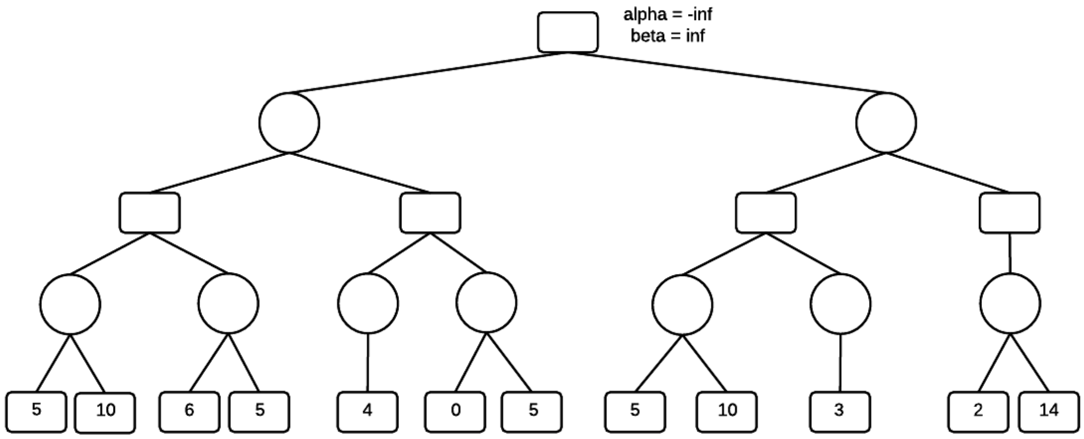
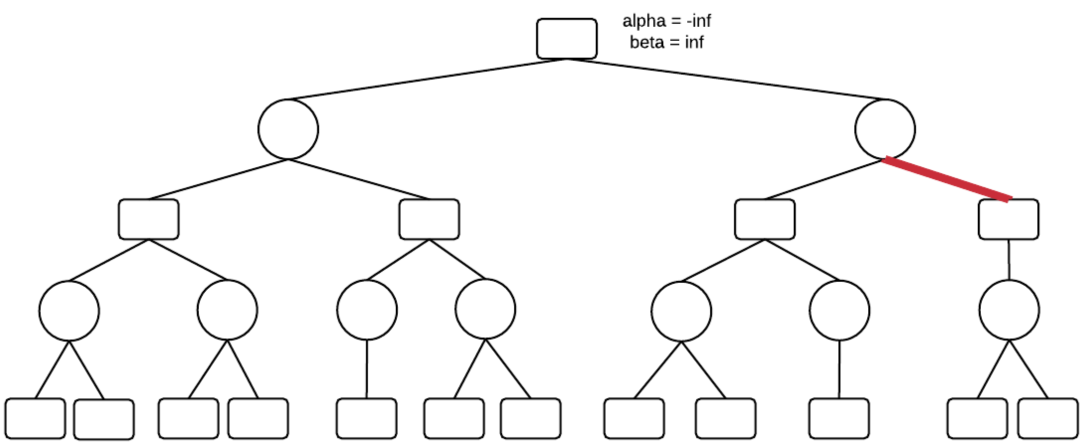
CSCI 3202 - Introduction to Artificial Intelligence
Instructor: Hoenigman
Assignment 4
Due Friday, September 25 by 4pm.

Problems

1. Use the alpha-beta algorithm to show the minimax value to MAX in the following game tree. Show the branches that are pruned during the search, and the values for MAX and MIN at each level in the tree.



2. For the following game tree, fill in values for the terminal nodes that will result in the tree not being pruned at the red branch. Show the values for MAX and MIN at each level of the tree and explain why the branch isn't pruned.



3. In the game tic-tac-toe, we can define X_n as the number of rows, columns, or diagonals with exactly n X's and no O's, and O_n as the number of rows, columns, and diagonals with exactly n O's and no X's. The utility function assigns +1 to any terminal node where $X_3 = 1$ and -1 to any terminal node where $O_3 = 1$. All other terminal nodes have a utility of 0. All non-terminal states are evaluated heuristically with a linear evaluation function defined as:

   $eval(s) = 3X_2(s) + X_1(s) - (3O_2(s) + O_1(s))$

   a. Show a partial game tree for a game of tic-tac-toe. From the root, generate two children and use the *eval(s)* function to score both child nodes. Select the highest-scoring child nodes and generate two children for that node. Repeat this process until a terminal node is reached. The X player goes first.
4. Repeat Question 3 using a different evaluation function of your choosing or creation. Explain your function and why you think it is a reasonable approach for evaluating a game of tic-tac-toe.
5. Show that the following assertion is true using an example: For every game tree, the utility obtained by MAX using minimax decisions against a suboptimal MIN will never be lower than the utility obtained playing against an optimal MIN.