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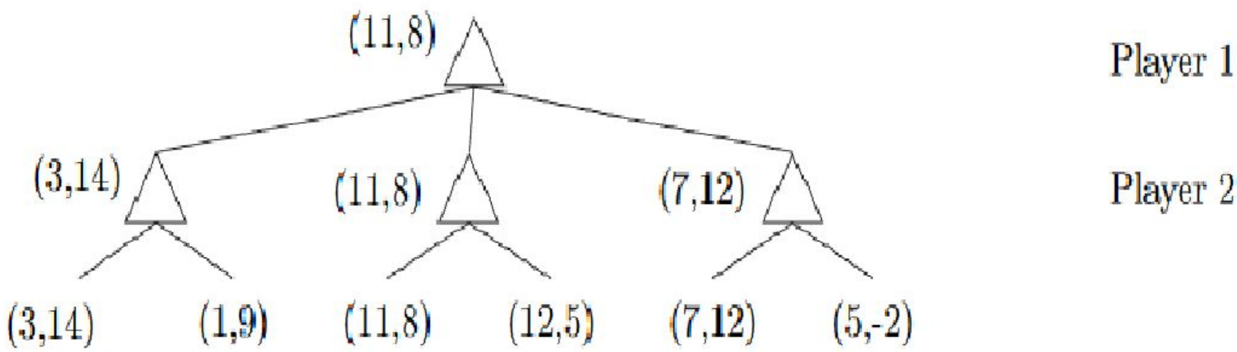
Problem 1.

(a)



(b)

The general condition under a child of a MIN node can be pruned is $U_B > k - \alpha$

Because maximum agent will make its(U_A) utility as much as it can. But the minimum agent will make (U_A) utility as smaller as it can. That is reveal player B will tries to minimum the (U_A) or maximum the ($-U_A$). Then we get, ($U_B = -U_A$) for standard minimax assumption.

We can remove or pruning the action for the minimum node(player B) if the $v < \alpha$. According from the previous information we can get if $U_A = -U_B < \alpha \Rightarrow U_B > -\alpha$ then we can prune the player B action.

$|U_B + U_A| \le k \Rightarrow U_A \le k - U_B$, reveal to prune if the upper bound is smaller than α. Then we need to satisfy $k - U_B < \alpha \Rightarrow U_B > k - \alpha$.

Problem 2.

(a)

Assume random pick of the bowls and random prefer color of the delegate.

$Bowls : 1,\ 2,\ 3.\quad Delegate : A,\ B,\ C.$

$Possible\ Set : \{[A_1B_2C_3],\ [A_1B_3C_2],\ [A_2B_1C_3],\ [A_2B_3C_1],\ [A_3B_1C_2],\ [A_3B_2C_3]\}$

$$Function\ for\ waste\ M\&M : \sum_{delegate=1}^{3} function(delegate,\ \#\ of\ M\&M\ not\ take,\ love\ color)$$

delegate stand for each delegate person. # of M&M not take will increase when i^{th} *M&M is not match the delegate's love color .*

Calculate the Function for waste M&M for each possible set and we get:

$f(set_1),\ f(set_2),\ f(set_3),\ f(set_4),\ f(set_5),\ f(set_6)$. Then find the minimum score of the six different set.

The score function is: $minimum(f(set_1),\ f(set_2),\ f(set_3),\ f(set_4),\ f(set_5),\ f(set_6))$

For each mix M&M bowls, I will pick Red M&M up and put it on the right bowl side and pick Blue M&M up and put it on the left bowl side. Keep the Green M&M on the original place.

(b)

If the local search reach local maximum then it won't be escape out from the local maximu.

For instance,

1	R	R	G	G
2	B	B	G	G
3	R	R	B	B

The total score from above is 6 and even the best move will decrease the total score as 1. That is reveal the situation reach the local maximum. No we will not converge the goal of bowls full of one M&M color.

(c)

If we permitting inserting M&Ms from one line into an arbitrary location in another line, I will rewrite the table as, (... in the cell represent any constant integer which is larger equal to 0)

1	...	R	...	R	...	G	...	G	...
2	...	B	...	B	...	G	...	G	...
3	...	R	...	R	...	B	...	B	...

We may insert the M&Ms to any position(which is mean there is no more 2 M&M's position switch). This means that we pick randomly move instead of best move. This is about the same concept as simulated annealing. So the local maximum can be escape. Therefore, there is no more local maximum problem, the plateau will instead of the local maximum. According to the lecture plateau can keep process working.

Problem 3.

Horn form:

$A \wedge B \Rightarrow D$

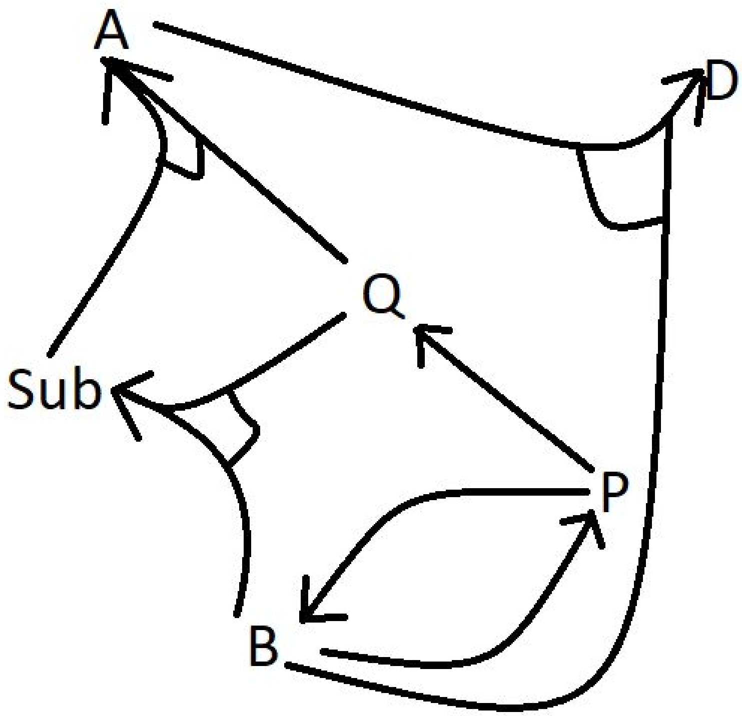
$Q \wedge Sub \Rightarrow A \quad where\ Sub = \neg R$

$Q \wedge B \Rightarrow Sub \quad where\ Sub = \neg R$

$P \Rightarrow Q$

$(P \Rightarrow B) \wedge (B \Rightarrow P)$

B



(a)

Forward Chaining:

Assume B is true

B is true implied P is true

P is true implied Q is true

B and Q are true implied Sub is true

Q and Sub are true implied A is true

B and A are true implied D is true

(b)

Backward Chaining:

Assume D is true

For A and B implied D is true we have to prove A and B are true

For Q and Sub implied A is true we have to prove Q and Sub are true

For Q and B implied Sub is true we have to prove Q and B are true

For P implies Q is true we have to prove P is true

For B implies P is true we have to prove B is true

Then, start prove each statement

B is true then B implies P is true

P is true then P implies Q is true

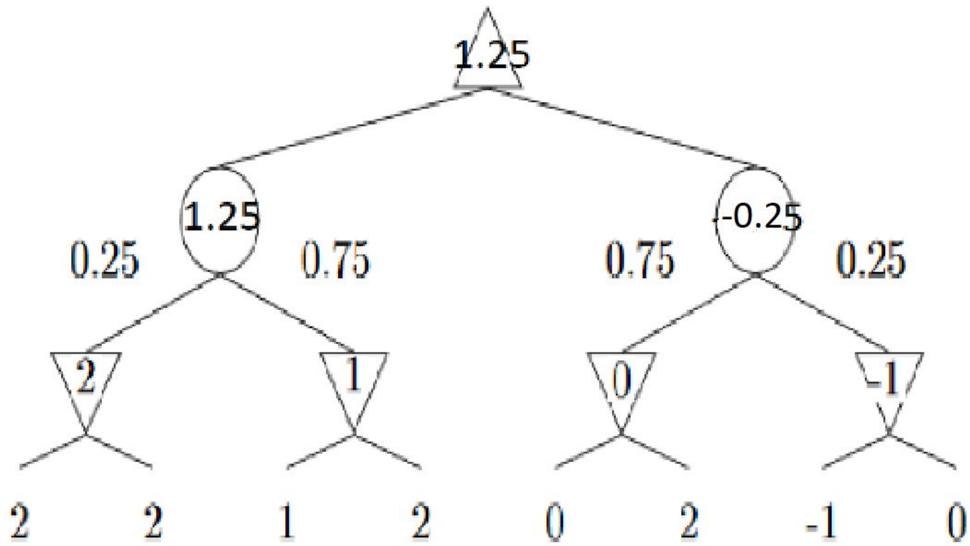
Q and B are true implies Sub is true

Sub and Q are true implies A is true

A and B are true implies D is true

Problem 4.

(a)



(b)

The values of first four leaves is 1.25(which is the result of top left branch). The 5^{th} and 6^{th} leaves giving result as 0(3^{th} *upside down triangle*). After 6^{th} leaf we have to evaluate the 7^{th} leaf. After we evaluate the 7^{th} leaves, the evaluation for 7^{th} *and* 8^{th} at most -0.25, because there are two situation:

First: $8^{th} < 7^{th}$, the evaluation for 7^{th} *and* 8^{th} will be smaller than -0.25. So the right branch has the value at most -0.25.

Second: $7^{th} > 8^{th}$, the e evaluation for 7^{th} *and* 8^{th} will be -0.25. So the right branch has the value -0.25.

No matter what value is for 8^{th} leaf, the biggest value for right branch is -0.25, which is smaller than the value for left branch. Therefore, we need to evaluate 7^{th} leaf and do not need to evaluate 8^{th} leaf.

(c)

We have to evaluate the first 5 leaves. First, we need to find out the value of top left branch.The value for left branch is 1.25. Then, 5^{th} leaves value is 0 and we can stop here. That is because the value of leaves are located in the interval [-2, 2]. If 5^{th} leaves value is 0, the evaluation for 5^{th} *and* 6^{th} is at most 0. Because if 6^{th} is greater than 5^{th} , the evaluation for 5^{th} *and* 6^{th} is 0, and if 6^{th} is smaller than 5^{th} , the evaluation for 5^{th} *and* 6^{th} is at most 0. Also, if we choose 2 for both 7^{th} *and* 8^{th} , the right branch has the value at most 0.5. Right branch will have smaller value than left branch.

Therefore, no matter what values for $6^{th}, 7^{th} and\ 8^{th}$, the right branch must be smaller than left branch. We only need to evaluate the first 5 leaves.

(d)

When we replace every x into positive linear transformation $ax + b$, each leaf node values become $ax_1 + b,\ ax_2 + b, ... to\ ax_i + b$.

This transformation doesn't change the min and max values we select. Since if we subtract b and divide a for all leaf node values, the min and max values we select will not change, still remaining x. Then, performing probability part will not actually change. So expectimax is insensitive to positive linear transformation.