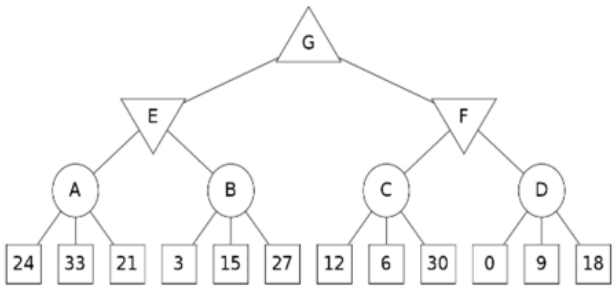
Artificial Intelligence

Fall 2024

Problem Set #2

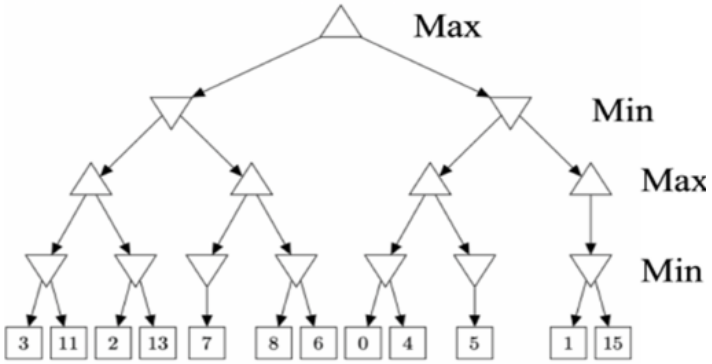
Due: Oct. 31 (Th)

Problem #1:
Consider the game tree shown below. Triangles that point up, such as the top node (root), represent choices for the maximizing player; triangles that point down represent choices for the minimizing player. The circular nodes represent chance nodes in which each of the possible actions may be taken with equal probability. The square nodes at the bottom represent leaf nodes. Assuming both players act optimally, carry out the **expectiminimax** search algorithm. Represent the values for the internal nodes.



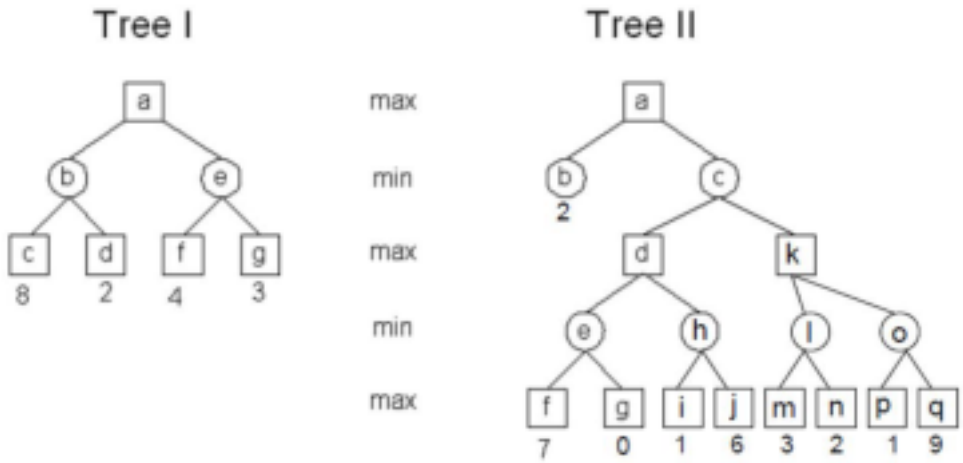
Problem #2:
Consider the Minimax tree below:

A. For all interior nodes, write the minimax value inside the triangle representing the node.
B. Assuming left-to-right traversal, show which branches would be removed by Alpha-beta pruning (if any) by drawing a short line through the pruned edge at a right angle.



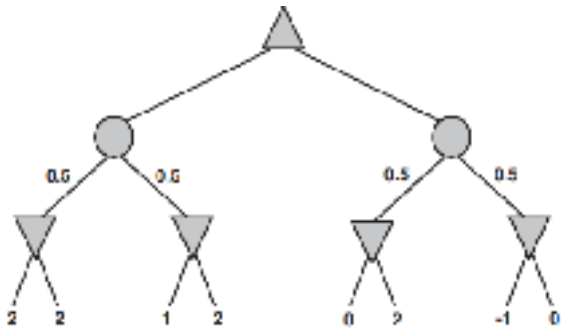
Problem #3:
Consider the following adversarial search trees. Note that underneath the leaves (e.g., nodes c, d, f, & g in Tree I) we have written the value returned by the heuristic evaluation function.

A. Using min-max search on Tree I, what is the value of node a?
B. Suppose Tree I is searched using alpha-beta search in a depth first fashion.
   E.g., if all nodes were explored, they would be visited in alphabetic order. Would alpha-beta visit all nodes, or would it prune one or more nodes? Answer "no pruning" or for each node which does get pruned, say "node X pruned immediately after visiting node Y".
C. Using min-max search on Tree II, what is the value of node a?
D. Answer question B for Tree II.



Problem #4:
Consider the following game tree, which has min (down triangle), max (up triangle), and expectation (circle) nodes:

A. In the figure above, label each tree node with its value (a real number).
B. In the figure above, circle the edge associated with the optimal action at each choice point.
C. If we knew the values of the first six leaves (from left), would we need to evaluate the seventh and eighth leaves? Why or why not?
D. Suppose the values of leaf nodes are known to be in the range [-2; 2], inclusive. Assume that we evaluate the nodes from left to right in a depth first manner. Can we now avoid expanding the whole tree? If so, why? Circle all of the nodes that would need to be evaluated (include them all if necessary).



Enjoy!!!