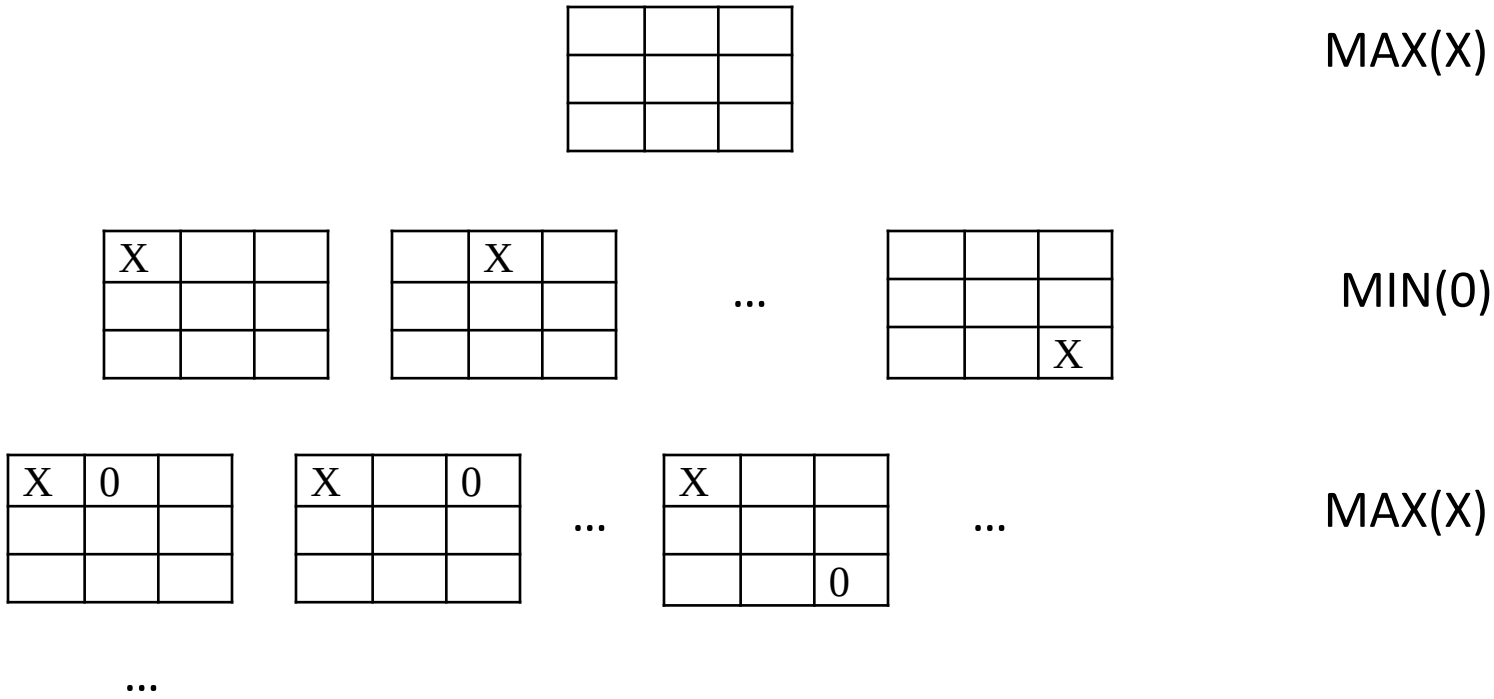
Chapter 5. Game Playing

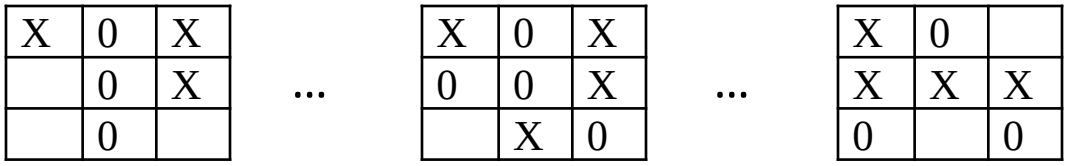
Topic 5.1 Games as Adversarial Search Problems

A) Representation of a Two-player Board Game

i) Players: MAX & MIN; Anyone can start; Make moves alternating each other.

ii) Classroom example: Tic-Tac-Toe





-1 0 +1

[Values returned by Utility function / Payoff function/ Objective function; MAX's point of view has been reflected.]

iii) Search problem with 4 components:

a) Initial state: Initial board position and information about the opener

b) Successor function: Returns a set of move-state pairs

c) Terminal test: Test to check whether the game is over

d) Utility function: Returns a numeric value, say, +1 for 'win', -1 for 'loss' and 0 for 'draw'; Zero sum; May be nonzero sum.

iv) Strategies of Players

- ✓ MAX searches for the sequence of moves (Plan) that leads to a terminal with maximum possible utility value, even if MIN plays in the best way;
- ✓ MIN searches for the opposite, that is, terminal with minimum possible utility.

B) Features of Game Playing

1. Multiple agent environment: More than one agent; Usually, their goals are in conflict; Agents plan against each other; Adversarial search.
2. Huge and Complicated Search Space: Real games, pure ones like Chess or Card playing, and idealized ones like economic, war or political games may involve many players, constraints, etc.
3. May include imperfect information in the form of unknown resources and intentions of the opponent(s).

4. Games may be competitive as well as cooperative; Mathematical game theory considers the impact of both types of agents important.

5. Inefficiencies are penalized severely; Time constraints may turn optimal search infeasible.