CS 208 – Design and Analysis of Algorithms

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As part of our project, we have decided to work on 3 algorithms, two of which involve DP and the other recursion.

1) Minimax Algorithm (Recursion)

Surely, anyone with a computer must have played a game of chess against it, and lost. What is the intelligence behind the computer's near perfect chess game? How does the computer adapt to your moves? Is this seemingly intelligent behavior limited to games? We decided to work on the algorithm that makes this possible, Minimax Search.

Minimax Search is a decision rule used in decision theory, game theory and statistics to minimize the possible loss for a worst case scenario. Minimax was originally formulated to serve **zero-sum game theory i.e.,** a game with zero net outcome, where one's gain is another's loss, covering both the cases where players take alternate moves and those where they take simultaneous moves.

2) Alpha – Beta pruning (Optimization using DP)

Minimax in itself is not the most optimal solution to the problem statement. Alpha-Beta pruning is a dynamic programming based optimization technique that is used most commonly for machine playing of two-player games like Tic-tac-toe, Chess etc..

It's based on the fact that it stops completely evaluating a move when at least one possibility has been found that proves the move to be worse than a previously examined move. Such moves need not be examined further.

When applied to Minimax, it results in the same tree as the Minimax, but faster.

3) Viterbi Algorithm (DP)

Viterbi algorithm is a dynamic programming algorithm for finding the most likely sequence of hidden states.

This algorithm is of importance especially in the context of information sources that are in the form of Markov Chains – mathematical system that undergoes transitions from one state to another.

Viterbi algorithm finds its applications in speech recognition, speech synthesis, keyword spotting, computational linguistics, and bioinformatics.