Name: Md. Rifat Ahmed

ID: 1931725042

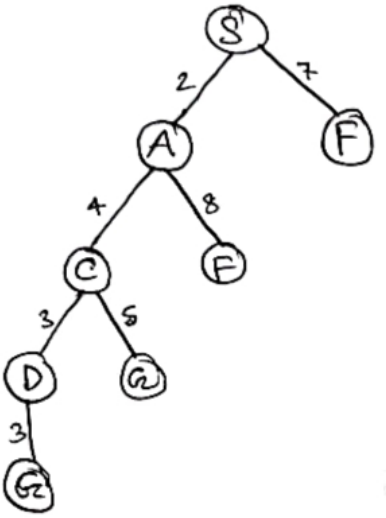
Course: CSE440

Section: 2

Assignment #1

Answer to the Question No - 1

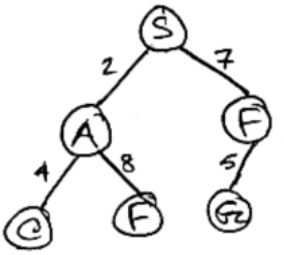
(i) Depth First Search:



Order of Node visit: S → A → C → D → G

Total Cost: 2 + 4 + 3 + 3 = 12

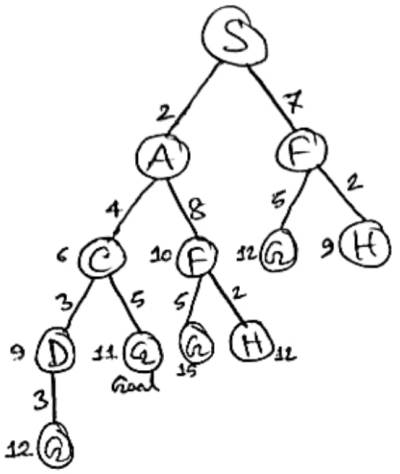
(ii) Breadth First Search:



Order of Node visit: S → A → F → C → F → G

Total Cost: 7 + 5 = 12

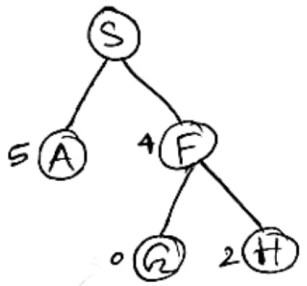
(iii) Uniform Cost Search:



Order of Node visit: S → A → C → F → D → H → F → G

Total Cost: 2 + 4 + 5 = 11

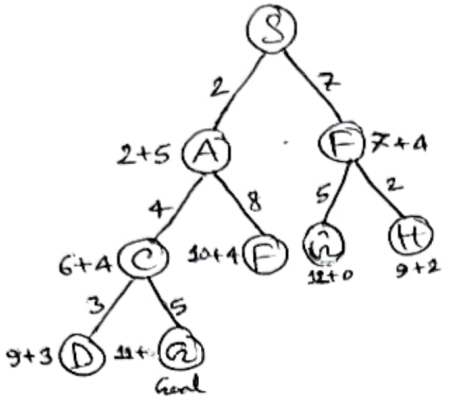
(iv) Greedy Best First Search:



Order of Node visit: S → F → G

Total Cost: 7 + 5 = 12

(v) A* Search:



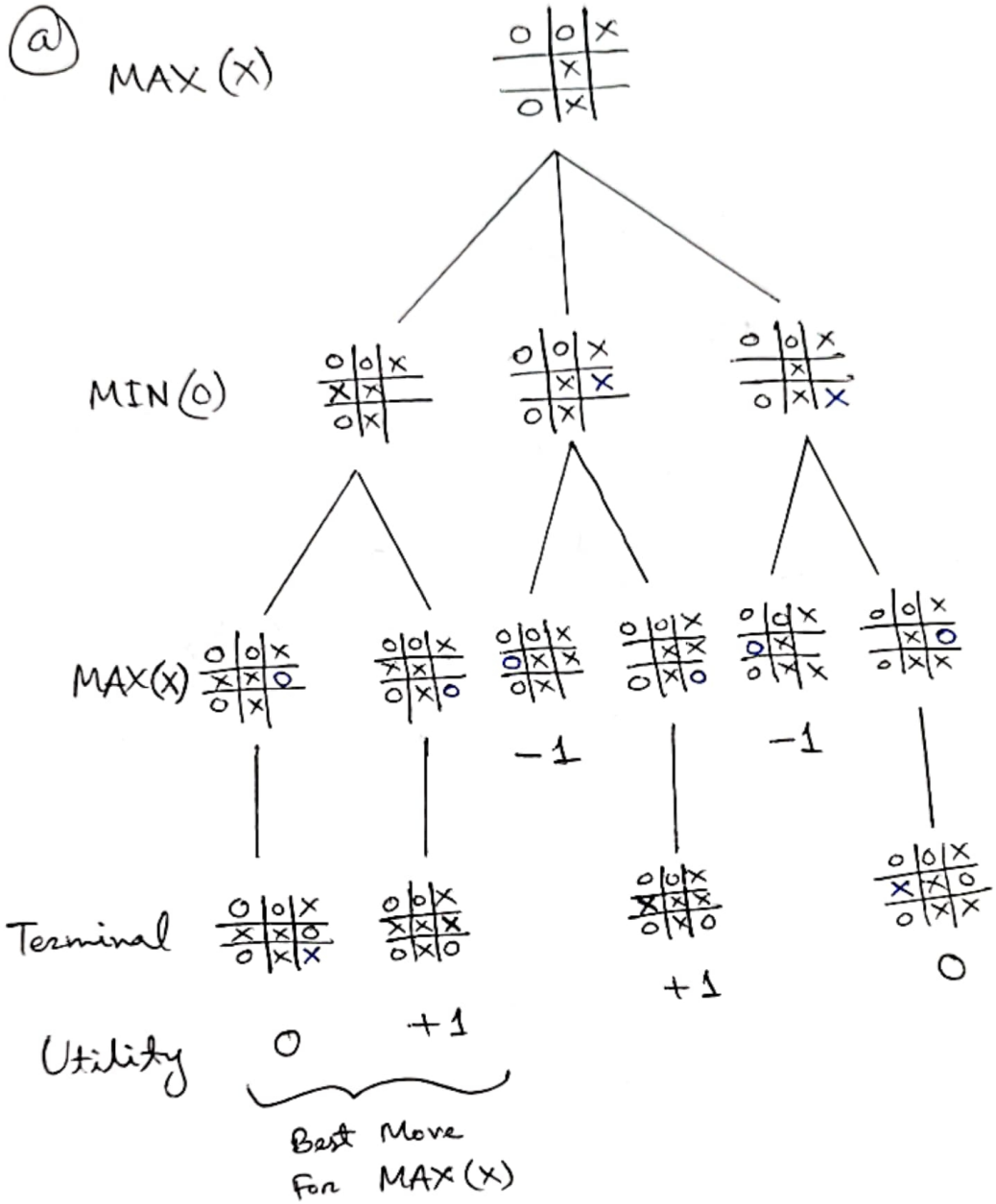
Order of Node visit: S → A → C → F → G

Total Cost: 2 + 4 + 5 = 11

(Ans.)

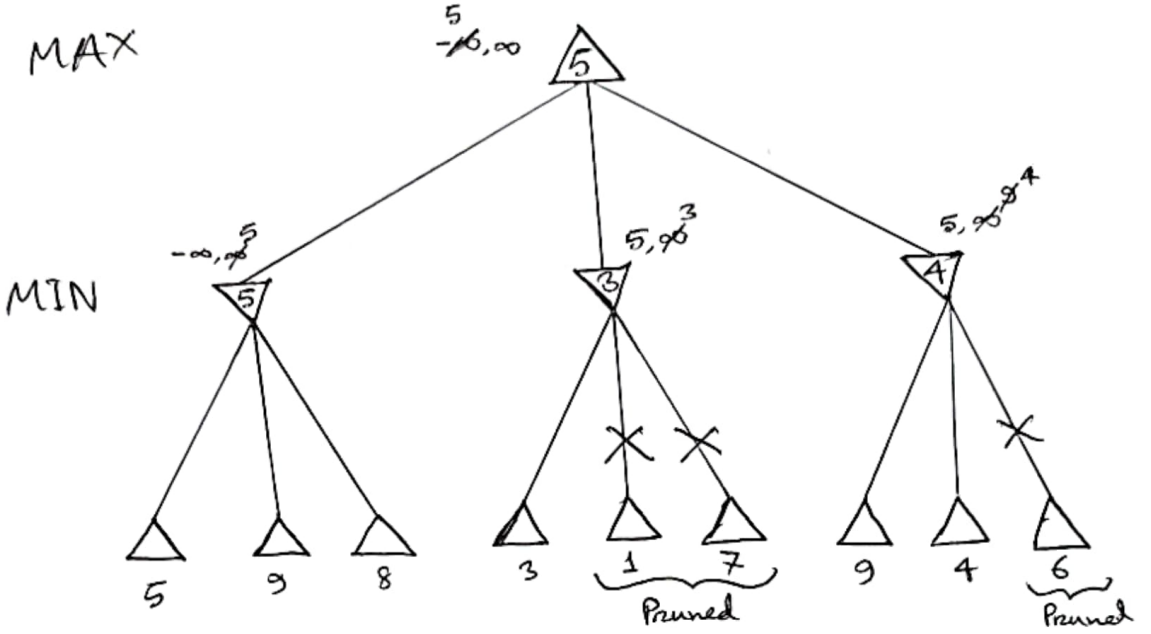
Answer to the Question No-2

(a)



So, the left move from the start would be the optimal move since following this will result in either a draw or a win for "X".

(b) Alpha-beta Pruning using Minimax algorithm:



So, the ~~4th~~ 5th, 6th & 9th terminal node will be pruned.

Answer to the Question No-3

(a) i) Writing down the Sentences using propositional logic:

H → Humidity is high

C → The sky is cloudy

R → It will rain

T → It is hot

Now, 1. $H \vee C$

2. $C \Rightarrow R$

3. $H \Rightarrow T$

4. $\neg T$

ii) Converting each of the sentences to CNF:

1. $H \vee C$

2. $\neg C \vee R$

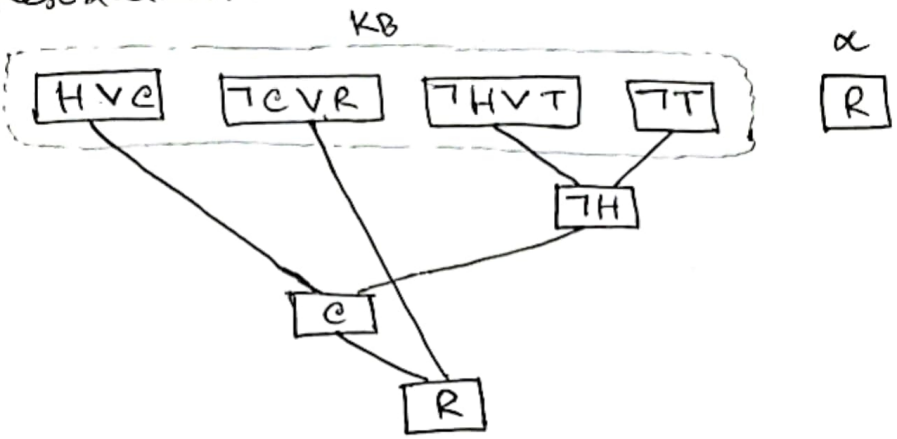
3. $\neg H \vee T$

4. $\neg T$

We have to prove (or disprove) — "It will rain."

$\therefore \alpha : R$

iii) Resolution:



∴ It will Rain.

(Proved)

(b) Writing the four given rules as horn clauses using propositional symbols.

Gas in tank → GT

Fuel line is okay → FL

Gas in engine → GE

Good spark → SP

Engine runs → ER

Power to the plugs → PP

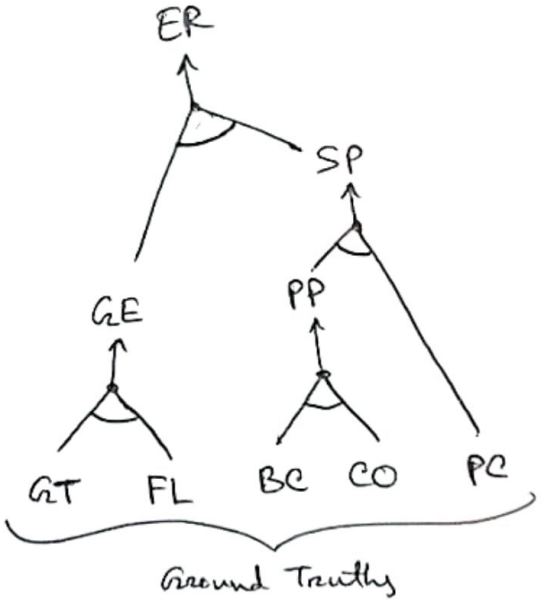
Plugs are clean → PC

Battery is charged → BC

Cables are okay → CO

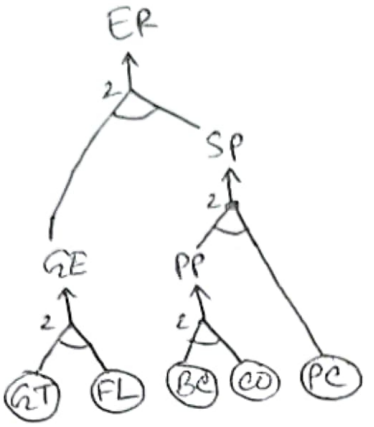
1. $(GT \wedge FL) \Rightarrow GE$
2. $(GE \wedge SP) \Rightarrow ER$
3. $(PP \wedge PC) \Rightarrow SP$
4. $(BC \wedge CO) \Rightarrow PP$
5. GT
6. FL
7. PC
8. BC
9. CO

AND-OR Graph:

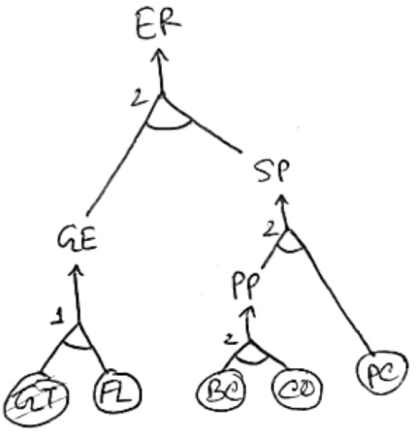


Forward Chaining:

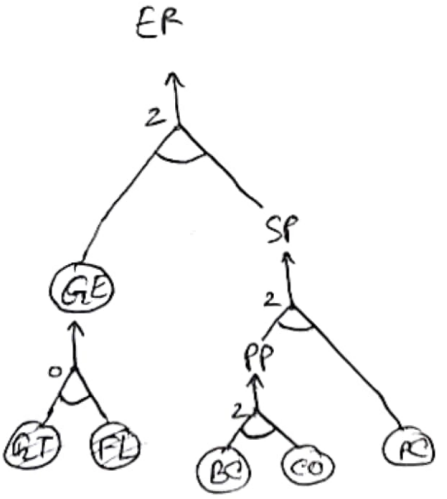
Step-1:



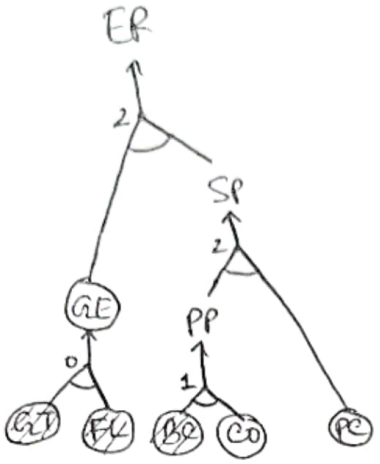
Step-2:



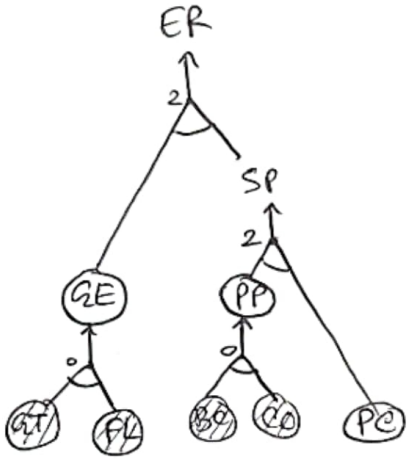
Step-3:



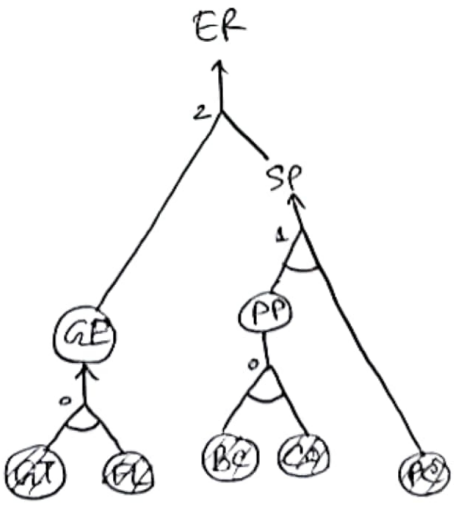
Step - 4:



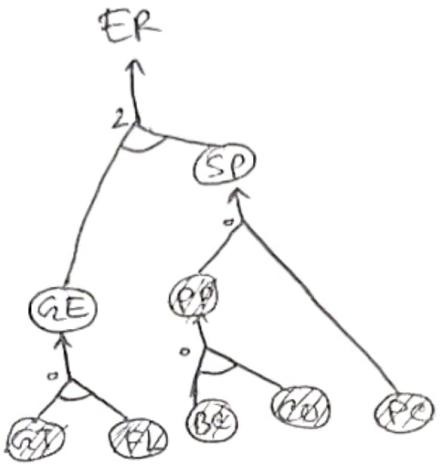
Step - 5:



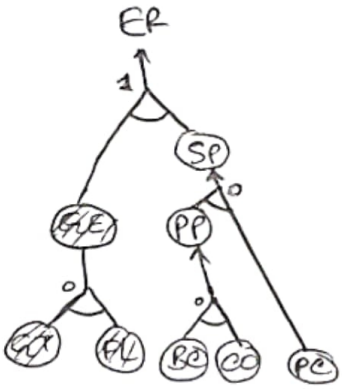
Step - 6:



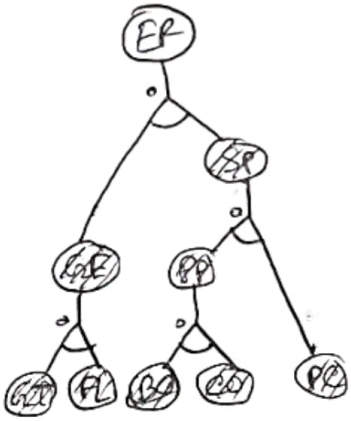
Step - 7:



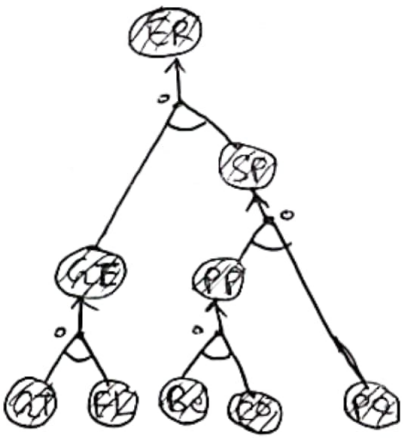
Step - 8:



Step - 9:



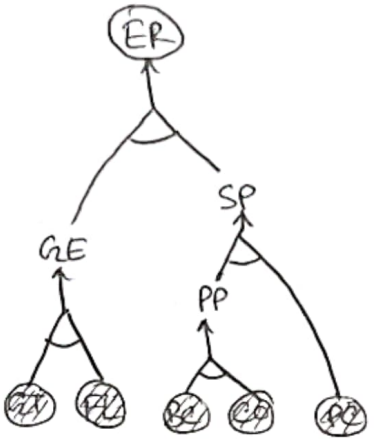
Step - 10:



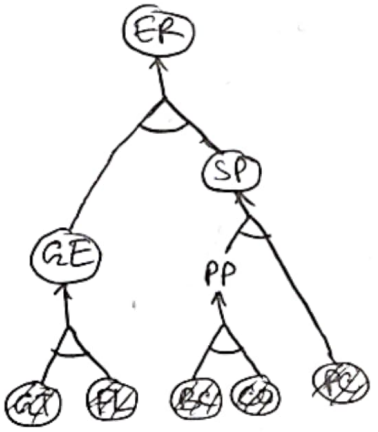
(Proved using Forward Chaining)

Backward Chaining:

Step-1:



Step-2:



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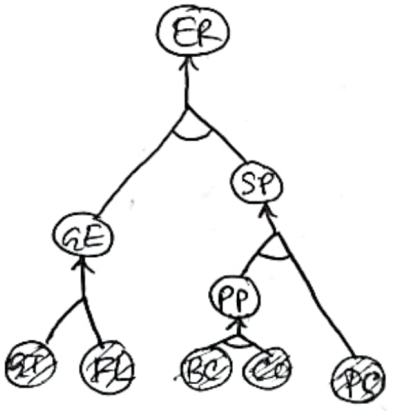
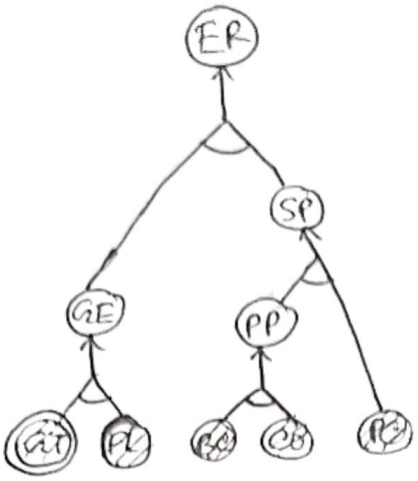


Step-4:



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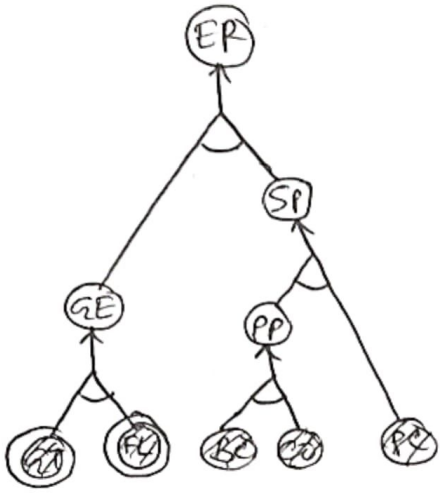

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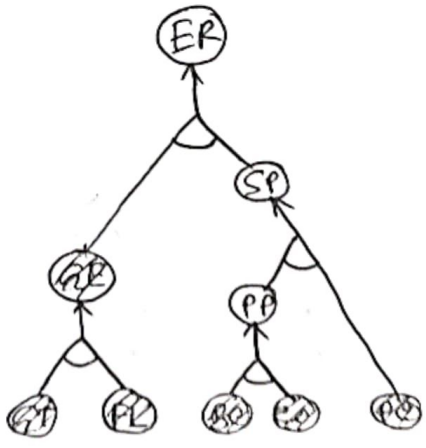
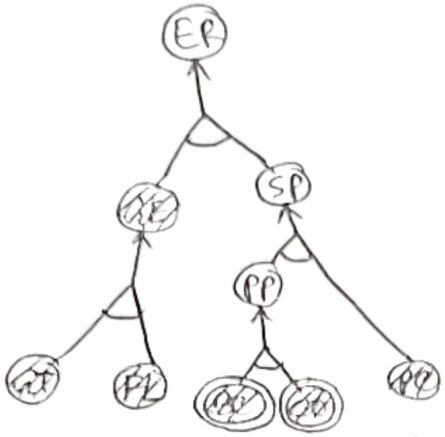
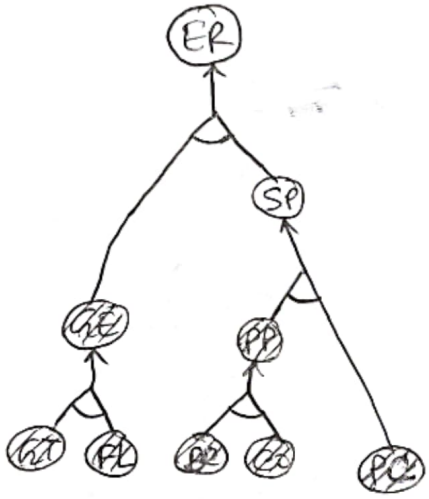


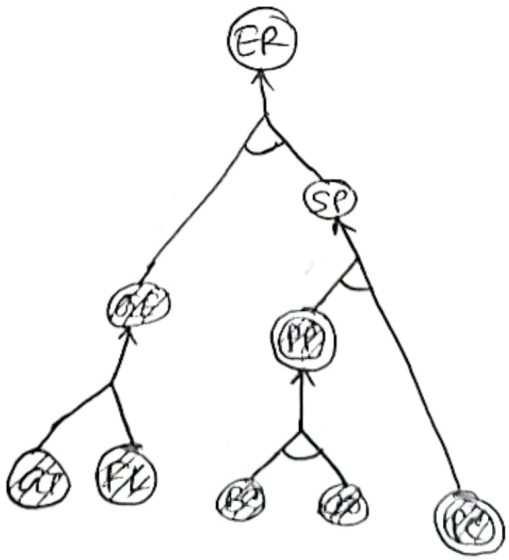
Step-7:



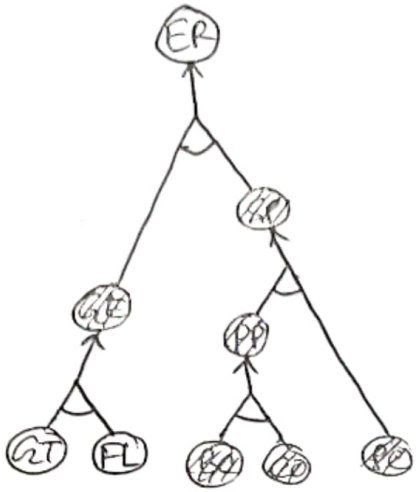
Step-8:



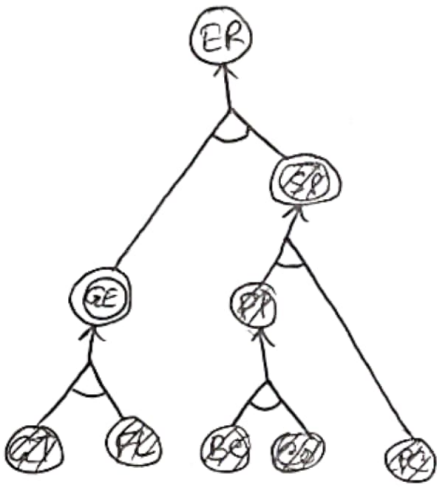
Step-9:



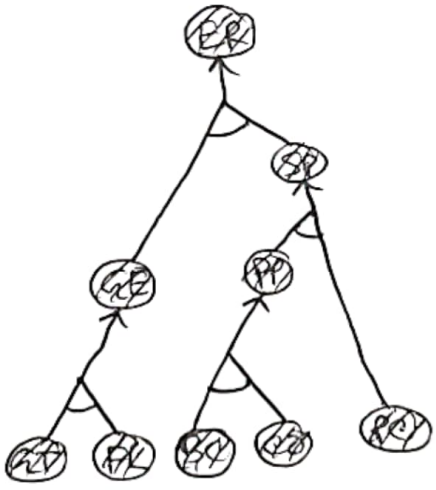
Step - 10 :



Step - 11 :



Step - 12 :



(Proved using Backward Chaining)

Answer to the Question No – 4

i) Both Dhaka and Chittagong are in Bangladesh:

$$In(Dhaka, Bangladesh) \wedge In(Chittagong, Bangladesh).$$

ii) There is a country that borders both India and Pakistan:

$$\exists x \left[Country(x) \wedge Borders(x, India) \wedge Borders(x, Pakistan)\right].$$

iii) All countries that border Bangladesh are in Asia:

$$\forall x \left[Country(x) \wedge Borders(x, Bangladesh)\right] \Rightarrow In(x, Asia).$$

iv) No region in South America borders any region in Europe:

$$\forall x, y \left[In(x, South\ America) \wedge In(y, Europe)\right] \Rightarrow \neg\, Borders(x, y)$$

v) No two adjacent countries have the same map color:

$$\forall x, y \left[Country(x) \wedge Country(y) \wedge Borders(x, y) \Rightarrow \neg\,(MapColor(x) = MapColor(y))\right]$$

(Ans.)