TDT4136 - Assignment 4
Minimax and alpha-beta pruning

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1 Overview

In this assignment, we will implement the Minimax algorithm for adversarial search. We will follow the pseudocode provided in Figure 6.3 (p. 196) of [RN21]. Afterwards, we will extend such implementation to use alphabeta pruning to speed up the search. The pseudocode that we will follow for alpha-beta pruning is provided in Figure 6.7 (p. 200) the same textbook.

The structure of the code was given in Python 3.10.12 on `https://inst.eecs.berkeley.edu/~cs188/su21/project2/`.

2 Minimax

We implemented of the Minimax algorithm given in the code file given on BlackBoard. In order to do so, we followed the instructions on `https://inst.eecs.berkeley.edu/~cs188/su21/project2/#question-2-5-points-minimax`. When we run the following command, we get the result bellow.

```
>>> (aitask4)   multiagent python autograder.py -q q2 --no-graphics

/Users/arthurtestard/ntnu_code/intro_to_ai/assignment4/multiagent/autograder.py:18:
DeprecationWarning: the imp module is deprecated in favour of importlib and slated for removal in Python 3.12;
see the module's documentation for alternative uses
  import imp
Starting on 10-18 at 16:41:07

Question q2
===========

*** PASS: test_cases/q2/0-eval-function-lose-states-1.test
*** PASS: test_cases/q2/0-eval-function-lose-states-2.test
*** PASS: test_cases/q2/0-eval-function-win-states-1.test
*** PASS: test_cases/q2/0-eval-function-win-states-2.test
*** PASS: test_cases/q2/0-lecture-6-tree.test
*** PASS: test_cases/q2/0-small-tree.test
*** PASS: test_cases/q2/1-1-minmax.test
*** PASS: test_cases/q2/1-2-minmax.test
*** PASS: test_cases/q2/1-3-minmax.test
*** PASS: test_cases/q2/1-4-minmax.test
*** PASS: test_cases/q2/1-5-minmax.test
*** PASS: test_cases/q2/1-6-minmax.test
*** PASS: test_cases/q2/1-7-minmax.test
*** PASS: test_cases/q2/1-8-minmax.test
*** PASS: test_cases/q2/2-1a-vary-depth.test
*** PASS: test_cases/q2/2-1b-vary-depth.test
*** PASS: test_cases/q2/2-2a-vary-depth.test
*** PASS: test_cases/q2/2-2b-vary-depth.test
*** PASS: test_cases/q2/2-3a-vary-depth.test
*** PASS: test_cases/q2/2-3b-vary-depth.test
*** PASS: test_cases/q2/2-4a-vary-depth.test
*** PASS: test_cases/q2/2-4b-vary-depth.test
*** PASS: test_cases/q2/2-one-ghost-3level.test
*** PASS: test_cases/q2/3-one-ghost-4level.test
*** PASS: test_cases/q2/4-two-ghosts-3level.test
*** PASS: test_cases/q2/5-two-ghosts-4level.test
*** PASS: test_cases/q2/6-tied-root.test
*** PASS: test_cases/q2/7-1a-check-depth-one-ghost.test
*** PASS: test_cases/q2/7-1b-check-depth-one-ghost.test
*** PASS: test_cases/q2/7-1c-check-depth-one-ghost.test
*** PASS: test_cases/q2/7-2a-check-depth-two-ghosts.test
*** PASS: test_cases/q2/7-2b-check-depth-two-ghosts.test
*** PASS: test_cases/q2/7-2c-check-depth-two-ghosts.test
*** Running MinimaxAgent on smallClassic 1 time(s).
Pacman died! Score: 84
Average Score: 84.0
Scores:        84.0
Win Rate:      0/1 (0.00)
Record:        Loss
*** Finished running MinimaxAgent on smallClassic after 0 seconds.
*** Won 0 out of 1 games. Average score: 84.000000 ***
*** PASS: test_cases/q2/8-pacman-game.test

### Question q2: 5/5 ###


Finished at 16:41:08

Provisional grades
==================
Question q2: 5/5
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Total: 5/5
```

3 Alpha-beta pruning

We implemented of the Alpha-beta pruning algorithm given in the code file given on BlackBoard. In order to do so, we followed the instructions on `https://inst.eecs.berkeley.edu/~cs188/su21/project2/#question-3-5-points-alpha-beta-` When we run the following command, we get the result bellow.

```
>>> (aitask4)   multiagent python autograder.py -q q3 --no-graphics

/Users/arthurtestard/ntnu_code/intro_to_ai/assignment4/multiagent/autograder.py:18:
DeprecationWarning: the imp module is deprecated in favour of importlib and slated for removal in Python 3.12;
see the module's documentation for alternative uses
  import imp
Starting on 10-18 at 16:25:38

Question q3
===========

*** PASS: test_cases/q3/0-eval-function-lose-states-1.test
*** PASS: test_cases/q3/0-eval-function-lose-states-2.test
*** PASS: test_cases/q3/0-eval-function-win-states-1.test
*** PASS: test_cases/q3/0-eval-function-win-states-2.test
*** PASS: test_cases/q3/0-lecture-6-tree.test
*** PASS: test_cases/q3/0-small-tree.test
*** PASS: test_cases/q3/1-1-minmax.test
*** PASS: test_cases/q3/1-2-minmax.test
*** PASS: test_cases/q3/1-3-minmax.test
*** PASS: test_cases/q3/1-4-minmax.test
*** PASS: test_cases/q3/1-5-minmax.test
*** PASS: test_cases/q3/1-6-minmax.test
*** PASS: test_cases/q3/1-7-minmax.test
*** PASS: test_cases/q3/1-8-minmax.test
*** PASS: test_cases/q3/2-1a-vary-depth.test
*** PASS: test_cases/q3/2-1b-vary-depth.test
*** PASS: test_cases/q3/2-2a-vary-depth.test
*** PASS: test_cases/q3/2-2b-vary-depth.test
*** PASS: test_cases/q3/2-3a-vary-depth.test
*** PASS: test_cases/q3/2-3b-vary-depth.test
*** PASS: test_cases/q3/2-4a-vary-depth.test
*** PASS: test_cases/q3/2-4b-vary-depth.test
*** PASS: test_cases/q3/2-one-ghost-3level.test
*** PASS: test_cases/q3/3-one-ghost-4level.test
*** PASS: test_cases/q3/4-two-ghosts-3level.test
*** PASS: test_cases/q3/5-two-ghosts-4level.test
*** PASS: test_cases/q3/6-tied-root.test
*** PASS: test_cases/q3/7-1a-check-depth-one-ghost.test
*** PASS: test_cases/q3/7-1b-check-depth-one-ghost.test
*** PASS: test_cases/q3/7-1c-check-depth-one-ghost.test
*** PASS: test_cases/q3/7-2a-check-depth-two-ghosts.test
*** PASS: test_cases/q3/7-2b-check-depth-two-ghosts.test
*** PASS: test_cases/q3/7-2c-check-depth-two-ghosts.test
*** Running AlphaBetaAgent on smallClassic 1 time(s).
Pacman died! Score: 84
Average Score: 84.0
Scores:        84.0
Win Rate:      0/1 (0.00)
Record:        Loss
*** Finished running AlphaBetaAgent on smallClassic after 0 seconds.
*** Won 0 out of 1 games. Average score: 84.000000 ***
*** PASS: test_cases/q3/8-pacman-game.test

### Question q3: 5/5 ###


Finished at 16:25:39

Provisional grades
==================
Question q3: 5/5
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Total: 5/5

Your grades are NOT yet registered.  To register your grades, make sure
to follow your instructor's guidelines to receive credit on your project.
```

References

[RN21] Stuart Russell and Peter Norvig. Artificial intelligence: a modern approach, 4th us ed. *University of California, Berkeley*, 2021.