Knowledge.

Intelligence is the accen of knowledge.

Exp. ① Ram is tall
② Bill loves Sue
③ Ram has leaned to use recursion to manipulate linked list in several programming language.

Types of knowledge

① Procedural knowledge
② Declarative knowledge
③ Heuristic knowledge.
④ Meta knowledge.

① active knowledge → with set of step.
② Passive knowledge → Person's database

Heuristic knowledge :- for judgement.

(4) knowledge about knowledge.

Specific Terms.

(1) Belief :- ~~Mear~~ To represent meaning knowledge True/False

(2) Hypatheris :- Sentence Justification Always True.

(3) Epistemology :- Nature of any thing How you represent the nature of ~~any~~ thing.

Knowledge & Data.

Knowledge Acquisition :-

→ expert

→ Report → Technical Report, ↳ Showing latest Research.

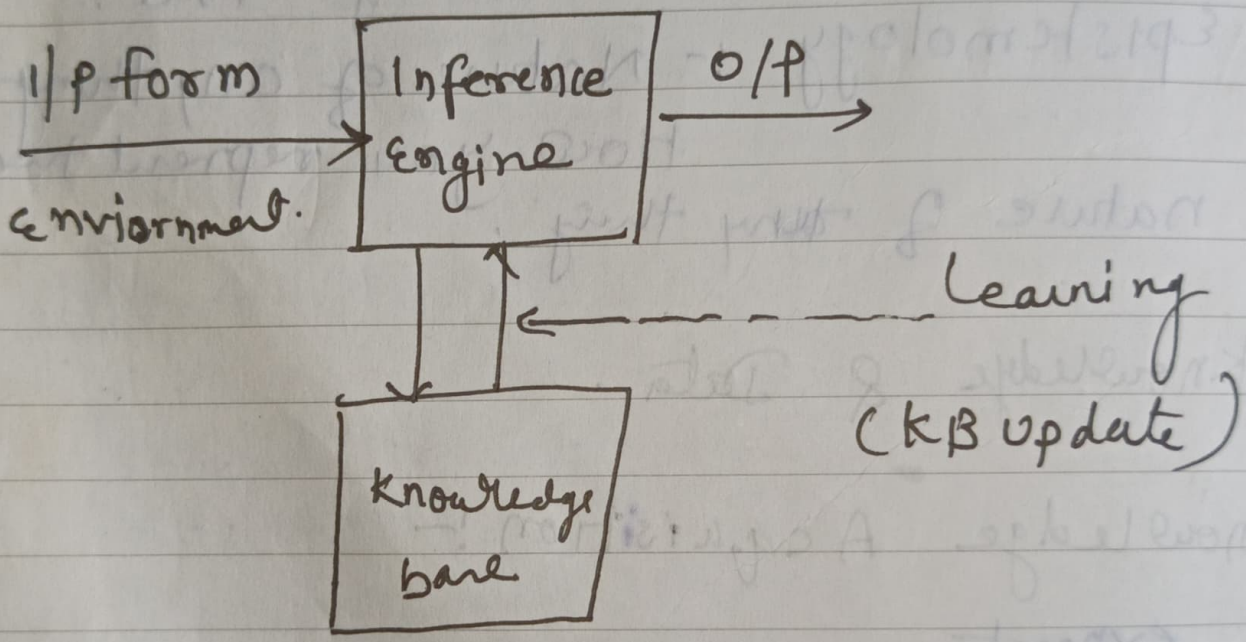
Creating some new knowledge from existing resources.

Knowledge based System:-

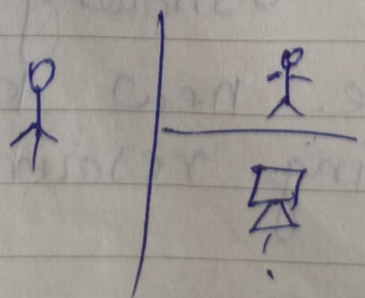
KB + Inference Engine

One man how much knowledge about the world.

→ derives the new sentence from input & KB.



Turing Test:- In the year 1950's



Turing test is finding the system with human intelligence.

① 3 rooms contain a person, a computer & interrogator

② Why do we need artificial intelligence?

→ AI is very important. its how the computer basically thinks. Its used in games and how the computer solves problems. AI is based on algorithms, events, time, procedures/steps conditions. AI is a huge part on how a computer works.

→ To supplement natural intelligence, AI means that you are building intelligence in an object so that it can do what you want it to so, as for esp robots, thus reducing human labour and reducing human mistakes.

4G | 3G

(2, 4, n) 14/07/10

(30)

State Space search

(1) Water Jug Problem:-

Production Rule.

① $(x, y) \longrightarrow (4, y)$ fill the 4G Jug
if $x < 4$

② $(x, y) \longrightarrow (x, 3)$ fill the 3G Jug
if $y < 3$

③ $(x, y) \longrightarrow (x-d, y)$ Pour the some water from 4G to the ground.
if $x > 0$

④ $(x, y) \longrightarrow (x, y-d)$ Pour some water from 3G to the ground
if $y > 0$

⑤ $(x, y) \longrightarrow (0, y)$ Empty the 4G jug on the ground
if $x > 0$

⑥ $(x, y) \longrightarrow (x, 0)$ Empty the 3 jug on the ground
if $y >$

3 - (4-4).

(7) $(x, y) \longrightarrow (4, y-(4-x))$
if $x+y \geq 4$ and $y>0$

(8) $(x, y) \longrightarrow (x-(3-y), 3)$
if $x+y \geq 3$ and $x>0$

(9) $(x, x) \longrightarrow (x+y, 0)$
if $x+y \leq 4$ and $y>0$

(10) $(x+y) \longrightarrow (0, x+y)$
if $x+y \leq 3$ and $x>0$

(11) $(0, 2) \rightarrow (2, 0)$

(12) $(2, y) \rightarrow (0, y)$.

Rule 1 :- Fill the 4G Jug

Rule 7 :- Pour ~~son~~ water from the 3G Rul into the 4G Jug until the 4G jug is full.

Rule 8. Pour water from the 4G into the 3G jug until the 3G jug is full

9. Pour all the water from the 3G jug into the 4G jug.

10 Pour all the water from the 4G jug into the 3G jug.

11. Pour the 2G from the 3G jug into the 4G jug.

12. Empty the 2G jug in the 4G jug on the ground.

Rule	4G	3G
Initial State	0	0
Rule 2	0	3
Rule 5	3	0
Rule 2	3	3
Rule 7	4	2
Rule 5	0	2
Rule 9	2	0

44	36		60
0	0	1	40
4	0	8	13
1	3	6	10
1	0	10	01
0	1	1	41
4	1	8	23
2	3	6	20
2	0		

There operations on a queue are as follow.

- MAKE-QUEUE (element, ...) creates a queue with the given element (s).
- EMPTY? (queue) returns true only if there are no more elements in the queue.
- FIRST (queue) returns the first element of the queue.
- REMOVE-FIRST (queue) returns FIRST (queue) and remove it from the queue.
- INSERT (element, queue) inserts an element into the queue & returns the resulting queue.
- INSERT-ALL (elements, queue) insert a set of elements into the queue & returns the resulting queue.

Measuring problem-solving Performance.

- Completeness: Is the algorithm guaranteed to find a solution when there is one?
- Optimality: Does the strategy find the optimal solution, ~~or~~
- Time Complexity: How long does it take to find a solution?
- Space complexity: How much memory is needed to perform the search?

Missionaries & cannibals problem.

* State (#m, #c, l/o)

① #m number of missionaries in the first bank
② #c no of cannibals in the first bank
③ The last bit indicates whether the boat is in the first bank.

Start state : (3, 3, 0)
Goal state : (0, 0, 1)

operators:

Boat carriers (1, 0) or (0, 1) or (1, 1) or (2, 0) or (0, 2)

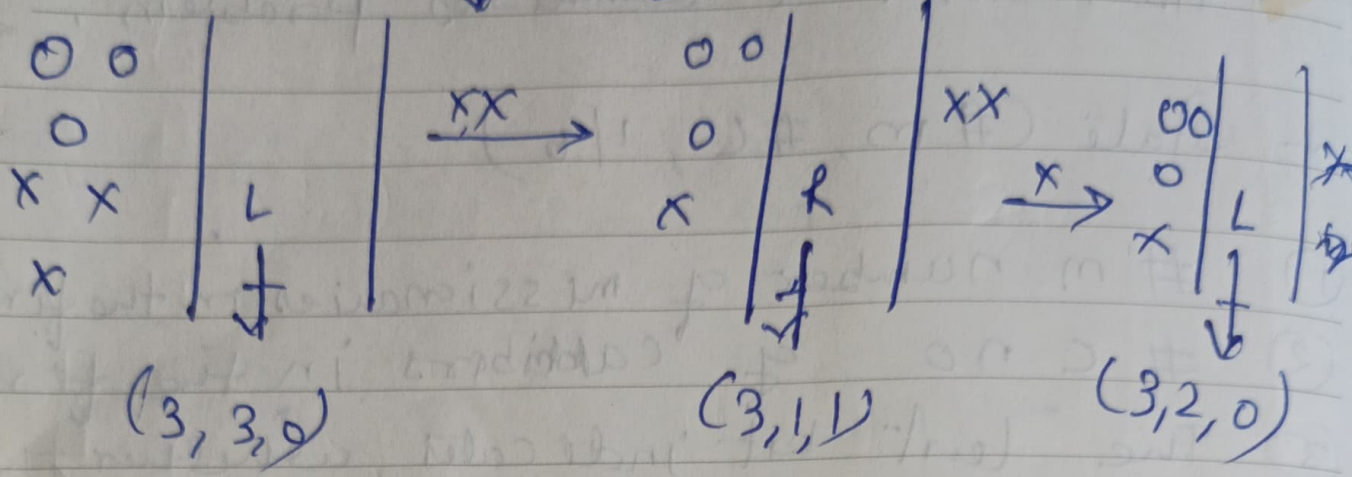
Given ($, s, o, g)

$ = is the set of state
s = s is the start state
o = is the set of state transition ops
g = is the set of goal state.

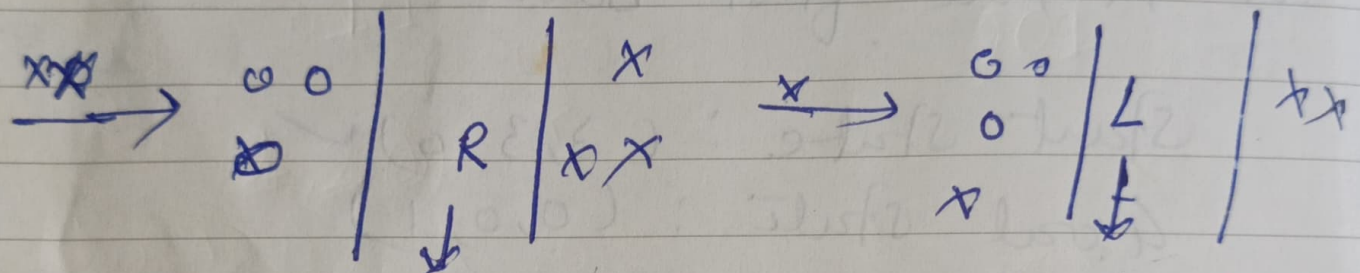
* To find out the sequence of the state transition leading from s to goal state

Boat position

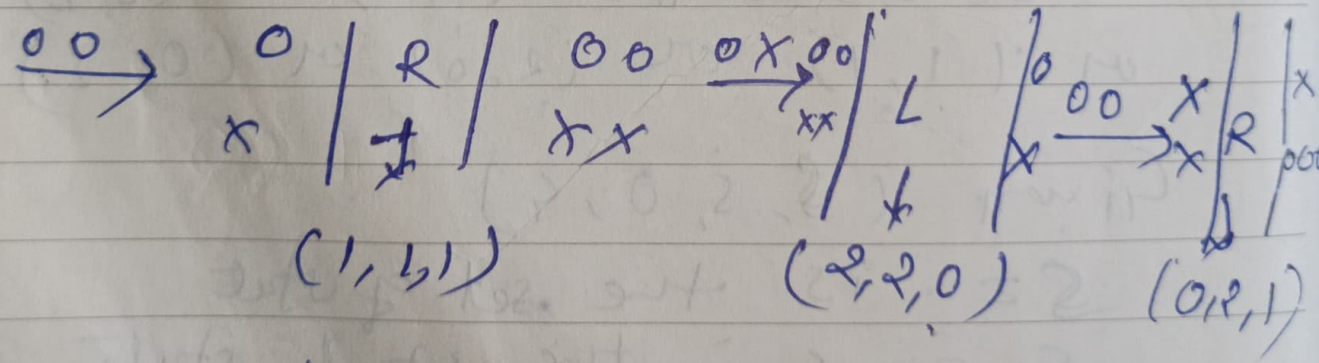
left



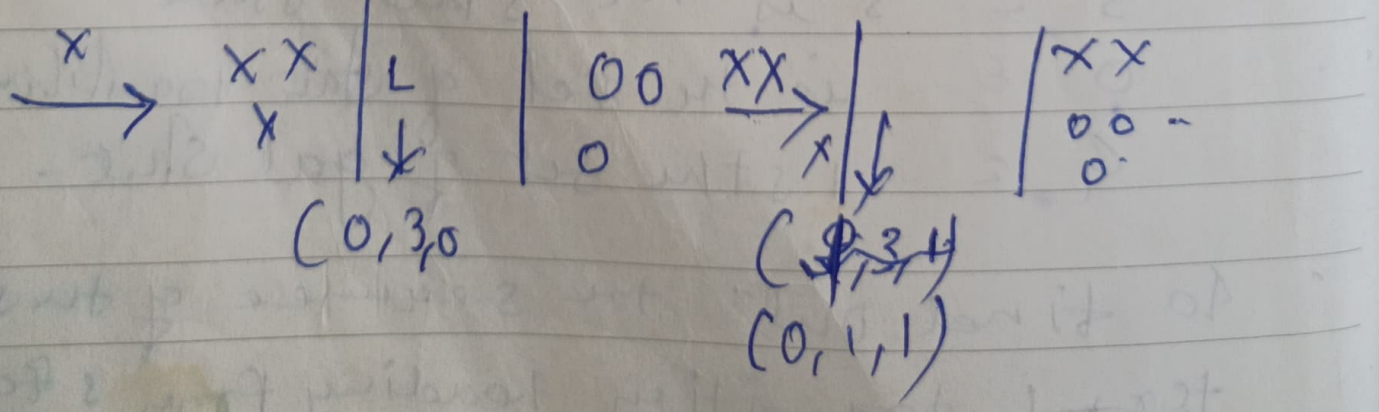
(3, 3, 0) (3, 1, 1) (3, 2, 0)



(3, 0, 1) (3, 1, 0)

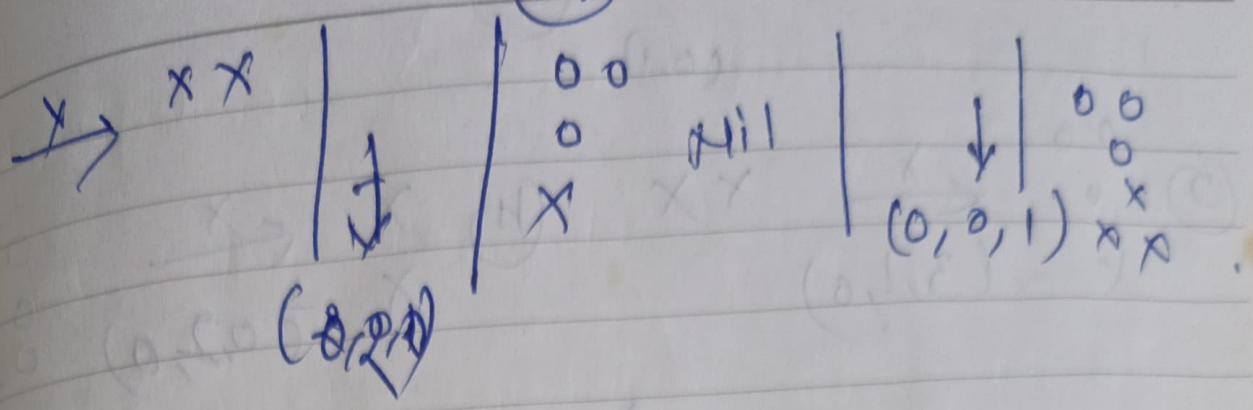


(1, 1, 1) (2, 2, 0) (0, 2, 1)



(0, 3, 0) (0, 1, 1)

(3)



(0,2,1)

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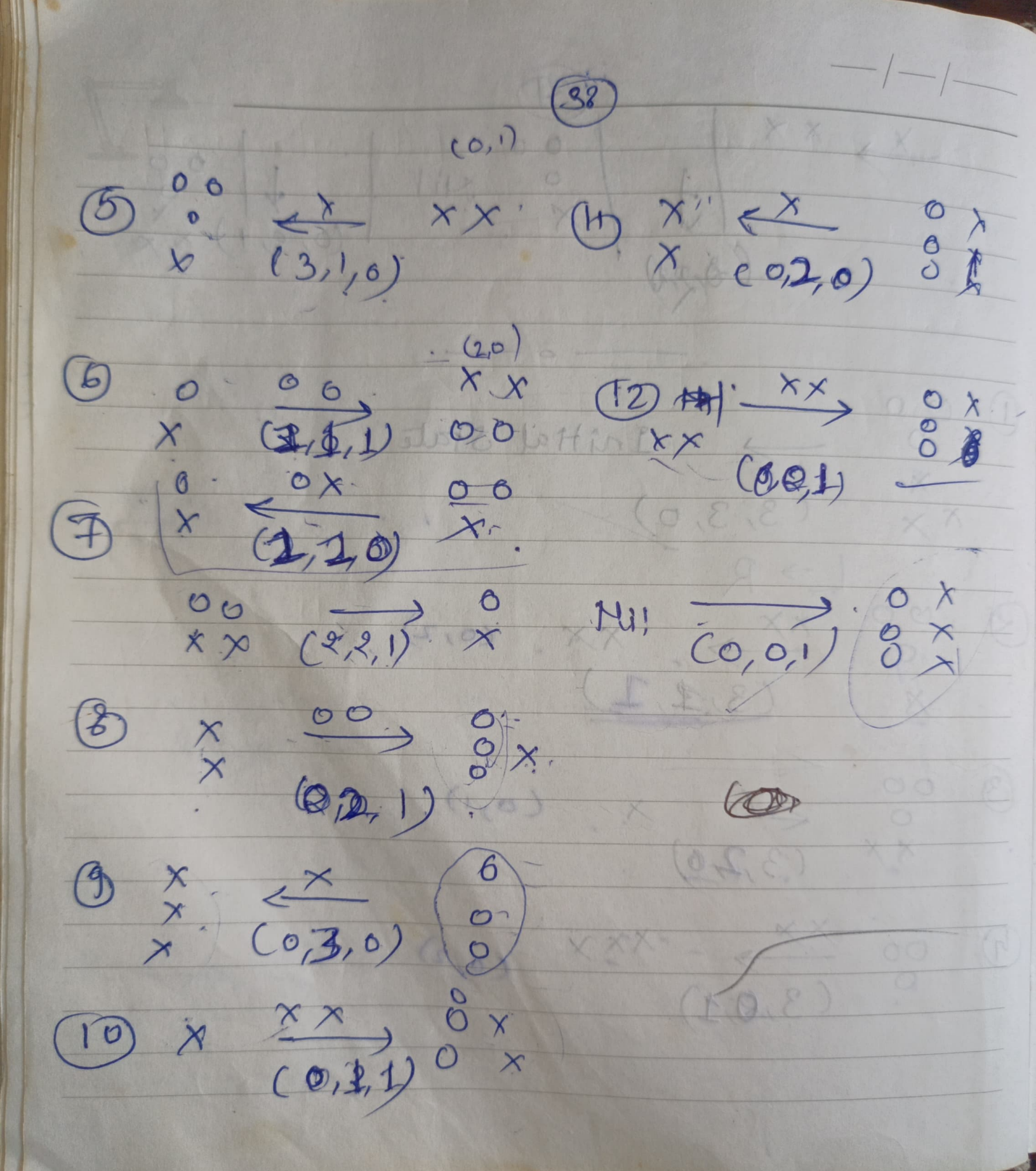
① Initial State → (3, 3, 0)

L → R

② (3, 1, 1) (0, 2)

③ (3, 2, 0) (0, 1)

④ (3, 0, 1) (0, 2)


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

Topics included in Better understanding of AI.

① robotics
② Memory organization
knowledge Representation.

forward Chaining :- This works by matching the existing condition of the problem with the antecedents of the rule in the KB.

Backward Chaining :- This is reverse process of forward chaining. Here the rule interpreter tries to match the 'Then' condition instead of 'If' condition as the forward chaining. Also known as goal driven.

Heuristic Information :- The information about the problem (the nature of states the cost of transforming from one state to another the promise of taking a certain path, and characteristics of the goals can sometimes be used to help guide the search more efficiently. This information can often be expressed in the form of a heuristic evaluation function f(n, g) a function of node n and/or the goal g.

However, heuristic is a rule of thumb or judgemental technique that leads to a solution some of the time but provides no guarantee of success.

UNIT 2. Heuristic Search

Contents :

- A framework for describing search method is provided and several general pulpose seach techniques are discussed.

- All are varieties of Heuristic Search :
  - Generate & test
  - Hill Climbing
  - Best first search
  - Problem reduction
  - Constraint satisfaction
  - Means-ends analysis.

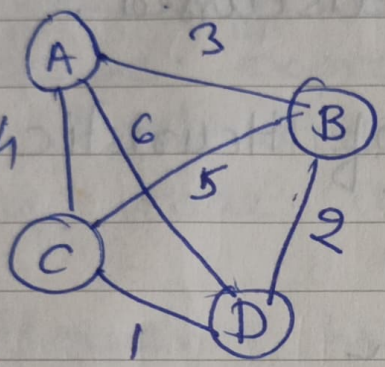
Heuristic

- Is a technique that improve the search method.
- Like our tour guides.
- Improve the quality of path seach
- Example :- General pupose heuristic - neaust neighbourhood.

- Applying it to Travelling Salesperson Problem

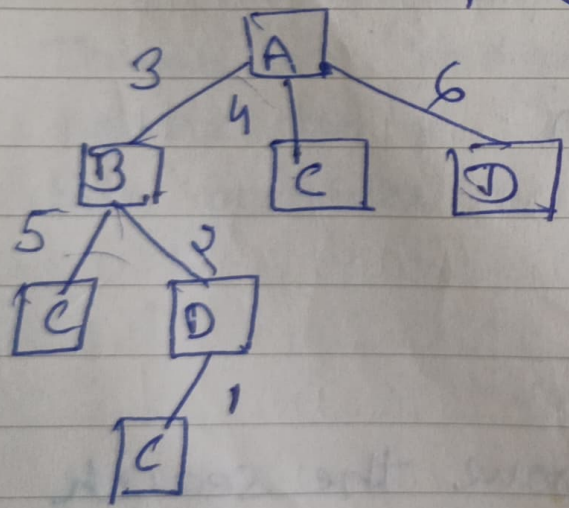
- Select a city arbitrarily
- Select the next city closest to current city and not visited yet
- Repeat steps till all cities have been visited

Start from A



Next city is B as cost is minimum

- From B select D
- From D select C finally A-B-D-C
- This executes in time proportional to N*N better than !N.



11101 Kathpadi to Bantwal

Heuristic

- Word heuristic come from greek word heuriskein meaning "to discover".

- Heuristic is a technique to improves the efficiency of search process by sacrificing the claims of completeness.

- Good heuristic leads in promising direction

- Heuristic fuction is a function that map from problem state descriptions to measure of desirability, represented as numbers.
- Heuristic are not as general as TSP problem

$h = f(x, y)$ where f can be squaring, identity function.

- Heuristic are important in real life problem solving proces - why?
  - Rarely we look for Optimum solutions
  - Good solutions do well

- People are satisfier rather than optimizers
- Seek solution which satisfy requirements and quit as they find one-exp parking spa

- Approximation produced may not be very good in worst case. Worst case hardly occur in real life time

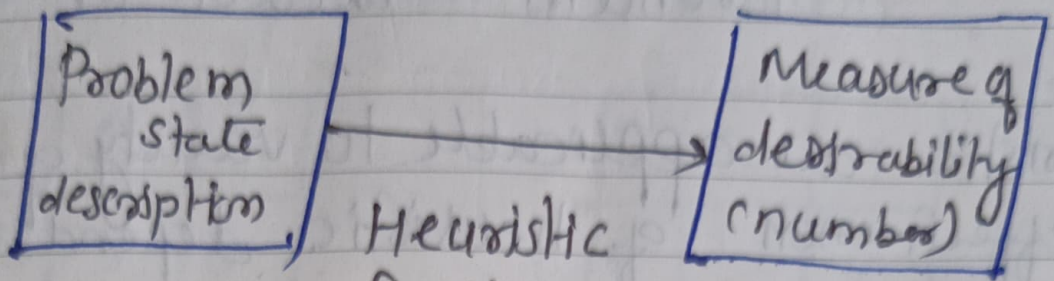
- Analyzing heuristic - leads to better understanding of the problem.

Heuristic function

- There are 2 ways in which domain specific heuristic knowledge can be incorporated in rule based search procedure

- In rule themselves where rule dipicts set of sensible moves instead of all moves.

- A heuristic function that evaluates individual problem states and determines the degree of desirability



- Can be simple or complex
- At times
  - Higher values → good positions
  - Lower values → good position.

- Objective of heuristic function: is to guide search process in most profitable direction by suggesting path to follow when more than one are available
- Good heuristic function take less time in search
- Bad heuristic function will not improve the search.
- There is trade-off between cost of evaluating hf and the saving in search time that function provides.

(4c)

Problem Characteristics

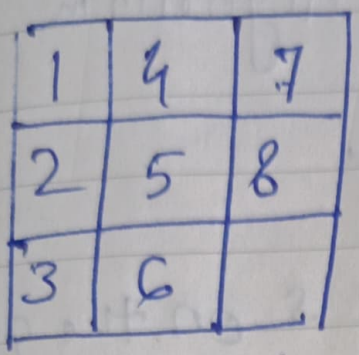
- Heuristic are applicable to variety of problems and effectiveness of heuristic depends on class of problem.

- Before applying the heuristic we must analyse the problem under the following heads.

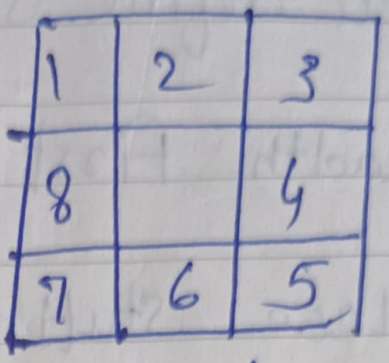
  - Is Problem decomposable?
    - Take Two Problems
      - Integration
      - Block domain problem

  - Can solution Step be ignored?
    - Ignorable in which solution step can be ignored eg (Mathematical theorm proving
    - Recoverable in which solution step can be undone (8-Puzzle)
    - Irrecoverable in which solution step can not be undone eg (Chess)

8 Puzzle Problem



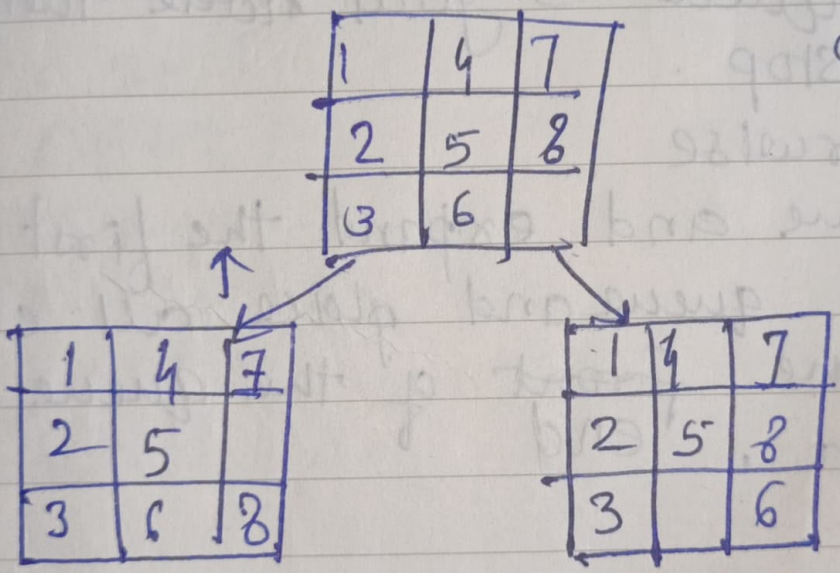
Initial



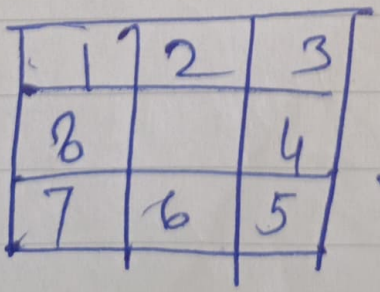
Goal.

Initial State
goal State
goal State

Operators → ↑ ← ↓



Explain 4 operators & apply it & then represent the goal State.



Goal.

Universally Well define Step → Algorithm

Breadth first search

(1) Place starting node s on the queue
(2) If queue is empty, return failure & stop.
(3) If the first node or ~~element~~ on the queue is goal node then return success and stop.
(4) Otherwise
(4) Remove and expand the first node from queue and place all children at the ~~front~~ end of the queue in any order.
(5) go to step 2.

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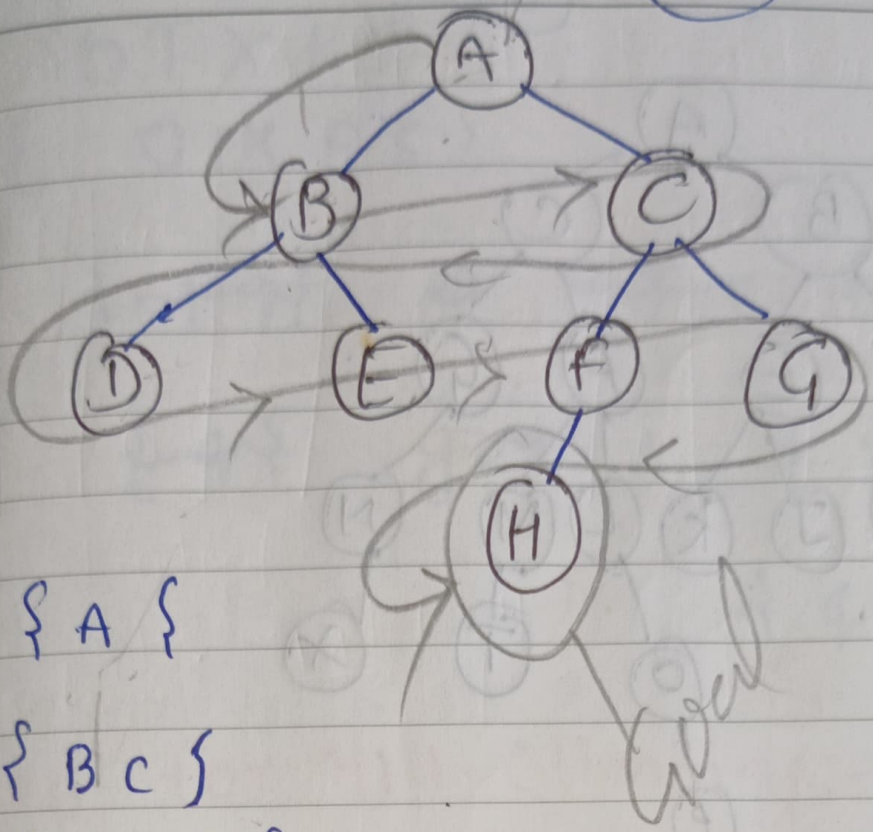


{ A {

{ B C }

{ C D E }

{ D E F G {

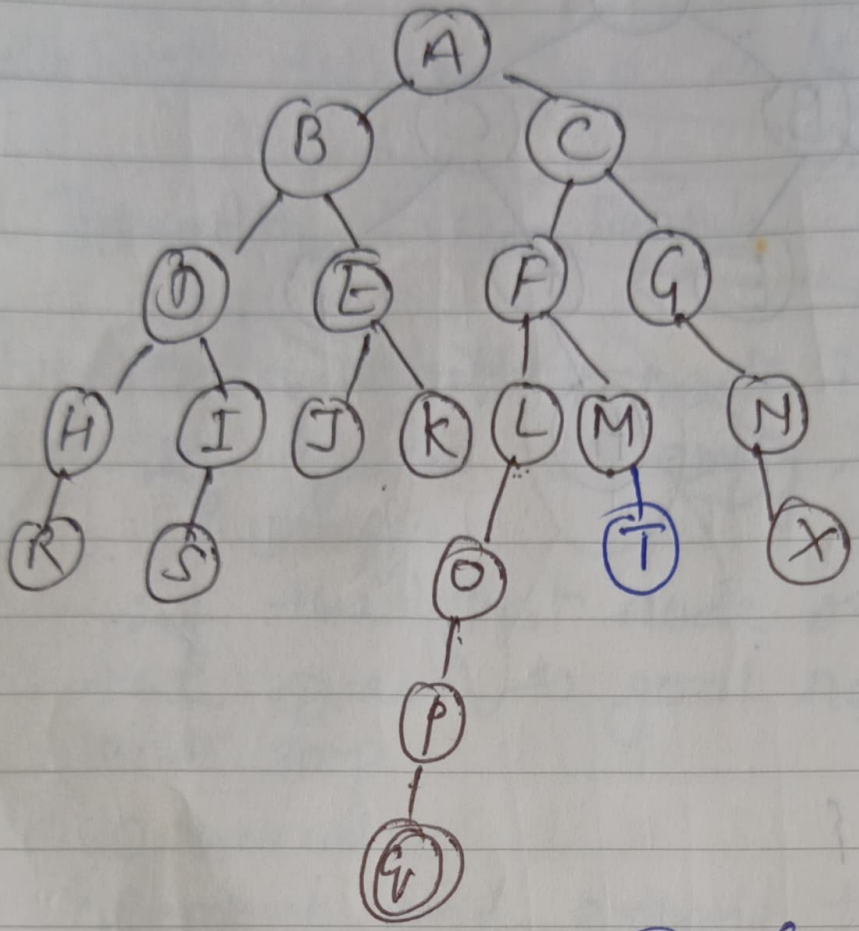
{ E F G }

{ F G }

{ G H }

{ H } ,

50



① {A}

② {BC}

③ {CDE}

④ {DEFG}

⑤ {EFGHI}

⑥ {FGHIJK}

⑦ {GHIJKLM}

⑧ {HIJKLMN}

⑨ {IJKLMNR}

⑩ {JKLMNRS}