

CS814 AI for Autonomous Systems – Coursework 2

Guidelines

Aim of the assignment

To provide deeper understanding of Game Playing algorithms (both Minimax and alphaBeta pruning algorithms).

Learning outcomes

Program in Python, with the goal being to implement key AI algorithms and build AI systems; Define and understand the problem of Artificial Intelligence as it relates to autonomous systems; Apply search techniques to enable autonomous systems to choose actions that are appropriate to their goals; Apply key techniques to adversarial problems, such as Mini-Max, alpha-Beta pruning, and Monte Carl Tree search

Submission

You will be allowed to submit two files only:

1. The first file consists of your answers on all questions. Please make sure that your file is well written and well structured. One should be able to clearly read your solution and identify the final answer to each and every question or sub-question. The submitted file should be in pdf format.
2. The second file consists of your coding, only as a support to the first file. The submitted file should be in ipynb extension.

Both files should be submitted using myPlace; no submission will be accepted in any different way. Any extension should be requested in advance of the submission deadline, with a valid reason. Assessments submitted after the Monday midday deadline without an approved extension will receive a mark of zero.

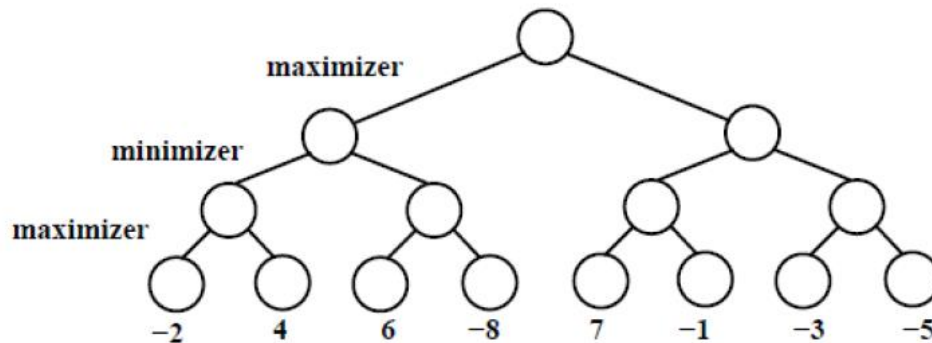
Good Luck!!

DUE: 12:00 noon, Monday November 23rd, 2020

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Part I (40% of the grade)

Let us consider the game tree shown below. For the avoidance of doubt: MAX plays first (top node), then MIN, then MAX. After these three moves, the game ends in all cases. The score shown underneath the terminal nodes is the value of the game to MAX.



Your solution document on the two questions below should be a single page file in portrait PDF format. Any submissions not meeting this formatting requirement will receive a mark of zero.

Question 1 (20%)

Apply the Minimax algorithm on this game. Show the chosen value next to the nodes where these are calculated. Then indicates the action that each player is expected to play in order (What is the first action of Max, what Min will play next, what Max will finally play).

Question 2 (20%)

Perform minimax with alpha-beta pruning on this game. Show all v , α and β values next to the nodes where these are calculated. Show any prunes that are made by drawing a double line across the arc.

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Part II (60% of the grade)

Question 3

Nine men's morris is a strategy board game for two players dating at least to the Roman Empire. Please check the following link on Wikipedia to have more information about the game: https://en.wikipedia.org/wiki/Nine_men%27s_morris

In this question, we are going to write a Python coding to enable the computer to play a variant of that game, which is called Six men's morris. Six men's morris gives each player six pieces and is played without the outer square of the board for nine men's morris. In addition, Flying is not permitted.

1. Choose a formalism to represent all possible states. (15%)
2. The search tree may be huge for this game. Choose an evaluation function for a non-terminal state. (10%)
3. Implement the alpha-beta algorithm that you have created in Question 3.2. Use the evaluation function when a depth of eight is reached. (25%)
4. Implement the main function of the algorithm that will allow a human being to play against the computer using the keyboard. (10%)