CS - 411 : AI - 1

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ASSIGNMENT - 1 [WRITTEN PART]

SUBMITTED BY :-

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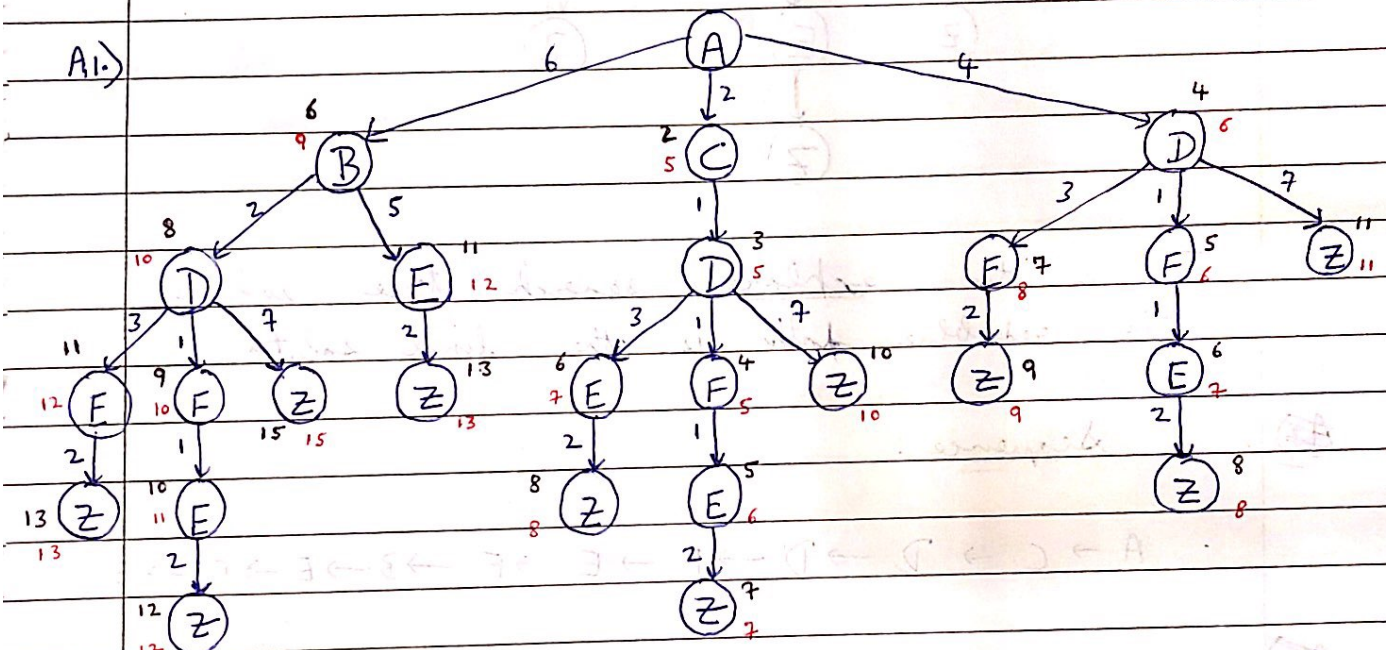
A1.)

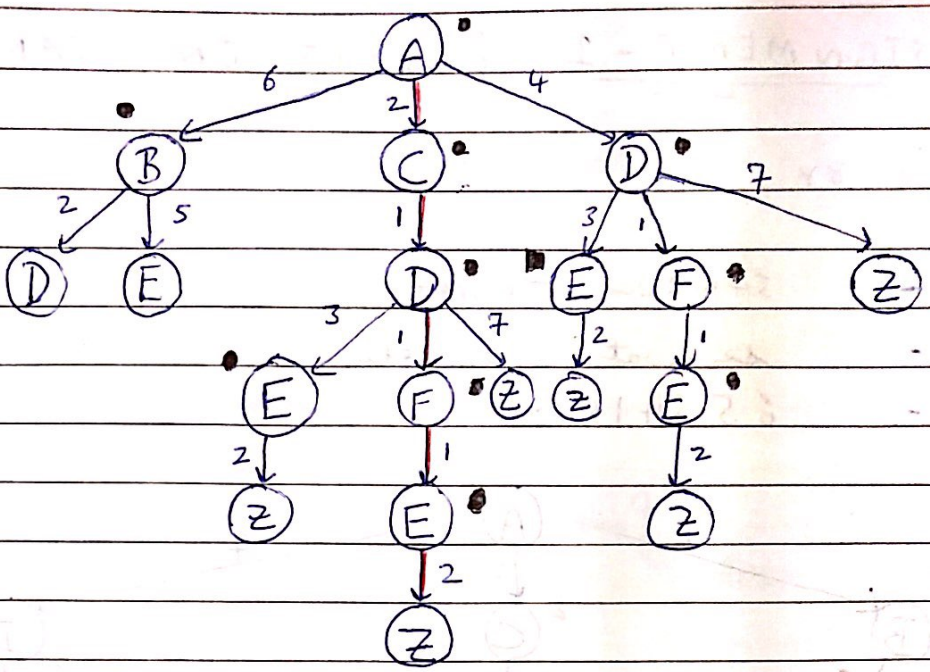


Values in black is the total cost to reach this particular node from start node.

Values in red is the sum of total cost to reach this node and the heuristic fuction value of this node.

This search tree will be used to answer questions 2 & 6.

A2.)



This is the explored search tree, where the red-blue path is the final solution.

A3.) Sequence :

A → C → D → D → F → E → F → B → E → E → Z

NOTE: In case of ties nodes are explored & expanded alphabetically

A4.) In uniform cost graph search the node which has been visited once will not be visited again

Explored node sequence :-

A → C → D → F → E → B → Z

Final path

A → C → D → F → E → Z

A.4) Heuristic Admissibility :

$h(D) \rightarrow$ heuristic value for D

For a function to be admissible it's value should always be less than the true cost of solution.

So, $3 + h(D) \leq 7$

(3 ↑ cost of reaching D; 7 ↑ true cost as calculated)

$\Rightarrow h(D) \leq 4$

Also, $h(D) > 0$ as $h = 0$ for goal state.

Hence, range of $h(D)$ for it to be admissible is :

$0 < h(D) \leq 4$ i.e $(0, 4]$

A5) Heuristic consistency is when :

$$h(n) \leq c(n, a, n') + h(n')$$

where, n' is successor of n

Hence, according to given graph :

$h(D) \leq c(D, 3, E) + h(E)$
$h(D) \leq c(D, 1, F) + h(F)$
$h(D) \leq c(D, 7, Z) + h(Z)$

"No religion has mandated killing others as a requirement for its sustenance or promotion." –Dr.A.P.J.Abdul Kalam

$\Rightarrow$ $h(D) \leq 3+1$

$h(D) \leq 1+1$

$h(D) \leq 7+0$

$\Rightarrow$ $h(D) \leq 4$

$h(D) \leq 2$

$h(D) \leq 7$

According to laws of inequality.

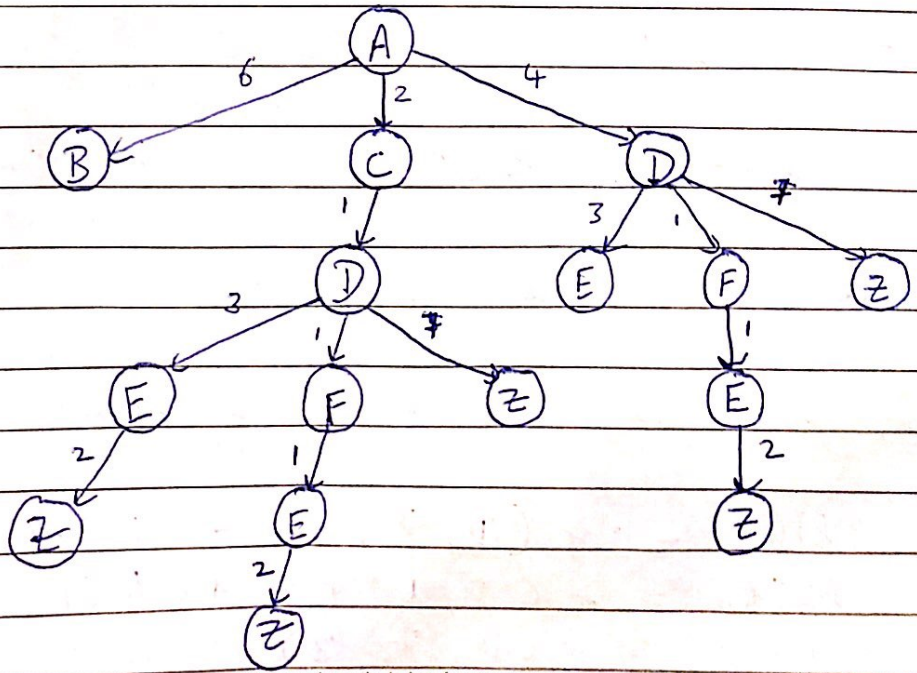
$$h(D) \leq 2$$

& $h(D) > 0$, since $h(n)=0$ is goal state

So, range of values where $h(D)$ is consistent over range

$$0 < h(D) \leq 2 \quad i.e \quad (0, 2]$$

A6) A* Tree Search



The above tree is the explored tree which was computed using tree in A1.

In case of ties the nodes are explored alphabetically.

Sequence of explored nodes :-

A → C → D → F → D → E → F → E → E → Z

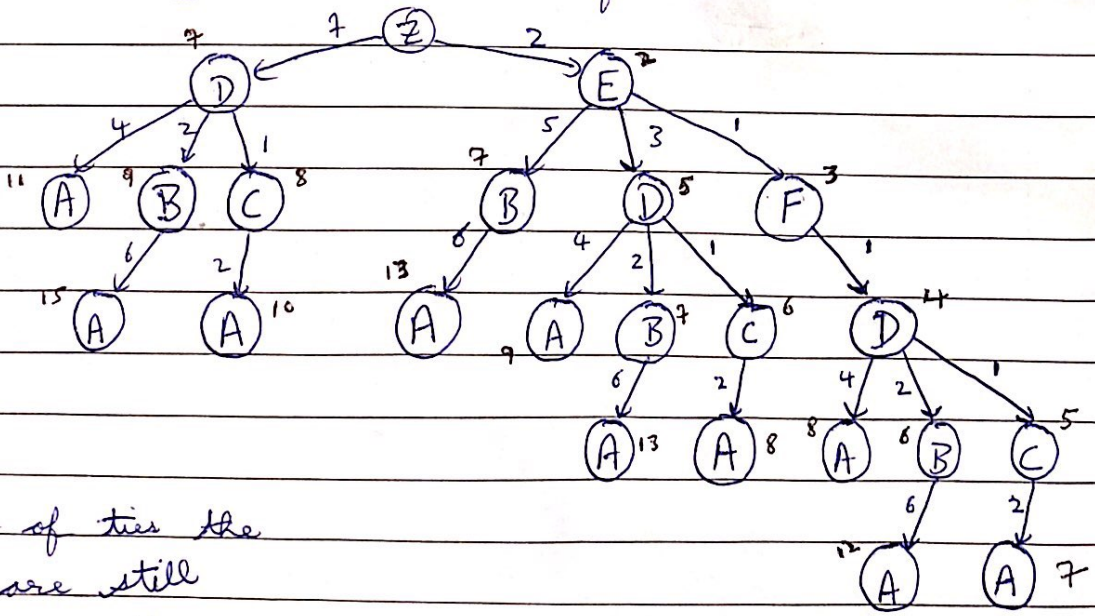
A7.) A* graph search

Explored sequence :-

A → C → D → F → E → Z

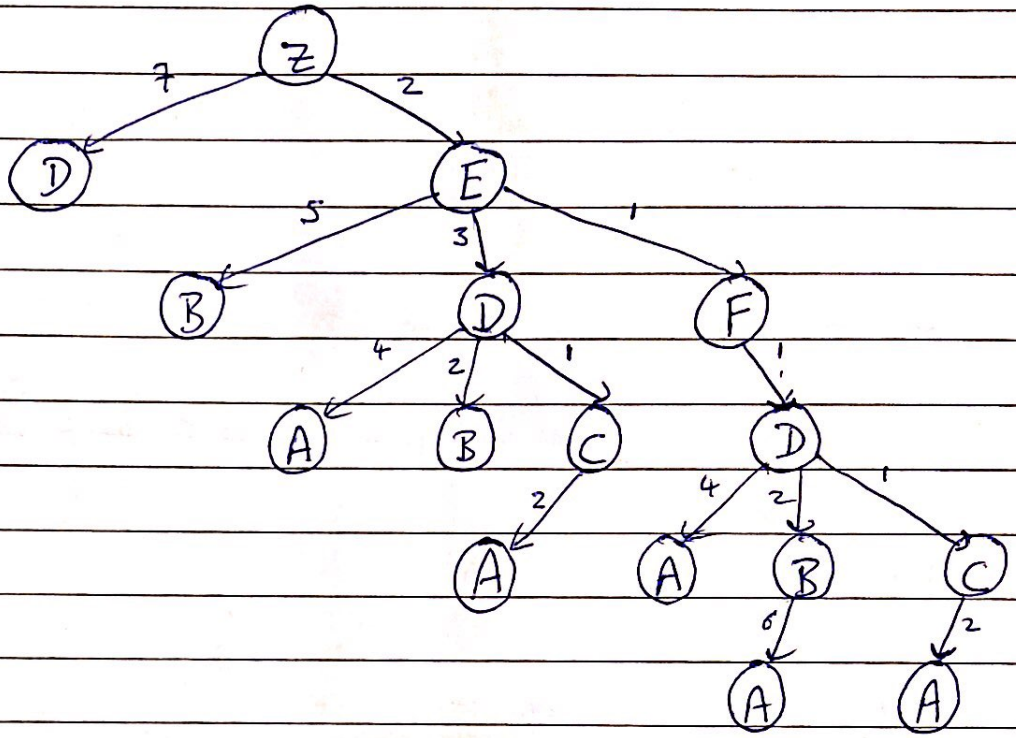
This sequence was computed using the graph present in assignment description.

A8.) Reverse search tree i.e from Z → A



In case of ties the nodes are still explored alphabetically.

A 9.) Reverse uniform cost search tree

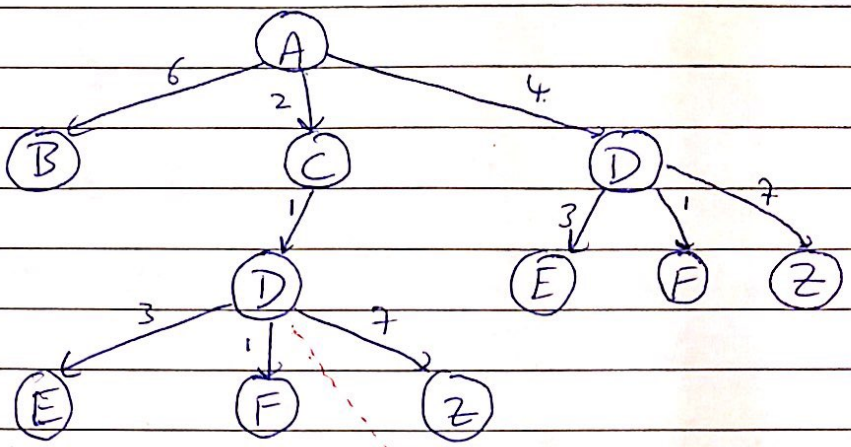


Sequence of explored node:

Z → E → F → D → ~~B~~ → ~~D~~ → B → C → A

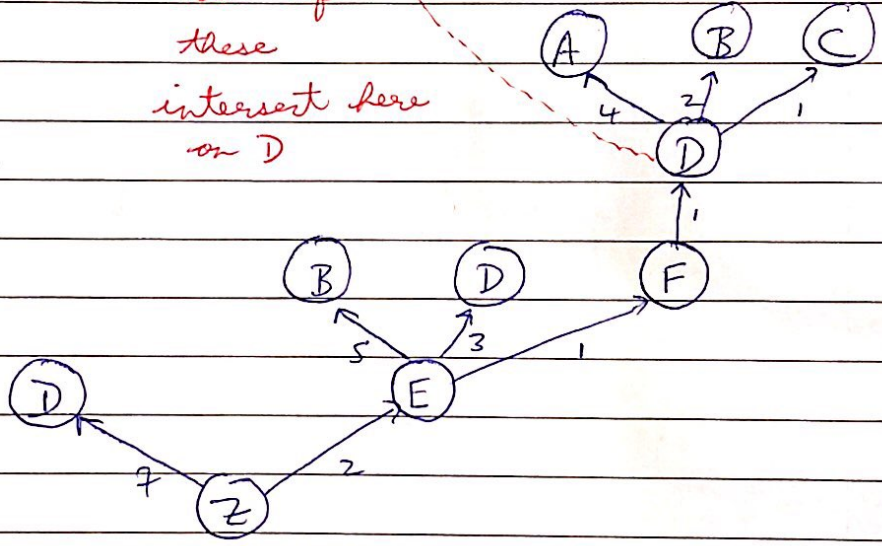
In case of ties nodes are explored alphabetically.

A10) Bidirectional uniform cost tree search



both of these intersect here on D

NOTE:
In case of ties nodes are explored alphabetically.



Explored node sequence :-

A to Z tree : A → C → D → D

Z to A tree : Z → E → F → D

Final sequence : Z → E → F → D → C → A

from backward

from forward