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Sem : VII

Subject : AI

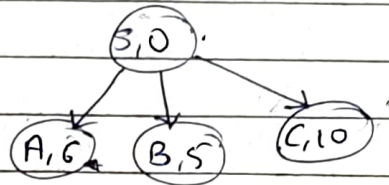
# Assignment - 1 (A)

Q.1  
1.1]

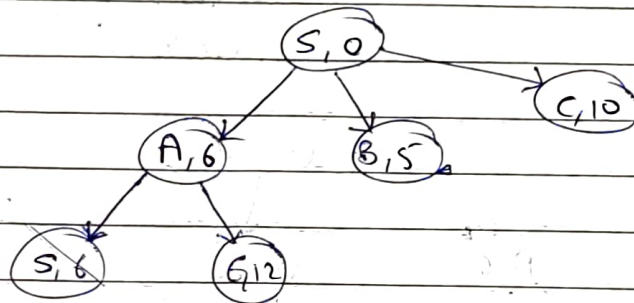
Step 0 :



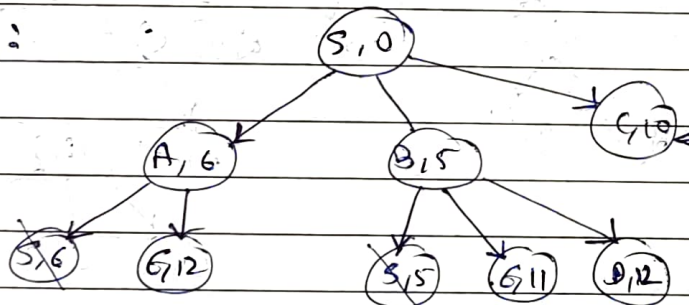
Step 1 :



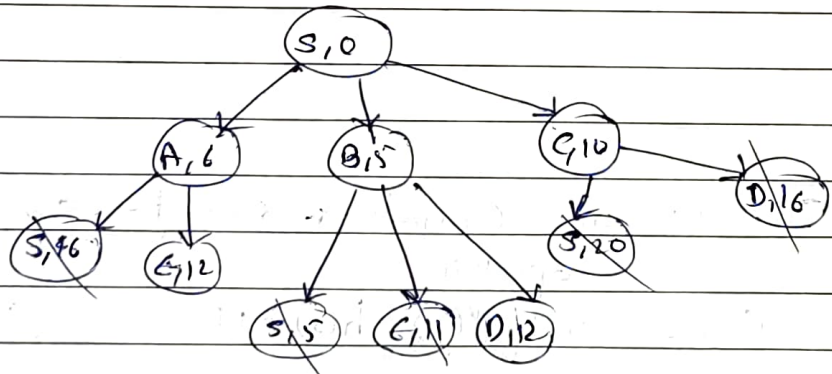
Step 2 :



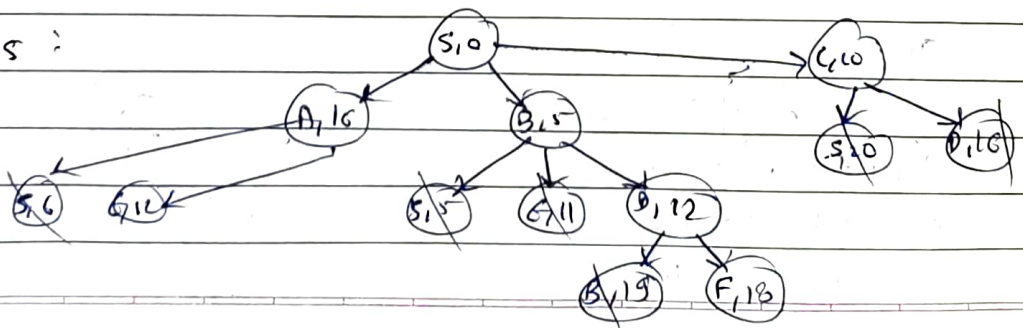
Step 3 :



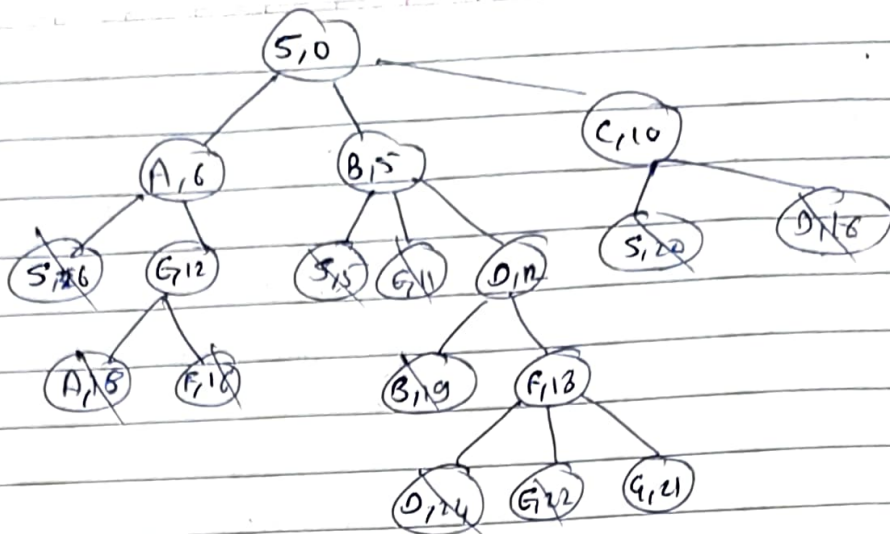
Step 4 :



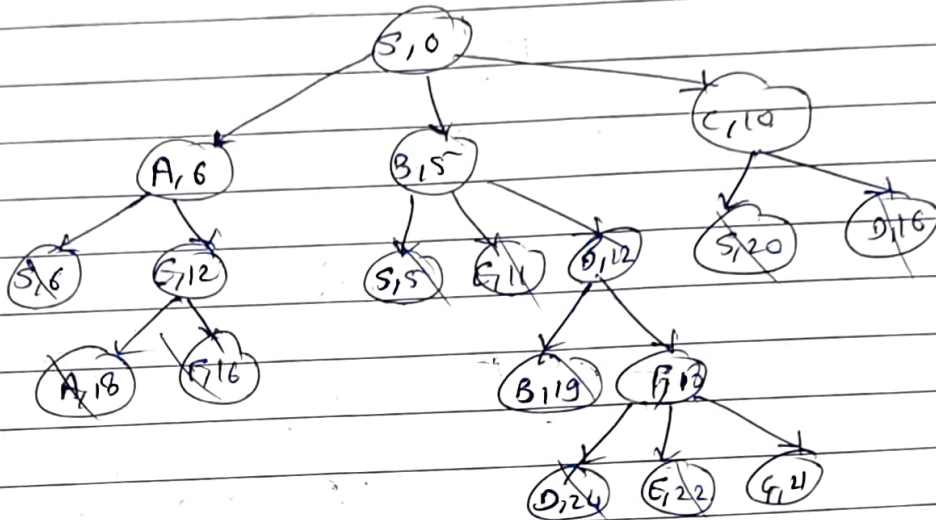
Step 5 :



Step 7 :



Step 8 :



1.4]

Initialization : Compute  $f$  score for  $s$  & put it in the openlist.

F-score  $s$  :  $f(s) = h(s) = 14$

$S,14$

Step 1 :

F-Score of Successors

$f(A) = h(A) = 10$

$f(B) = h(B) = 13$

$f(C) = h(C) = 4$

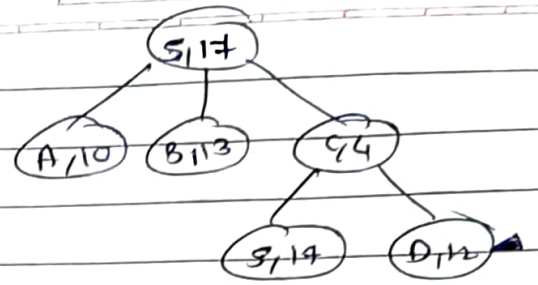


Step 2 :

F-score of successors

$$f(s) = h(s) = 17$$

$$f(D) = h(D) = 2$$



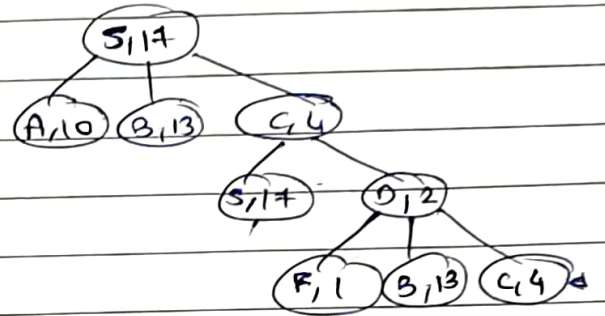
Step 3 :

F-score of successors

$$f(C) = h(C) = 4$$

$$f(B) = h(B) = 13$$

$$f(F) = h(F) = 1$$



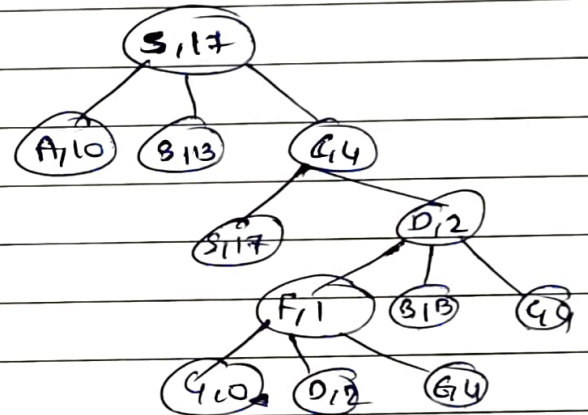
Step 4 :

F-score of successor

$$f(D) = h(D) = 2$$

$$f(E) = h(E) = 4$$

$$f(G) = h(G) = 0$$

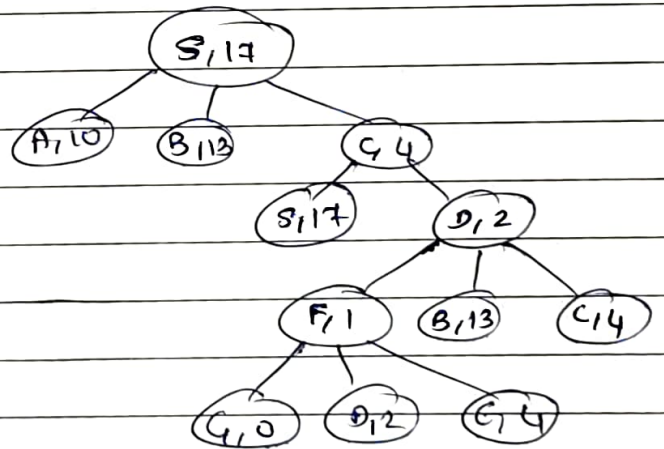


Step 5 :

Solution is -

$S \rightarrow C \rightarrow D \rightarrow F \rightarrow G$  with

$$\text{Sol. cost} = 10 + 6 + 6 + 3 = 25$$





Q.2 Consider foll. instance of 8 puzzle problem :

8	7	6
2	1	5
3	4	-

Initial Configuration

-	8	7
2	1	6
3	4	5

Goal Configuration

Consider Heuristic functions defined below :

$h_1$  : Misplaced tiles count except space

$h_2$  : Correctly placed tiles count except space

$h_3$  : Sum of ~~Manhattan~~ Manhattan distance between current and correct position of all tiles except space.

a] In 8 puzzle problem we are concerned with getting to goal configuration within least no. of steps. All moves are thus equally costly. Define  $g(n)$  in your own words. What will be the cost of 6 step sol. also mention it to some arbitrary 8 puzzle instance?

→ The lowest path cost  $g(n)$  can be the cost to reach the goal configuration in least steps.

In our case, we can reach the final configuration in at least 4 moves : UP, UP, LEFT, LEFT.

Since all the moves are equally costly, we compute  $g(n)$  as

$$g(n) = 1 + 1 + 1 + 1$$

$$g(n) = 4$$

Consider the foll. arbitrary 8 puzzle instance which gives sol. in 6 steps :

8	7	6
2	1	5
-	3	4

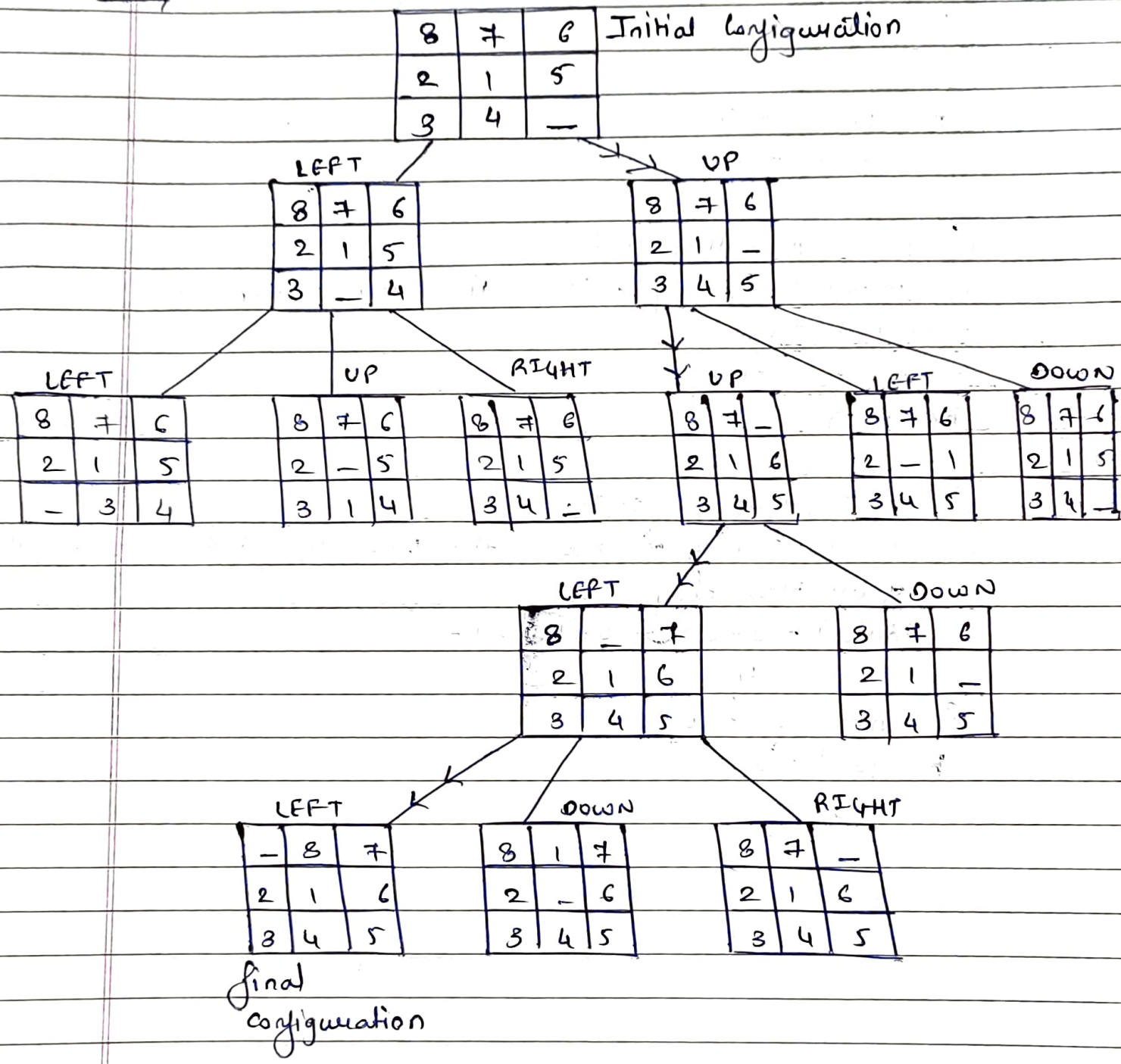
The sol. can be represented as:

$\{\{8, 7, 6\}, \{2, 1, 5\}, \{-, 3, 4\}\} \rightarrow \{\{8, 7, 6\}, \{2, 1, 5\}, \{3, -4\}\} \rightarrow$   
 $\{\{8, 7, 6\}, \{2, 1, 5\}, \{3, 4, -\}\} \rightarrow \{\{8, 7, 6\}, \{2, 1, -\}, \{3, 4, 5\}\} \rightarrow$   
 $\{\{8, 7, -3\}, \{7, 1, 6\}, \{3, 4, 5\}\} \rightarrow \{\{8, -, 7\}, \{2, 1, 6\}, \{3, 4, 5\}\} \rightarrow$   
 $\{\{-, 8, 7\}, \{2, 1, 6\}, \{3, 4, 5\}\}$

Since all the moves are equally costly, the cost would be

$$g(n) = 8$$

c] Draw exhaustive state space tree of depth limited to 4 instance of 8 puzzle problem in the question.



c]

for  $i=1$ ,  $n = \text{initial state}$

$h_1(\text{initial}) = \text{misplaced tiles count except space}$

$$h_1(\text{initial}) = 4$$

$n = \text{goal state}$

$$h_1(\text{goal}) = 0$$

for  $i=2$ ,  $n = \text{initial state}$

$h_2(\text{initial}) = \text{Correctly placed tiles count except space}$

$$h_2(\text{initial}) = 4$$

for  $n = \text{goal state}$

$$h_2(\text{goal}) = 8$$

for  $i=3$ ,  $n = \text{initial state}$

$h_3(\text{initial}) = \text{sum of manhattan dist between current \& correct position of all tiles except space}$

$$h_3(\text{initial}) = 0 + 0 + 0 + 0 + 1 + 1 + 1 + 1 \\ = 4$$

for  $n = \text{goal state}$

$$h_3(\text{goal}) = 0$$