1 Problem 1

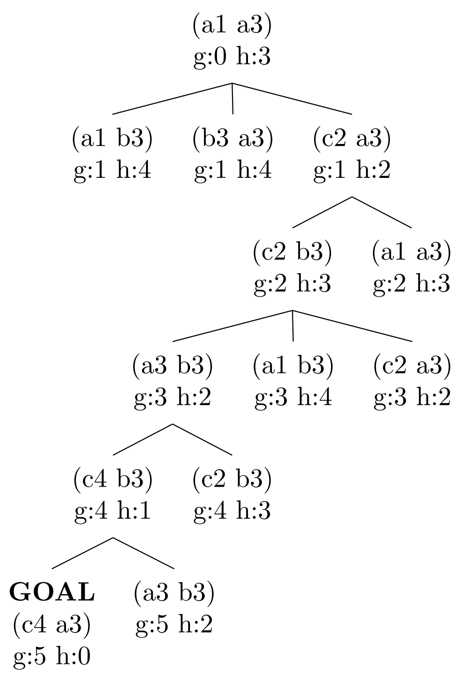
1.1 Notes

The most common mistakes for this problem were:

1. Forgetting to return the rook to a3, and end with it at b3
2. Incorrectly calculating a heuristic (usually off by one)
3. Not including a successor in tree (no points were taken off when it was repeated state)

1.2 Solution

Figure 1: Example Search Tree



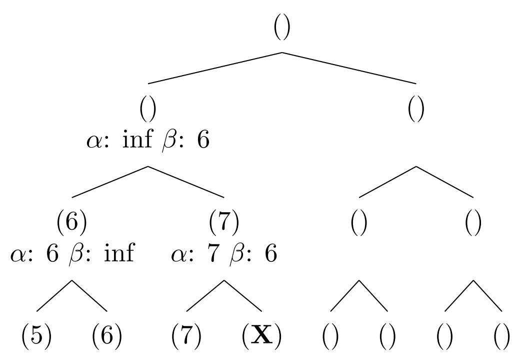
2 Problem 2

2.1 Notes

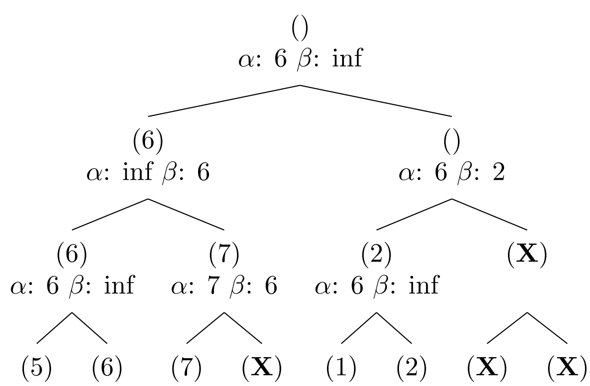
A node can be pruned once you know it will never be chosen. The min player can prune the terminal 4, because it knows the max player will get at least 7 in this subtree, and the best the max player can do in the sibling tree is a 6. So min will never allow max player to enter this subtree.

The max player can prune the node above terminals 3 and 8 because it knows the min player will get 2 or less in this subtree, and the best the min player can do in a sibling tree is 6. So max will never allow min player to enter this subtree.

2.2 State of Tree At first Prune



2.3 State of Tree At Second Prune



3 Problem 3

3.1 Part A

$A => B$ is the same as not A or B. Why? not A or A is always true for any A. We know A implies B (whenever A then also B), so not A or A is the same as not A or B. Using this:

$\neg P \vee Q$
$\neg Q \vee R$

3.2 Part B

We will show this is entailed using proof by contradiction.

We want to add $\neg(P => R)$ to the knowledge base. We know from Part A that this is the same as $\neg(\neg P \vee R)$. Additionally, from the hint we know this is $P \wedge \neg R$. We arrive at the following knowledge base:

1. $P \wedge \neg R$
2. $\neg P \vee Q$
3. $\neg Q \vee R$

And can prove using:

4. $\neg P \vee R$ (Resolution on 2 and 3)
5. P (Implied by 1)
6. R (Resolution on 4 and 5)
7. $\neg R$ (Implied by 1)

We have arrived at both R and $\neg R$ in our knowledge base. Therefore, by contradiction, $P => R$ must be entailed.

3.3 Part C

Using the same technique as B, we arrive at the following knowledge base:

1. $R \wedge \neg P$
2. $\neg P \vee Q$
3. $\neg Q \vee R$

Attempting to do some form of resolution results in:

4. $\neg P \vee R$ (Resolution on 2 and 3)

But it is not immediately obvious how to proceed. Instead, we will look for a value to satisfy the knowledge base. The assignment must satisfy:

$$(R \wedge \neg P) \wedge (\neg P \vee Q) \wedge (\neg Q \vee R)$$

The above is true when R = true, P = false, no matter what Q is. This means that $R => P$ is not entailed. Negating it and adding it to the knowledge base did not derive a contradiction.