- CSC545/645 Artificial Intelligence - Assignment 6

Due date: Thursday, October 13, 2022, 2:00pm. Please create a folder called assignment6 in your local working copy of the repository and place all files and folders necessary for the assignment in this folder. Once done with the assignment, add the files and folders to the repo with svn add *files,folders* and then commmit with svn ci -m "SOME USEFUL MESSAGE" *files,folders* .

Exercise 6.1 [12 points]
Read chapter 5 of the textbook.

1. **Discuss how well the standard approach to game playing (Minimax, Expectiminimax) would apply to games such as tennis, pool, and soccer, which take place in a continuous, physical state space. Here are some hints for the discussion:**

a) **Would the approach work?**

If there was some way to slice up the game state into distinct values then potentially. Tennis can be a game of player 1 and player 2 with decisions as to where (approximately) to hit the ball - the calculations to make this shot can be done later. Pool can be done the same way, and while soccer is harder there may be ways to generalize the field, player locations, and current objective.

b) **What would be the state space size?**

This wildly depends on how the world is sliced up and what the system is considering.

c) **What would it take to make the approach work in theory?**

For example, the tennis state space would be however many squares you slice the court into to the power of how many turns until the ball could be confidently hit to a far enough square away from the player (anticipating a win). Basically, any of the games need to have some arbitrary way to confidently assume, given an action, a win would occur.

d) Would it work in practice?

There are definitely better tools (that weve already learned!) that would accomplish this task better, but hypothetically a system could work to some extent.

[6 points]

2. **Describe how the minimax and alpha-beta algorithms change for two-player, nonzero-sum games, in which each player has his or her own utility function (for the leaf nodes). You may assume that each player knows the other's utility function. If there are no constraints on the two terminal utilities, is it possible for any node to be pruned by alpha-beta? Discuss this subject.**

Even though each player's utility function is known, they are not opposite in nature. This fundamentally ruins alpha-beta pruning and would make it irrelevant. There could be plays/actions where for each player the world changes in a way that is positive for both of them, which would overlap alpha and beta and ruin any further analysis from that point forward.

[6 points]

Exercise 6.2 [8 points]
Implement the minimax and the alpha-beta pruning algorithm. Use TicTacToe as your example to test the algorithms. Evaluate the number of iterations with and without pruning. You may want to use the framework that Alexander H¨artl (Java) and Fan Zhang (Python) have prepared for you. [8 points]