Künstliche Intelligenz – Übung 5

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Organizational

Homework 3

Homework 4

Homework 5

Misc: Questions, Anecdotes & etc

Organizational

Personal information

my email address: marius.frinken@fau.de

PGP encrypted mails are preferred!

my PGP fingerprint:

`F4BD 7ED4 96A5 9BA6 9FD6 901C 1EEC 9B1B 8CD5 3DA1`

NO .DOCX PLEASE

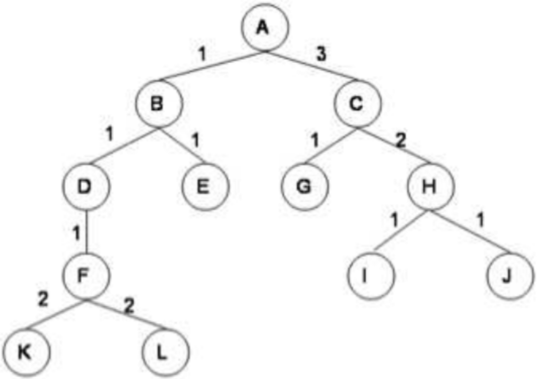
Please hand in ***.pdf** or ***.txt** files!

Solutions

Solutions for old homeworks are available at
https://kwarc.info/teaching/AI/assignments.pdf

Homework 3

Problem 3.1



BFS: A,B,C,D,E,G
DFS: A,B,D,F,K,L,E,C,G
IDFS: A,A,B,C,A,B,D,E,C,G
UCS: A,B,D,E,C,F,G

Problem 3.2

https://swish.swi-prolog.org/p/Tree%20search.swinb

Homework 4

Example Solution

(have a look at one possible solution)

Homework 5

Problem 5.1

Should be quite easy, but please **explain** your answer!

Problem 5.2 – Tic-Tac-Toe in Prolog

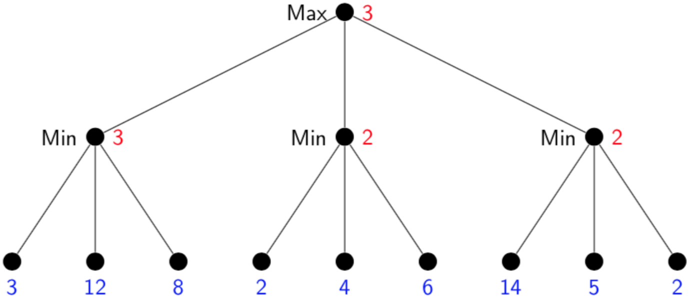
Realistically, you have two options:

1. hard code it
2. use the **Minimax-Algorithm**

I suggest you use option **2**.

Minimax Recap I

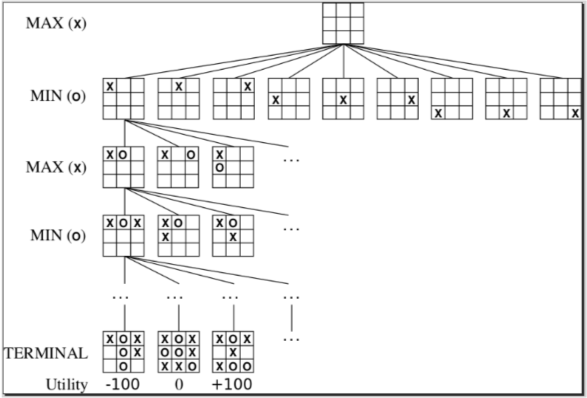
Minimax: Example



- Blue numbers: Utility function u applied to terminal positions.
- Red numbers: Utilities of inner nodes, as computed by Minimax.

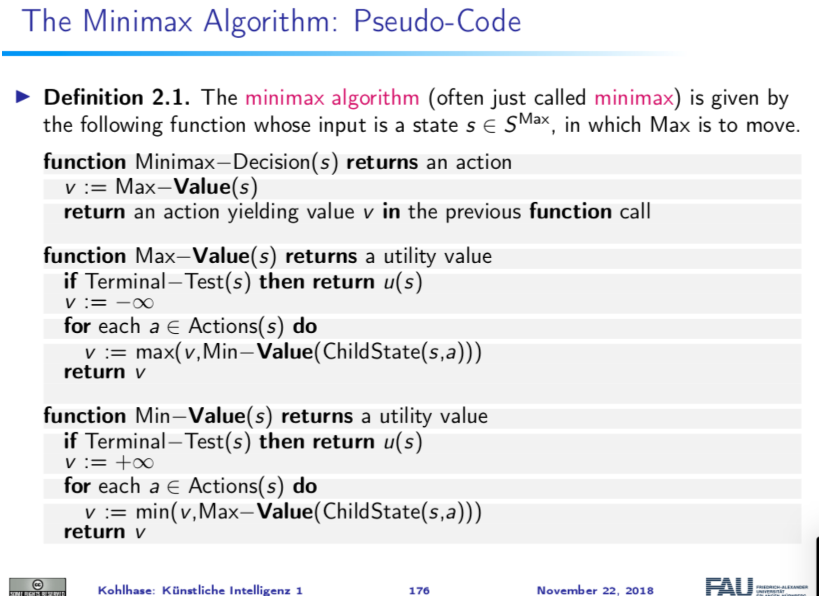
Minimax Recap II

Example Tic-Tac-Toe



- Game tree, current player marked on the left.
- Last row: terminal positions with their utility.

Minimax Recap III



The Minimax Algorithm: Pseudo-Code

- **Definition 2.1.** The minimax algorithm (often just called minimax) is given by the following function whose input is a state $s \in S^{\mathrm{Max}}$, in which Max is to move.

```
function Minimax−Decision($s$) returns an action
  $v$ := Max−Value($s$)
  return an action yielding value $v$ in the previous function call

function Max−Value($s$) returns a utility value
  if Terminal−Test($s$) then return $u(s)$
  $v := -\infty$
  for each $a \in$ Actions($s$) do
    $v$ := max($v$,Min−Value(ChildState($s$,$a$)))
  return $v$

function Min−Value($s$) returns a utility value
  if Terminal−Test($s$) then return $u(s)$
  $v := +\infty$
  for each $a \in$ Actions($s$) do
    $v$ := min($v$,Max−Value(ChildState($s$,$a$)))
  return $v$
```

Kohlhase: Künstliche Intelligenz 1 176 November 22, 2018

Tips:

- start with a function that outputs all possible moves (= resulting Boards), you may use the pre-defined function `move/3`
- inbuild method `findall/3` might be helpful
- inbuild method `maplist/3` might be helpful
- inbuild method `max_list/2` and `min_list/2` might be helpful

see `https://gl.kwarc.info/teaching/AI/blob/master/Marius/uebung05/tips.pl`

KALAH

Familiarize yourself with the framework!

You will have to **simulate** the game, so you will need a model for the game states. (Similar to the board of the Tic-Tac-Toe game)

KALAH II

My tip:
have the following basic outline:

1. get it to run on your setup
2. implement a stupid agent (e.g. always the first pit) and test it
3. implement a model for the game states or use the newly added `KalahGUI` module
4. use the model to implement some Adversarial-Game-Search-Algorithm like *Alpha-Beta-Pruning* or *Monte-Carlo-Sampling*
5. ??? [1]
6. Profit! (100 Bonus-Bonus Points for the best team!)

[1] (mostly finding a good evaluation function and having efficient code that runs deeply down the search-tree)

Misc: Questions, Anecdotes & etc

Where are these slides and Prolog examples available?
from now on at `https://gl.kwarc.info/teaching/AI`

Any other Questions?