CS 540: Introduction to Artificial Intelligence

Homework Assignment #2
Solution

Problem 1. Minimax and Alpha-Beta
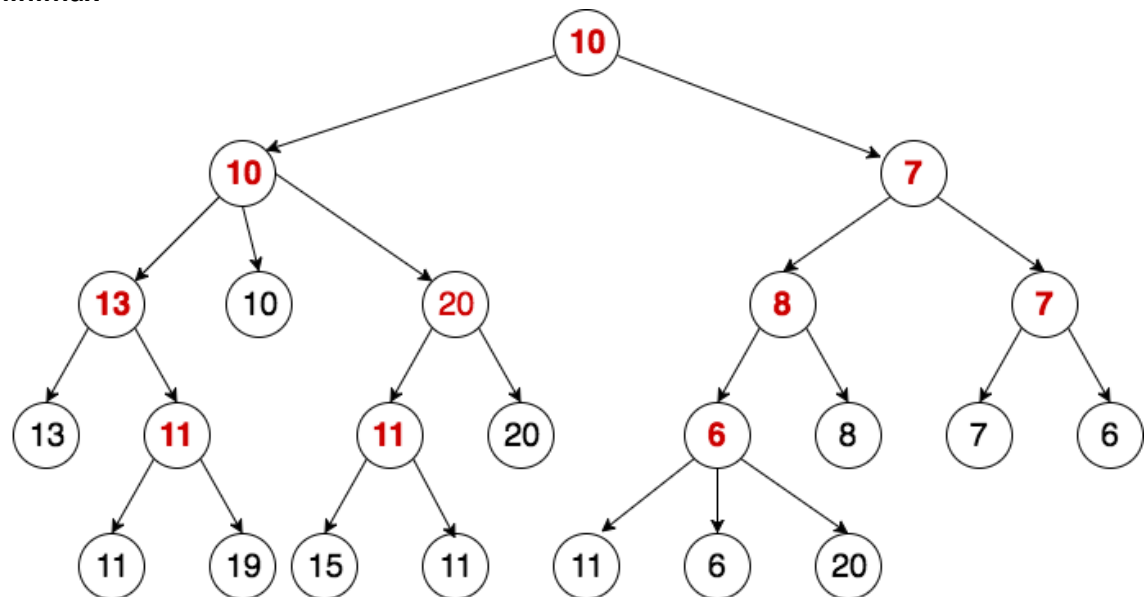
a) Minimax

b) Alpha-Beta Pruning
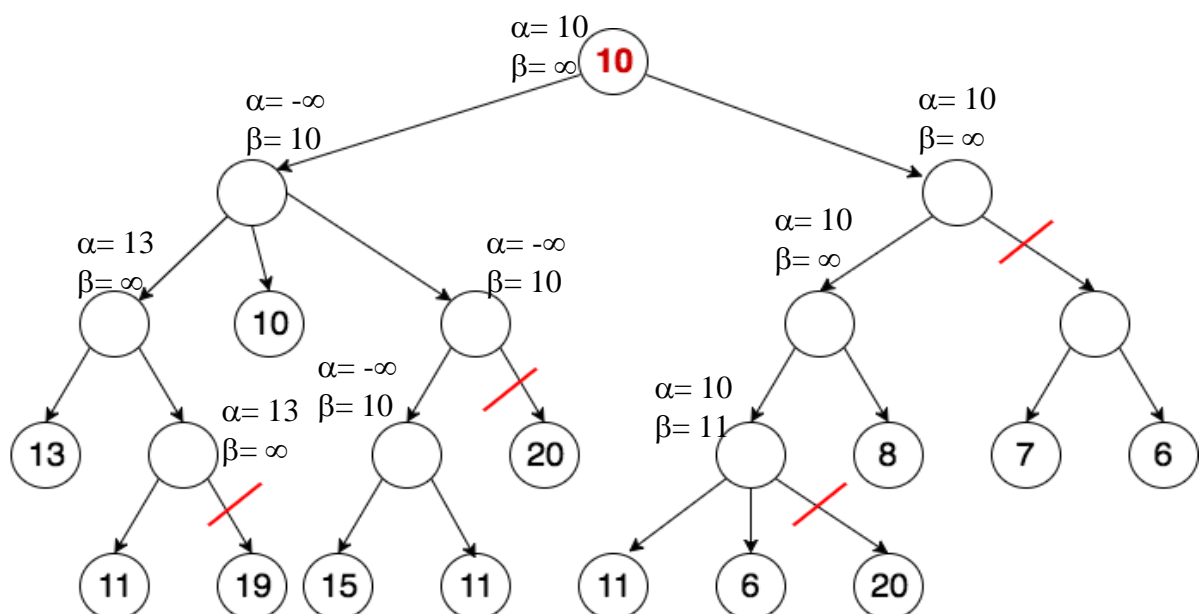

c)   No, Alpha-beta pruning only speeds up Minimax algorithm, it doesn't change any move.

Problem 2. Hill Climbing

a) This is a combination problem.
   If there are n locations in the current state, we pick two locations out of n and swap them.
   So we have $\binom{n}{2} = \frac{n(n-1)}{2}$ neighbors

b) This is a permutation problem.
   With n locations, the size of the search space with distinct states is $P_n^n/2 = n!/2$

c) *Generate next state from the given state.*
   The initial state $< M - E - C - S - W - M >$ which has a cost of 0.8 + 1.5 + 1.3 + 0.3 + 0.6 = 4.5. We have 6 successors:
   $< M - C - E - S - W - M > : 3.5$
   $< M - S - C - E - W - M > : 4.3$
   $< M - W - C - S - E - M > : 4.2$
   $< M - E - S - C - W - M > : 4.2$
   $< M - E - W - S - C - M > : 3.5$
   $< M - E - C - W - S - M > : 4.6$
   The algorithm will move to $< M - C - E - S - W - M >$ because:
   -   Its cost is lower than the initial state
   -   It has the lowest cost and higher priority (alphabet order)

   Global solution
   The algorithm stops if there is not any neighbor having better score. The best state reached from the given state is $< M - C - S - E - W - M >$ with a cost of 3.2.
   The solution is, in general, a local optimal one, not a global optimal solution. Fortunately, in this case, this local state is also the global one (we can check that there is not any shorter tour than this tour). The hill climbing gets the global solution, the path is:
   $< M - E - C - S - W - M > -> < M - C - E - S - W - M > -> < M - C - S - E - W - M >$