Homework 4: Alpha-Beta Pruning

This past week we developed a program in class to create a depth-first exploration of the game tree for Tic Tac Toe. In this assignment, you will turn this into an implementation of minimax search that employs alpha-beta pruning to limit the number of nodes expanded. Your goal is to present a write-up of these methods that discusses the effect on exploring the game tree of each of these methods in this particular setting. You will want to think in advance about what the purpose of each of these methods is, what results you would expect to see from using them, and how you might measure those results in your particular implementation.

In order to do this, you will need to first convert the code to perform minimax search using our discussed utility function at the terminal nodes. From there, develop a cutoff function and an evaluation function; you will want to think carefully about your choices and be able to justify them in your write-up. Feel free to implement, test and revise your functions as needed. Finally, implement the pruning mechanism by which alpha-beta pruning eliminates branches of the tree from exploration. At each step, be sure to collect any data necessary (e.g. number of nodes expanded, depth in tree selected, runtime, choice of action, etc.) to support your writeup.

Your final report should discuss each of minimax search, alpha-beta pruning, your cutoff function and your evaluation function. Discuss what role each of them is intended to have in exploring a game tree and how effective each appears to be in improving the search behavior. Back your discussion up with specifics from your data collected. In addition to submitting your written lab report, provide a well-documented copy of all of your source code.