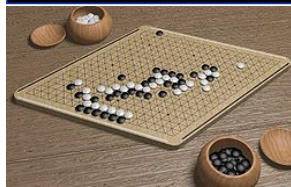
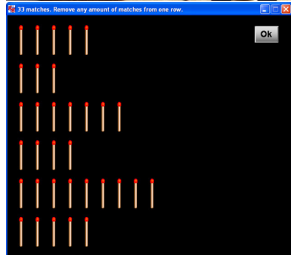
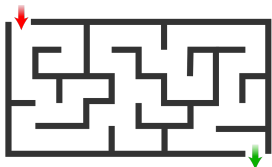
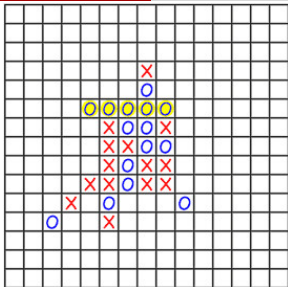
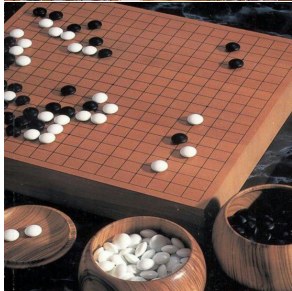


Computational Complexity and Games

Abdallah Saffidine

CSE, The University of New South Wales, Sydney, Australia.

July 3



UNDECIDABLE

⋮

2EXP

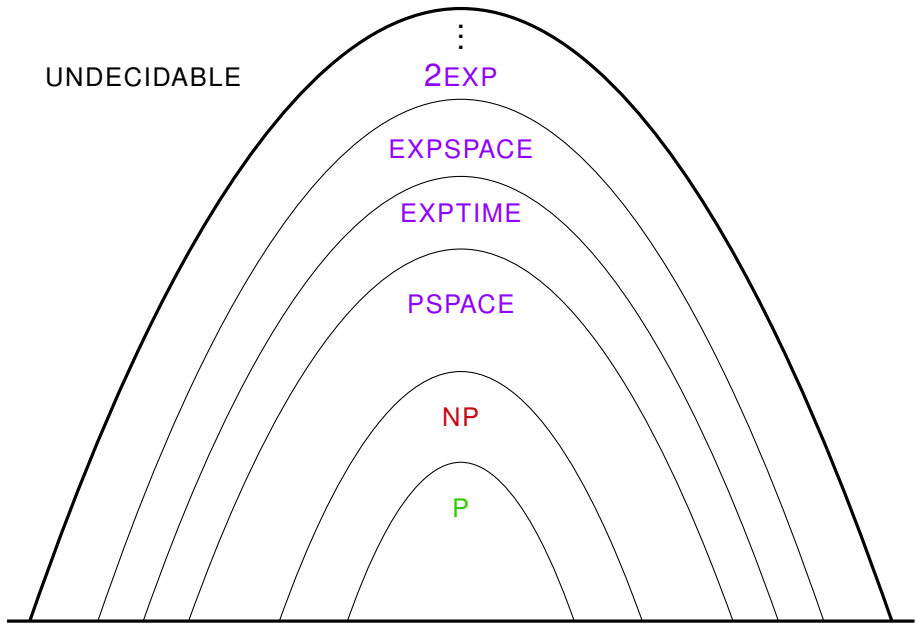
EXPSpace

EXPTIME

PSPACE

NP

P



UNDECIDABLE

Magic
the
Gathering

⋮

2EXP

EXSPACE

EXPTIME

PSPACE

NP

P

Go

Lemmings

Candy Crush

Maze

Nim

Hex

Chess

Gomoku

Guessing the complexity of Games

| | Cooperative | Adversarial |
|-------------------|---------------------|-------------|
| “Trivial” | Maze | Nim |
| Polynomial depth | Candy Crush | Hex, Gomoku |
| Exponential depth | Lemmings | Chess, Go |
| Unbounded depth | Magic the Gathering | |

P_{TIME}

NP

P_{SPACE}

P_{SPACE}

E_{TIME}

UNDECIDABLE

Current and Future Work

Current and Future Work

Parameterized Complexity (Tomorrow @ IAF!)

| | | |
|---|---|---------|
| (Non-)trivial but highly structured games | → | FPT |
| Player 1 is blocked by Player 2 | → | W[1] |
| Player 1 is forcing Player 2 | → | CO-W[1] |
| Both have independent goals | → | AW[*] |

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Games of Imperfect Information

Bridge, Poker

Hanabi

Starcraft, RTS Games

Kriegspiel, Phantom Go, ...

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Minesweeper (Computer Games Workshop @ IJCAI2017!)