

CS341

Artificial Intelligence

Lecture 7

DR. HEBA MOHSEN

Adversarial Search

COMPETITIVE ENVIRONMENTS (GAMES)

Introduction

Why is game playing so interesting from an AI point of view?

- Game Playing is harder than common searching
 - The search space is too large for complete searches
- We are facing an unpredictable opponent
 - Games are adversarial search problems
 - Solution is strategy, contingency plan.
 - There are time limits
- Game playing is considered to be an intelligent activity.

Introduction

Two-Person games

- How do we think when we play e.g. Chess?
 - If I move my queen there, then my opponent has to move his knight there and then can I move my pawn there and check mate.
- We are making some assumptions
 - We want our best move
 - The opponent wants his best move
 - The opponent has the same information as we
 - Our opponent wants to win

MiniMax

Games with two players MIN and MAX are a search problem with:

- Initial state
- Successor states
- Terminal test / state
- Utility function (objective / payoff)

MiniMax

Utility function

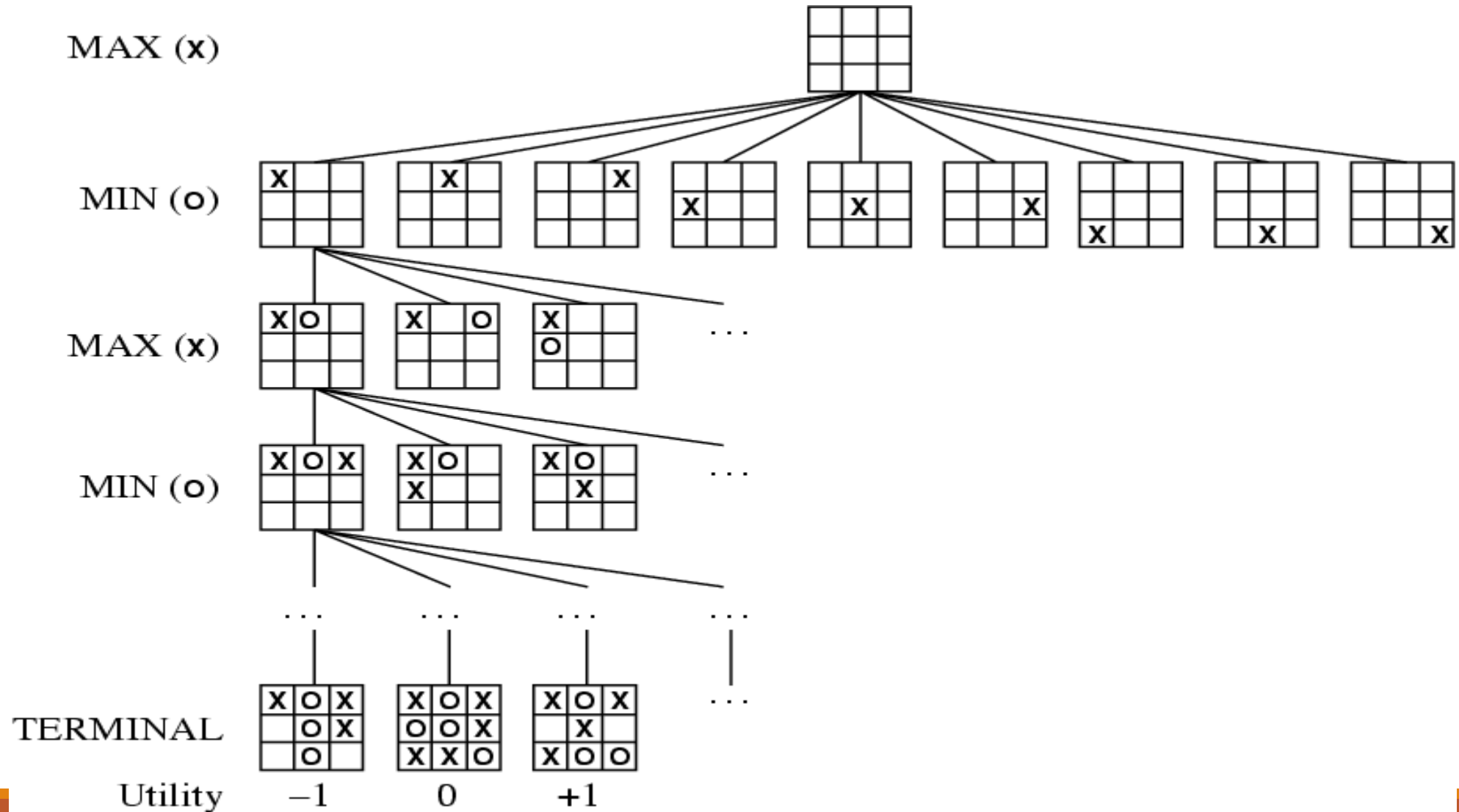
- Is assumed to be in relation with Max
 - What is good for max is always bad for min.
 - E.g. if max wins then min lose
- In chess the utility function might be.
 - -1 if min wins
 - 0 for a draw
 - 1 if max wins

MiniMax

Simple Games

- If we play e.g. TicTacToe, we can generate a complete search tree
- Some leafs in the tree will end up with max winning and some with min winning
- For more complex games a complete search tree is impossible. But that's a question for the near future.

MiniMax

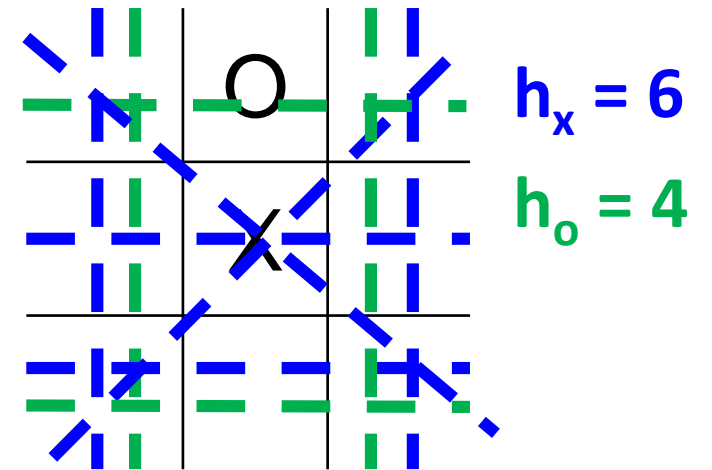


Heuristic (utility function) on Tic-Tac-toe

h: heuristic which is the number of cols/rows or diagonal where there is possibility of completing.

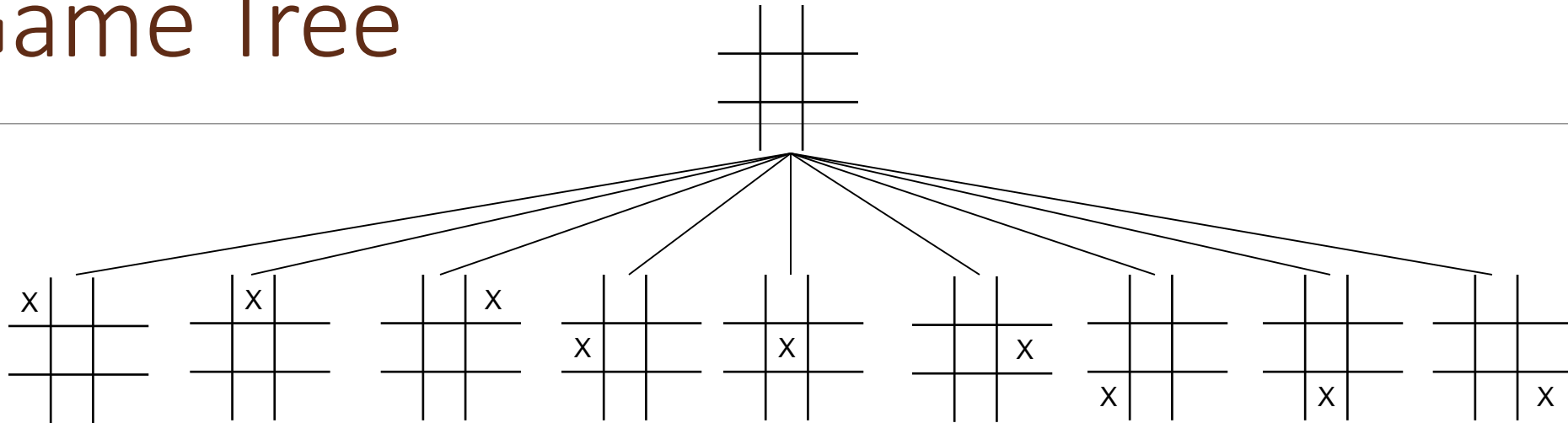
Then $h = h_x - h_o$

Where if h : positive \rightarrow X is superseding
 h : negative \rightarrow O is superseding



$$h_x - h_o = 6 - 4 = 2$$

Game Tree



Game Tree

X moves

x		x
	x	o
o		o

O moves

x	x	x
	x	o
o		o

x		x
x	x	o
o		o

x		x
	x	o
o	x	o

X moves

x	o	x
x	x	o
o		o

x		x
x	x	o
o	o	o

x	o	x
	x	o
o	x	o

x		x
o	x	o
o	x	o

x	o	x
x	x	o
o	x	o

x	o	x
x	x	o
o	x	o

x	x	x
o	x	o
o	x	o

Game Tree

X moves (MAX)

O moves (MIN)

X moves (MAX)

