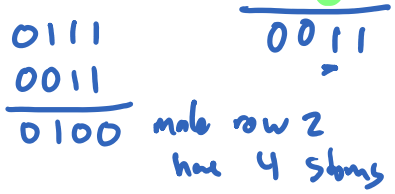
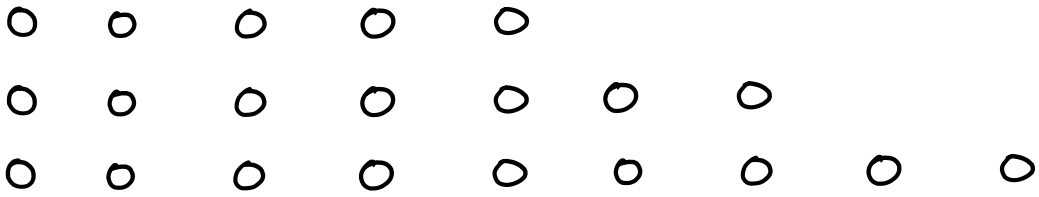
Multi-row Nim

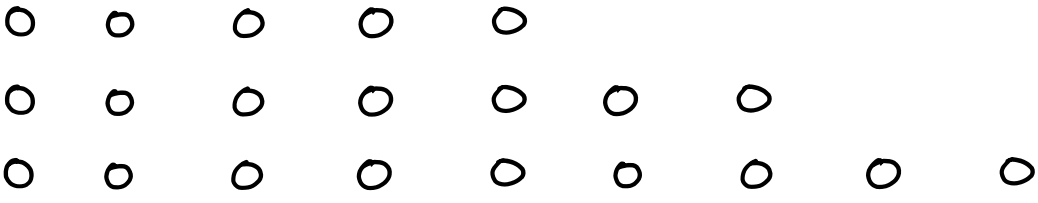
Start with rows of n_1, n_2, ..., n_k stones

On each turn, take as many stones as you wish from one row

If no possible moves, you lose (last move wins)







History

1940: Nimatron

1949: Shannon - minimax

1956: work checkers, chess

1989: Chinook

1992: TD-Gammon

1997: Deep Blue beat Kasparov

1999: solitare Yahtzee solved

2007: checkers solved

2013: Deepmind Atari

2016: AlphaGo

2017: AlphaZero

2019: AlphaStar

2020: DARPA

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Combinatorial Games

Combinatorial Game:

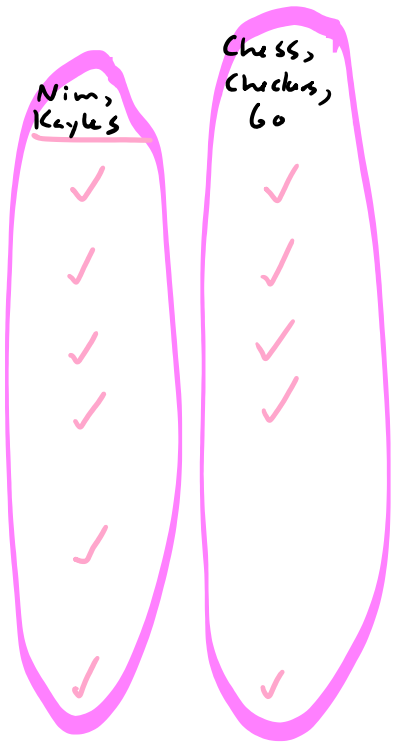
- two-player
- turn-based
- non-stochastic
- perfect information

normal last move wins

misére last move loses

finite

impartial - possible moves don't depend on turn

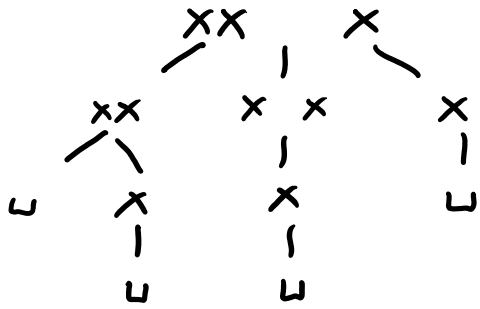


Complexity

[Game complexity - Wikipedia]

State Space – # of arrangements of pieces

checkers: 5^{32}



Game tree size

Branching factor

Depth