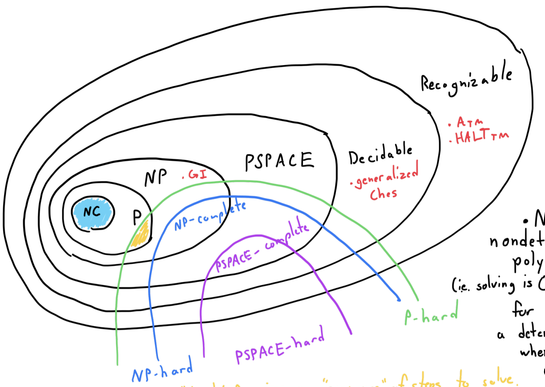
Complexity Zoo



- NP = nondeterministic polynomial-time (ie. solving is $O(n^k) \cong O(k^n)$-time for input n on a deterministic computer when $k \leq n$, so k is unbound)

P-complete: cannot be parallelized! Requires a "sequence" of steps to solve. (unless NC = P)

NC: Problems decidable in polylogarithmic time on a parallel computer with a polynomial number of processors.

- NP-complete problems
  i. SAT and 3SAT
  ii. CLIQUE
  iii. Hamiltonicity
  iv. Independent set
  v. Feedback Vertex set
- Unknown
  i. Graph isomorphism (GI)

PSPACE

- A class of problems that can be solved in a polynomial amount of space (relative to input size).

- QSAT – True quantified Boolean formula satisfiability

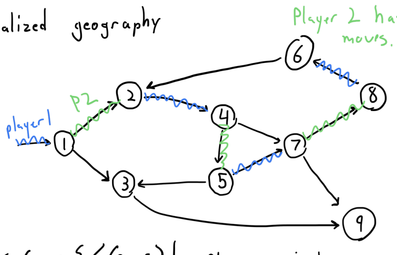
$\exists x \forall y \exists z ((x \vee z) \wedge y)$

computation tree

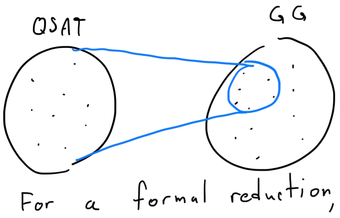


depth (time to solve) is exponential w.r.t. the number of vertices

- Generalized geography



$GG = \{\langle G, s\rangle \mid$ Player 1 has a winning strategy for generalized geography on graph G starting on node $s\}$



For a formal reduction, see Theorem 8.14

$\exists x_1 \forall x_2 \exists x_3 (x_1 \vee \bar{x}_2) \wedge (x_2 \vee x_3)$

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