CS188 – Introduction to Artificial Intelligence

Section Handout #2, FORMULATING AND SOLVING CSPS

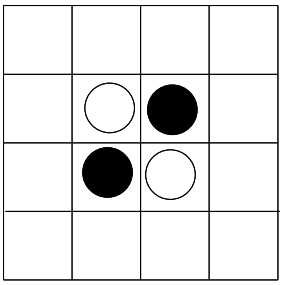
Klein, Fall 2007

Question 1 (Class)

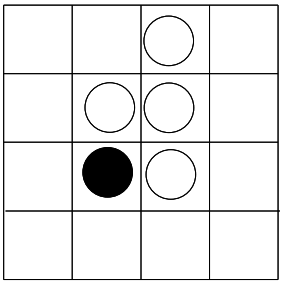
Othello (slightly modified)

Othello is a two-player game. Player 1 (MAX) plays with white tiles, while Player 2 (MIN) plays with black. When a white tile is placed on the board, any contiguous line of black tiles between the new tile and another white tile is replaced with a contiguous line of white tiles. Such contiguous lines can include diagonal lines. Similarly, placing a black tile can reverse the colour of white tiles. When there is no legal move for the current player, the game stops. The score of the game is the number of white tiles on the board at the end of the game. The initial configuration of the board, along with a move for each player, is shown below.

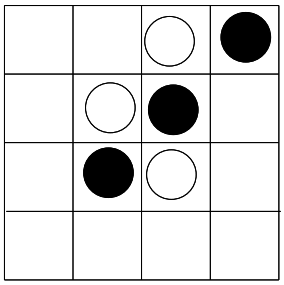
Initial board position



White moves



Black moves



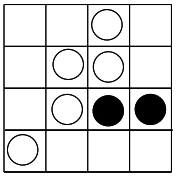
You wish to calculate the minimax value of this game. Luckily, you already know the minimax values of the following board positions. (See following page for known positions).

a. Draw the minimax tree for this game. Treat board positions with known minimax values as leaves. Assume that new board positions are generated by considering new moves from left to right, then from top to bottom.

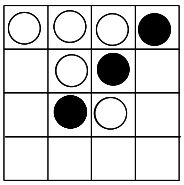
b. Identify all branches of the tree that will be pruned by alpha-beta pruning.

c. Propose an evaluation function for this game. Compare the results of your function with the values of the known board positions.

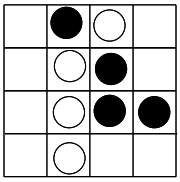
Known board positions.



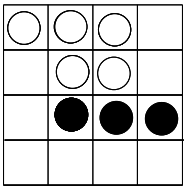
10



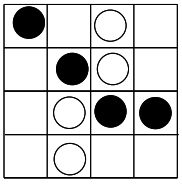
9



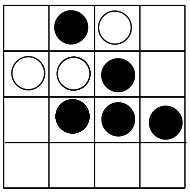
8



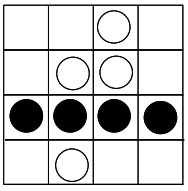
11



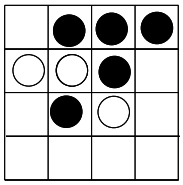
7



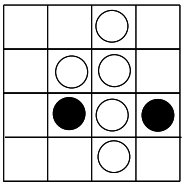
8



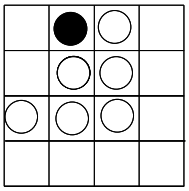
9



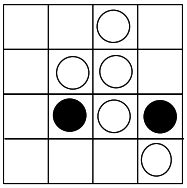
4



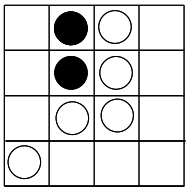
7



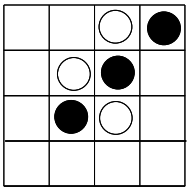
5



9



7



4

Question 2 (Class)

Suppose that you (MAX) are playing a game against your friend (MIN). Fortunately for you, your friend is very tired from working on Project #1, and as such, she is not playing optimally today.

a. *Suppose that you decide to use minimax decisions in playing against your friend. Can the fact that she is playing suboptimally hurt the performance of minimax? In other words, can the utility obtained by using minimax decisions against a suboptimal player be lower than that obtained against an optimal player? If so, provide a game tree that demonstrates this behaviour. If not, provide a proof.*

b. *Now suppose that you are aware when your friend will make a suboptimal move, and which move she will make. Can you take advantage of this? In other words, can a suboptimal strategy on your part achieve higher utility than a minimax strategy? If so, provide a game tree that demonstrates this behaviour. If not, provide a proof that this is not possible.*

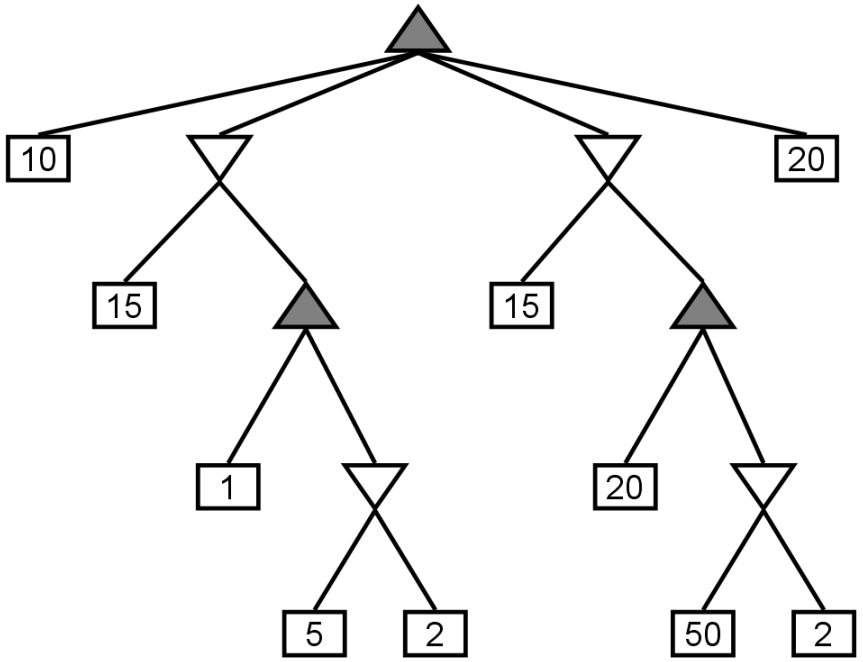
CS188 – Introduction to Artificial Intelligence

Section Handout #2, FORMULATING AND SOLVING CSPS

Klein, Fall 2007

Question 1 (Homework)

Consider the following minimax tree.



\

a. What is the minimax value for the root?

b. Draw an X through any nodes which will not be visited by alpha-beta pruning, assuming children are visited in left-to-right order.

c. Is there another ordering for the children of the root for which more pruning would result? If so, state the order.

d. Propose a general, practical method for ordering children of nodes which will tend to increase the opportunities for pruning. You should be concise, but clearly state both what to do about min nodes and max nodes.