

CSCE625: Introduction to Artificial Intelligence

Programming Assignment 2 : Search for Games

Dylan Shell

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1 Problem Domain

Consider the following simple game played between two players. A pile of n matches is placed between Alice and Bob. Each player takes turns removing some matches from the pile, in an alternating fashion. Players are permitted to remove one, two, or three matches in each turn. The player who is forced to take the last match loses.

2 Assignment

This is what you are required to do:

1. Write a program that generates the game tree for this game for each of $n \in \{7, 15, 21\}$ via the minimax algorithm.
2. Extend your code to use alpha-beta pruning. Build those trees and analyze the games:
 - (a) What are the relative sizes of the trees?
 - (b) Does opting to go first or second play a role in the outcome of the game? What is the value of the game?
 - (c) How well will the optimal player fair in a play-off against a random player (*i.e.*, one who chooses from amongst the valid actions with uniform probability)?
3. Using the results from above synthesize a Moore machine for each of the games (*i.e.*, for the three values of n and whether you go first or second). A natural way to do this is to think about an input alphabet $\Sigma = \{1, 2, 3\}$ representing the number of matches taken by the opponent and an output alphabet $\Lambda = \{1, 2, 3\}$ representing the number of matches you choose to take. Compress the information in the game by generating as small a Moore machine as you can.

3 Submission

Due date: 6 October at 11:59pm.

Submission method: Via e-mail to the TA.

Submit (in electronic form) the following:

1. Turn in a zip file which includes all the source files and a documentation PDF file, with the items below. (Do not describe your results in the e-mail)
2. The zip file should be named `student-last-name-hw-number.zip`
e.g., jones_hw2.zip
3. Subject of e-mail should be named as `[csce625]last-name-hw-number`
e.g., [csce625] jones_hw2

The zip should include the following:

1. The documentation PDF must include a detailed description of your approach. This should include:
 - (a) A description of the both tree algorithms.
 - (b) A visualization of the trees produced. (The GraphViz package contains `dot` and its friends, which are useful tools for this.)
 - (c) Your analysis of the games by addressing the questions in 2(a)–2(c) above.
 - (d) Your Moore machines represented in some graphical way.
2. The code you wrote for this assignment.
3. A description of how to run the submission.
4. A list of the resources used (*e.g.*, online forums, links to example code on the web, *etc.*).
5. A statement of the Aggie Code of Honor.

You may discuss this openly with your friends and classmates, but you must write your own code and compile your submission independently. If in doubt about whether a resource you used should be included in the “list of resources used” above, err on the side of caution and include it.