MDL - Assingment - 2

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Que 1   Express the _____ one on it."

⇒ States :

① Holding (A) : The block A is held in robota hand

② Empty (A) : Signifies that robot's arm is empty

③ On Table (A) : Signifies that block A is Kept on the table.

④ On Block (A, B) : The block A is on Block B.

⑤ Clear (A) : There is nothing on top of block A.

⇒ Actions :

① Pick up (A) : The robot's arm picks up block A

② Put Down (A) : Block A is put down on the table at a free space

③ Put On (A, B) : puts block A on top of block B

④ Remove (A, B) : Remove block A from top of block B.

⇒ The Initial state :
The Configuriation provided to us in the starting will be initial state.

⇒ Goal state :
The configuration that needs to be achived is goal state.

⇒ Path cost :

• Let a unit cost is changed (say equal to 1) for moving a block from one position to any other position,

Therefore,

$$\text{Path cost} = \begin{cases} 1 & : \text{A moment happens} \\ 0 & : \text{otherwise.} \end{cases}$$
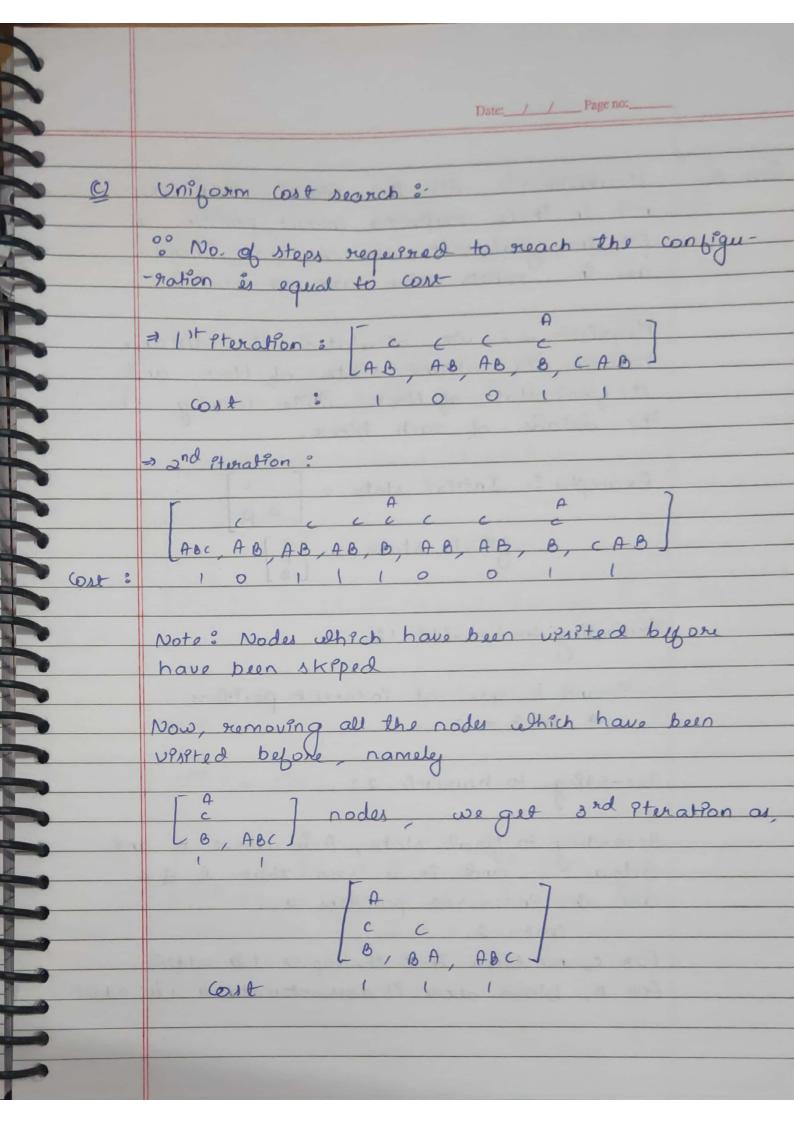
The optimal solution is the case with the minimum path cost required to go from the initial state to goal state.

Que 2 Given the following ——— iteration each,

→ Initial state $\begin{bmatrix} C \\ A\ B \end{bmatrix}$, final state : $\begin{bmatrix} A \\ B \\ C \end{bmatrix}$

(a) Bredth first search,

1st iteration : $\begin{bmatrix} B & & & & \\ C & C & & C & c \\ A, & AB, & ABC, & AB, & AB \end{bmatrix}$

2nd iteration : $\begin{bmatrix} & & & B & & \\ C & & C & C & C & C \\ AB, & ABC, & AB, & AB, & A, & AB \end{bmatrix}$

3rd iteration:

Note: Configuration $\begin{bmatrix} C \\ AB \end{bmatrix}$ is already a valid state but we will skip it to move to the next step.

$\begin{bmatrix} & B & & & & & \\ C & C & C & C & B & B & C & c \\ AB, & AB, & A, & AB, & AC, & ACB, & AC, & AB, & AB, \\ & & A & & A & & & \\ ABC, & BC, & BC, & ABC & & & & \end{bmatrix}$

(b) Depth first search :-

1st iteration : $\begin{bmatrix} C & C & & C & C \\ A, & AB, & ABC, & AB, & AB \end{bmatrix}$

2nd iteration : $\begin{bmatrix} B & & & & \\ C & C & C & & C & C \\ A, & AB, & AB, & ABC, & AB, & AB \end{bmatrix}$

3rd iteration :

Note : since node $\begin{bmatrix} B \\ C \\ A \end{bmatrix}$ is already visited in

our DFS, we will skip it and move to the next node,

Also, node $\begin{bmatrix} C \\ AB \end{bmatrix}$ is also visited earlier hence we will skip both occurances of it and proceed directly to node [ABC]

$\Rightarrow \begin{bmatrix} B & B & C & C & A & A \\ AC, & ACB, & AC, & AB, & AB, & ABC, & BC, & BC, & ABC, \\ C & C & & & & \\ AB, & AB \end{bmatrix}$

Ⓒ Uniform cost search :-

∵ No. of steps required to reach the configu-
-ration is equal to cost

⇒ 1ˢᵗ iteration :
$$\begin{bmatrix} c & c & c & \overset{A}{c} & \\ AB & AB & AB & B & CAB \end{bmatrix}$$

cost :   1   0   0   1   1

⇒ 2ⁿᵈ iteration :

$$\begin{bmatrix} c & c & c & c & c & \overset{A}{c} & \\ ABC & AB & AB & AB & B & AB & AB & B & CAB \end{bmatrix}$$

Cost :   1   0   1   1   1   0   0   1   1

Note: Nodes which have been visited before
have been skipped

Now, removing all the nodes which have been
visited before, namely

$$\begin{bmatrix} \overset{A}{c} & \\ B & ABC \end{bmatrix}$$ nodes , we get 3ʳᵈ iteration as,
    1   1

$$\begin{bmatrix} A & & \\ c & c & \\ B & BA & ABC \end{bmatrix}$$

Cost   1   1   1

Que 3

Heuristic 1 : All the blocks which are not in their respective correct position as per the goal state are counted, Those are in robots arms are not counted.

Heuristic 2 : we calculated the distance between the current states of block and the final state of block while looking at the details of each block.

Examples :- Initial state : $\begin{bmatrix} & C \\ A & B \end{bmatrix}$

final state : $\begin{bmatrix} C \\ A \\ B \end{bmatrix}$

According to heuristic 1:

A and C are at incorrect positions

⇒ cost = 2

According to heuristic 2:

According to final state, A is above B and below C and it is seen that B & C are at incorrect positions ⇒

cost = 2

for c, no block is at the top ⇒ 1 is added

for B, block above it does not match ⇒ 1 is added

Que 4 Initial state: $\begin{bmatrix} C \\ A\ B \end{bmatrix}$, final state: $\begin{bmatrix} A \\ B \\ C \end{bmatrix}$

Using heuristic ①

1st iteration: $\begin{bmatrix} B & & & & \\ C & & C & C & C \\ A, & AB, & ABC, & AB, & AB \end{bmatrix}$

cost :   3   3   2   3   3

Expanding the node with cost 2.

2nd iteration:

$\begin{bmatrix} B & & B & C & & A & A & & B & & & C \\ AC, & ACB, & AC, & AB, & AB, & ABC, & BC, & BC, & ABC, & A, & AB,AB, & AB \end{bmatrix}$

cost   1   2   2   3   3   2   2   2   2   3   3   3   3

Removing all the visited nodes expanding with cost 1

3rd iteration:

$\begin{bmatrix} & A & & C & & & B \\ & B & B & AB & & A & A & B \\ & B & B & B & B & C & & C \\ ACB, & AC, & C, & AC, & AC, & AB, & BC, & BC, & A \end{bmatrix}$

cost :   2   1   0   1   2   3   3   3   2   3