures.

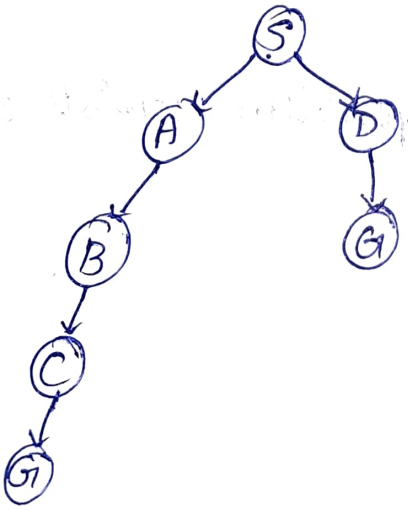
* The algorithm starts from root node and explore all the possible branches of the node before backtracking.

* It is a last in first out strategy.

* It is implemented using stack.



S → G1 (Goal state).



Soln

S-A-B-C-G1//.

S-A-B-G

S-A-G1.

Time complexity

$$T(n) = 1 + n^2 + n^3 + \dots n^d.$$

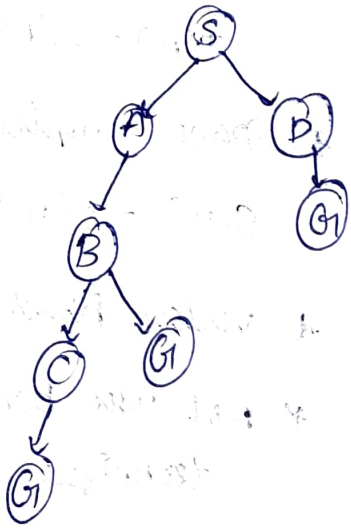
$$= O(n^d)$$

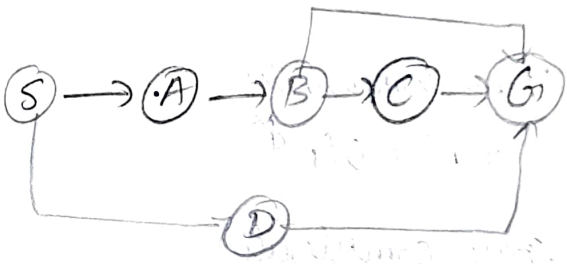
↳ order

Space complexity:

$$S(n) = O(n \times d)$$

BFS





Soln

S - D - G.

Time complexity

$$T(n) = O(n^d)$$

Space complexity

Sp $S(n) = O(nd)$

* BFS is an algorithm for traversing (or) searching a tree (or) graph data structure.

* It uses first-in first-out strategy

* It is implemented using queue data structure

* It finds shortest path.

Write down the difference b/w DFS & BFS

DFS	BFS
* Depth first Search.	* BFS is Breadth first Search.
* It uses stack data Structure.	* It uses de queue data Structure.
* Time complexity: $T(n) = O(n^d)$	* Time complexity: $T(n) = O(n^d)$
* Space complexity $S(n) = O(n \times d)$	* Space complexity: $S(n) = O(n^d)$
* Edge based technique.	* vertex based technique
* It uses the back tracking technique	* Not uses back tracking technique
* Suitable for decision treee	* Not suitable for decision tree
* DFS is fast in Performance	* BFS is slow in Performance

Uniform cost search.

* The goal is to find the path where the cumulative Sum of the cost is least.

* The cost of a node equal to cumulative cost of all the nodes.

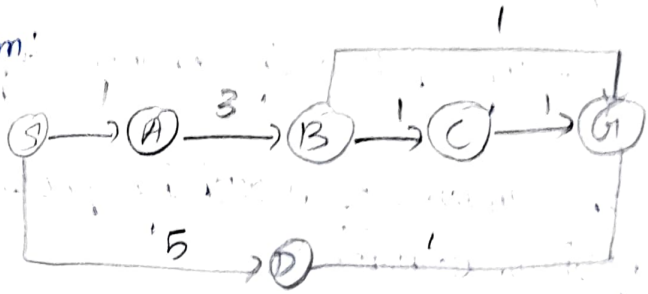
cost(node) = cumulative cost of all nodes

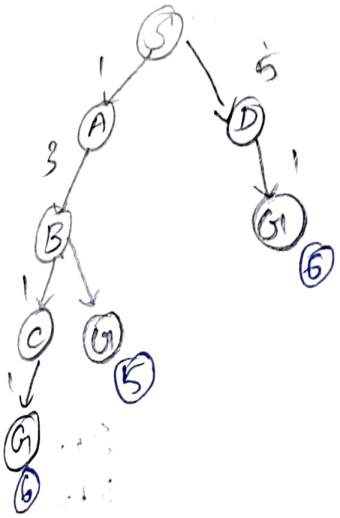
Cost(root) = 0.

* It is implemented by the priority queue.

* It gives maximum priority to the lowest cumulative cost

Problem:





Soln.

$S \rightarrow A \rightarrow B \rightarrow G_1$.

Cost(node) = 5

Time complexity:

$$T(n) = O\left(b^{(1+C^*/E)}\right)$$

C^* = Cost of optimal solution.

E = Each step to get closer to the goal node.

Space complexity:

$$S(n) = O\left(b^{(1+C^*/E)}\right).$$

Heuristic Search:

It is a type of search process used in problem solving.

It involves using previously known information.

To reduce the amount of searching process and to obtain an optimal solution.

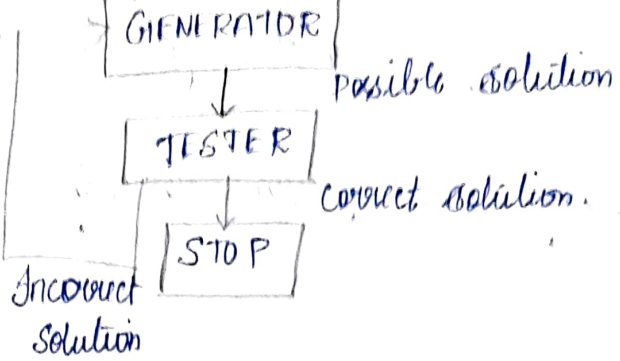
There are many classification of a Heuristic search method:

1. Generate and Test
2. Hill climbing
3. Best - First search
4. A* Algorithm } repeated question
5. AO Algorithm }
6. Problem reduction
7. Constraint
8. Satisfication Problem.
9. Means End analysis.

BFS
DFS
Uniformed.

Generate and Test:

* It is a Heuristic search method.
* It uses Depth first search method with backtracking.
* In this technique, all the possible solutions are generated and tested until it produce the best solution.

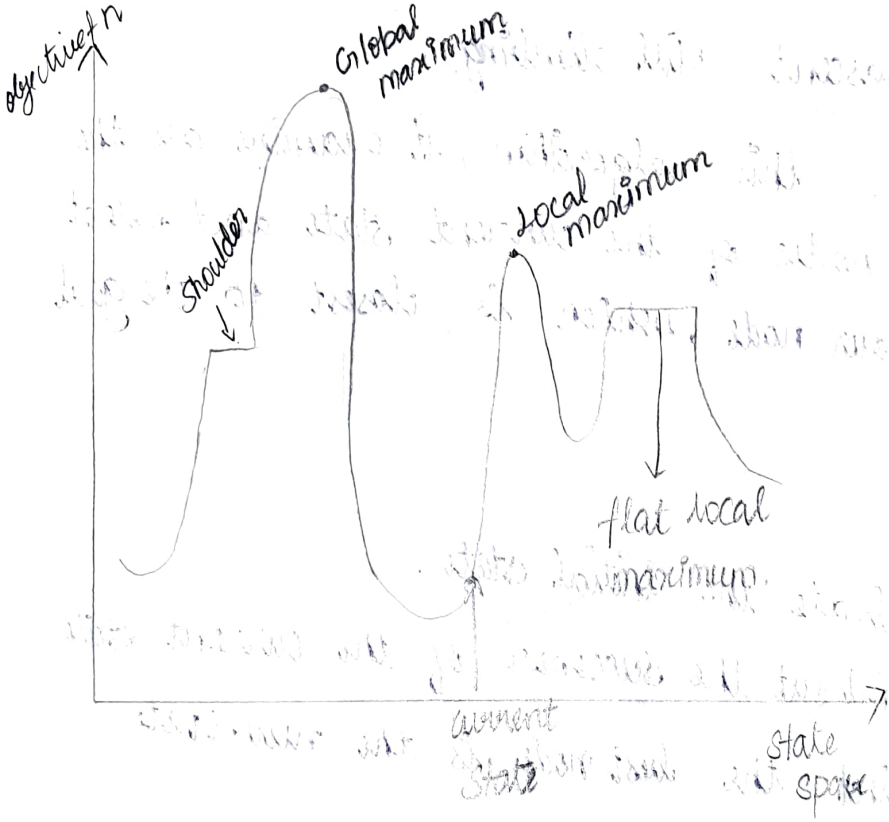


Algorithm:

To generate all the possible solution.

Hill climbing:

1. Simple Hill climbing.
2. Steepest Ascent climbing
3. Stochastic climbing



* Hill climbing ~~is a~~ algorithm is a local search algorithm which continuously moves in the direction of increasing value to find the peak value of the mountain (or) the least solution to the problem.

* It is used for optimizing the mathematical problems.

Eg: Travelling sales person, Greedy search.

1. Algorithm

* Evaluate the initial state.
* If it is a goal state, stop the process
* Check a new state. If it is a goal state then it returns success, otherwise it chooses the next current state.

2. Steepest ascent Hill climbing:

In this algorithm, it examine all the neighbouring nodes of the current state and select one neighbour node, which is closest to the goal state.

Algorithm:

1. Evaluate the initial state.
2. Find out the successor of the current state.
3. Select the best node is the new state
4.

Problems in Hill climbing:

1. Local maximum
2. Plateau
3. Ridge.

Stochastic

Local maximum:

* It is a peak value, which is better than each of its neighbouring states.

*

Plateau:

All the neighbouring state have the same value.

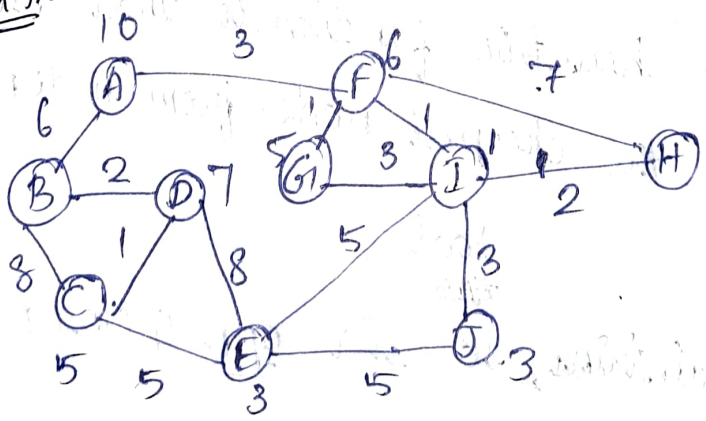
Ridge:

It is a local maximum value which is higher than the surrounding value.

Simulated annealing:

This algorithm uses the process of ~~term~~ annealing hardening a metal or glass to a high temperature and then cooling gradually, so that it allows the metal to reach a goal state.

A* Algorithm:



→ A* algorithm is used for path finding and graph traversal.

→ It is also used to find the shortest path efficiently.

→ Eg. online games & web based games.

→ It maintains a prior path originating a start node and extend the node one edge at time.

→ It continues until its termination

→ It extend the path by using the function $f(n) = g(n) + h(n)$. where n is the last node.

$g(n)$ = cost of the path from start node to node n

$h(n)$ = evaluate the cheapest path. heuristic function that estimate the cost of the cheapest node from node n to goal node.

tool

→ It maintains two list open & closed

1. Start with node A.

A < B, F

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

$= 8 + 6 = 14$

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

$= 6 + 3 = 9.$

$f(F) < f(B)$

→ go to node F.

$f(F)$ is the smallest value.

2. A – F < G1, H

$f(G1) = A - F - G1$

$= g(A) + h(A) + g(F) + h(F) + g(G1) + h(G1)$

$= 10 + 3 + 3 + 1 + 5 = 9$

$f(H) = A - F - H = 13.$

$= 3 + 7 + 3 = 13.$

G1 – expanded.

G1 < I

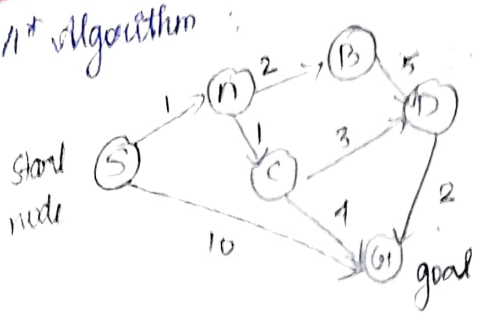
G1 – I.

$F(I) = A - F - G1 - I.$

$= 9$

∴ shortest path is A – F – G1 – I.

A* algorithm



State	hcn
S	5
A	3
B	4
C	2
D	6
G1	0

1) S → A

Calculate $F(n) = g(n) + h(n)$

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

$f(A) = 1 + 3 = 4.$

2) S → G1

$f(G1) = g(G1) + h(G1)$

$f(G1) = 10 + 0 = 10$

$4 < 10$ choose A node

3) S → A < B, C

i) S → A → B

S - A - B $f(B) \Rightarrow g(B) + h(B)$

1 2

$= (1+2) + 4 = 7$

$f(B) = 7$

ii) S - A - C $f(C) = g(C) + h(C)$

$f(C) = 2 + 2 = 4$

4 - lowest cost

$4 < 7$

S - A - C

Take C node to expand

S-A-C-D ⇒ f(D) = g(D) + h(D)

S-A-C-D f(D) = 5 + 6 = 11. f(D) = 11.

S-A-C-D
1 1 3
5

f(G1) = g(G1) + h(G1)

f(G1) = 6 + 0 = 6.

6 < 11

To take node G1.

Final path is S → A → C → G1 ⇒ optimal path.

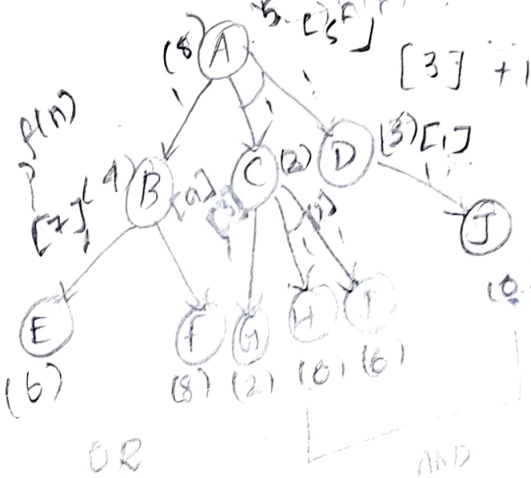
cost = 6.

optimal path - least value of cost.

AO* Algorithm: Also known as AND-OR graph algorithm

↓

Anytime optimal optimality solution



By default g(n) = 1 for all nodes.

OR → omitted AND → dependent

1) B-E

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

f(E) = g(E) + h(E)

= 1 + 6 = 7.

2) B-F

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

f(F) = g(F) + h(F)

= 1 + 8

= 9

C-G
C-H } AND
C-I

$f(G) = G\,g(G) + h(G)$

$= 1 + 2$

$= 3$

AND

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

$= 0 + 1 + 0$

$= 1$

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

$= 0 + 1 + 0$

$= 1.$

$f(H) = f(H) + f(I)$

$= 1 + 1$

$= 2$

D-J.

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

$= 1 + 0$

$= 1.$

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

$= 1 + 1$

$= 2.$

$f(A) = g(C) + h(C) + g(D) + h(D)$

$= 1 + 1 + 3 = 5.$

3 Means Ends Analysis :

Unit - II

Knowledge Representation

1. Procedural knowledge
2. Declarative knowledge

Procedural	Declarative
* It is also known as interpretive knowledge.	* It is also known as descriptive knowledge.
* It defines How to perform the task.	* It defines what to do to perform the task.
* It can't easily communicate	* It can easily communicate.
* It is generally process-oriented	* It is generally data-oriented
* Debugging and validation is not easy	* Debugging and validation is easy.
* Less effective	* More Effective

Representation of knowledge.

1. Object.
2. Event
3. Performance
4. Meta-knowledge
5. Fact.
6. Knowledge phase

Types of knowledge:

1. Declarative knowledge
2. Procedural knowledge
3. Meta-knowledge
4. Heuristic knowledge
5. Structural knowledge

Knowledge cycle:

1. Perception
2. Learning
3. KRR
4. Planning
5. Execution.

Forward & Backward chaining

As per the law, it is a crime for an American to sell weapons to hostile nations. Country A, an enemy of America, has some missiles, and all the missiles were sold to it by Robert, who is an American citizen.

Criminal

§ "Matching Techniques:"

Matching is the processing of comparing two or more structures to discover their likenesses (or) differences. The structures may represent a wide range of objects including physical entities, words (or) phases in some languages.

Representations will be given in one or more formalisms like FOPL, networks

Fuzzy matching:

It is method that provides an improved ability to process word based matching queries to find matching sentences from a database

when an exact match is not found an sentence, the fuzzy matching can be obtained. This matching it attempts to find a match to the above heuristic level.

Applications

Healthcare
Finance & Insurance
Education
Government
Video conference.