COMS 4701 - Homework 3 - Conceptual

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Question 1

The following are true about adversarial search:

- In zero-sum games with two players, one agent maximizes one single value, while the other minimizes it.
- We can't always search the leaves in game trees because we may be limited in time.
- Both Alpha and Beta are sent down the tree.
- Alpha is the current lower bound on MAX's outcome and Beta is the current upper bound on MIN's outcome.

Question 2

(a) Max at the root has a value of **2**. See below for my work:

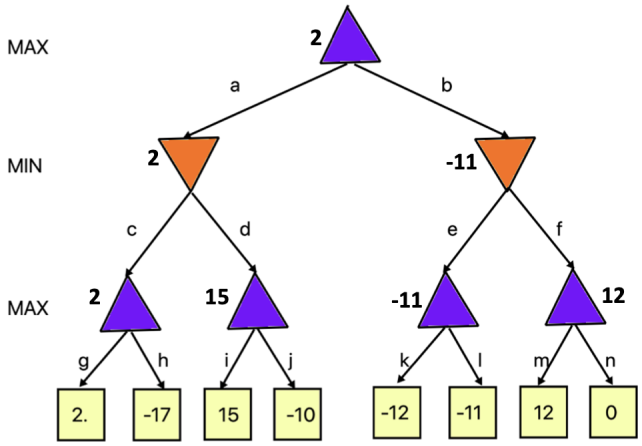

Figure 1: Adversarial search result.

(b) **Branches j, f, m, and n will all be pruned.** $\alpha - \beta$ pruning uses DFS in its algorithm. So first, it will initialize $\alpha = -\inf$ and $\beta = \inf$. Then it will go all the way down to the left most purple triangle and $\alpha = 2$ at that node. It will then go back up to the left most orange triangle and $\beta = 3$, while $\alpha = -\inf$. Then it will go down to the next purple triangle. Here, $\beta = 3$ still and $\alpha = 15$. Since $\alpha \geq \beta$, we prune branch j. Then we go all the way back up to the root node where $\alpha = 2$ and $\beta = \inf$. We bring these values down to the left purple triangle node on the right side of the tree and we see that β become -11. Now since $\alpha \geq \beta$ once again, we prune branches f, m, and n.

Question 3

1. KB : **HEADS** $\rightarrow$ **IWIN**; **TAILS** $\rightarrow$ **YOULOSE**
2. (a) Add the following to KB : **HEADS** $\vee$ **TAILS**
   (b) Add the following to KB: **YOULOSE** $\rightarrow$ **IWIN**;
   (c) Add the following to KB: **IWIN** $\rightarrow$ **YOULOSE**;

   My knowledge base now has KB : **HEADS** $\rightarrow$ **IWIN**; **TAILS** $\rightarrow$ **YOULOSE**; **YOULOSE** $\rightarrow$ **IWIN**; **HEADS** $\vee$ **TAILS**; **IWIN** $\rightarrow$ **YOULOSE**;
3. - $\neg$ **HEADS** $\vee$ **IWIN**
   - $\neg$ **TAILS** $\vee$ **YOULOSE**
   - **HEADS** $\vee$ **TAILS**
   - $\neg$ **YOULOSE** $\vee$ **IWIN**
   - $\neg$ **IWIN** $\vee$ **YOULOSE**
4. See Figure 2 for my resolution proof.

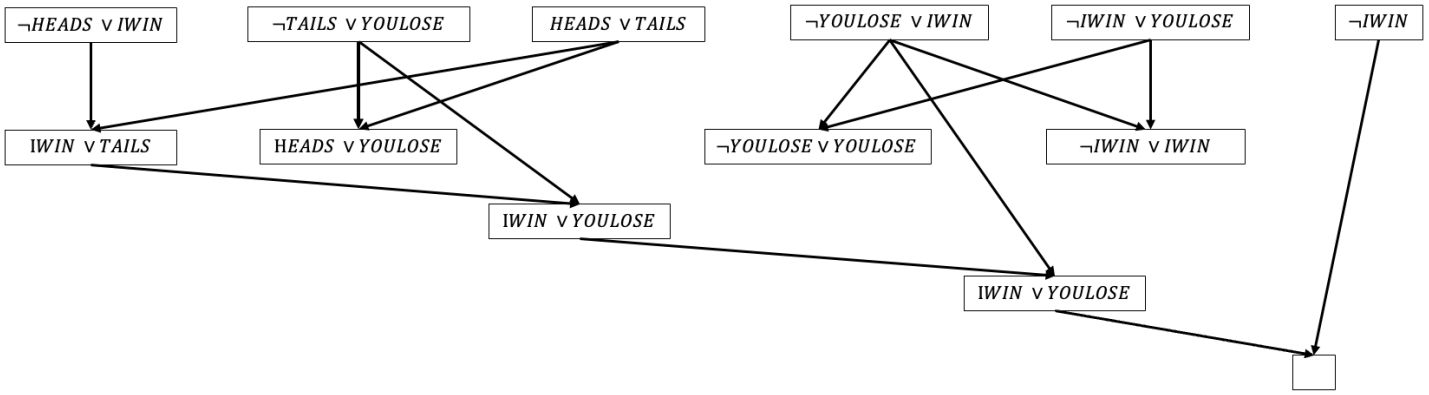

Figure 2: Resolution Proof of **IWIN**

Question 4

(a) 5 closest neighbors of M: G, H, L, N, R

(b) M will be a part of the positive class because most of its neighbors are a part of that class.

(c) Assigning a mass to each of the data points will skew the results greatly, especially since the standard deviation of the mass is 100. The distance between the masses will be on the scale of hundreds while the euclidean distance will be much smaller. As a result, there is going to be bias, in which the distance between masses overshadows the euclidean distance. This will result in a bias of your results in which the neighbors are the ones that have similar mass but not necessarily close to each other.To ensure there is equal influence between euclidean distance and mass distance, you need to normalize all the euclidean and mass distances. You need to make sure they are on the same scale.